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ENHANCED NATURAL ATTENUATION TREATABILITY STUDY WORK PLAN SITE 1120 NAS PENSACOLA FL

5/1/2003

TETRA TECH

Enhanced Natural Attenuation Treatability Study Work Plan

for

Site 1120

Outlying Landing Field Bronson

Pensacola, Florida

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888
Contract Task Order 0302

May 2003

03JAX0096

ENHANCED NATURAL ATTENUATION TREATABILITY STUDY WORK PLAN FOR SITE 1120

OUTLYING LANDING FIELD BRONSON PENSACOLA, FLORIDA

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
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Naval Facilities Engineering Command
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North Charleston, South Carolina 29406

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CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0302

MAY 2003

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The professional opinions rendered in this decision document identified as Enhanced Natural Attenuation Treatability Study Work Plan for Site 1120, Outlying Landing Field Bronson, Pensacola, Florida were developed in accordance with commonly accepted procedures consistent with applicable standards of practice. This document was prepared under the supervision of the signing engineer and is based on information obtained from others. If conditions are determined to exist differently than those described in this document, then the undersigned professional engineer should be notified to evaluate the effects of any additional information on the project described in this document.

May 6, 2008
Gregory S. Roof, P.E.
Professional Engineering Number 50842
Tetra Tech NUS, Inc. Engineering No. 7988

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ACRONYMS

bls	Below Land Surface
°C	Degrees Celsius
CLEAN	Comprehensive Long-term Environmental Action Navy
COC	Constituents of Concern
CTO	Contract Task Order
DPT	Direct Push Technology
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FL-PRO	Florida Petroleum Range Organics
FOL	Field Operations Leader
ft	Feet/Foot
GCTLs	Groundwater Cleanup Target Levels
H_2SO_4	Sulfuric Acid
HASP	Health and Safety Plan
HCl	Hydrochloric Acid
HDPE	High Density Polyethylene
HSM	Health and Safety Manager
IDW	Investigation-Derived Waste
µg/L	Micrograms per Liter
mg/L	Milligrams per Liter
MgO_2	Magnesium Peroxide
$Mg(OH)_2$	Magnesium Hydroxide
ml	Milliliter
MOP	Monitoring Only Plan
MSDS	Material Safety Data Sheet
NA	Not Analyzed
NADC	Natural Attenuation Default Concentration
NAS	Naval Air Station
Navy	United States Navy
NTU	Nephelometric Turbidity Units
OLF	Outlying Landing Field
ORC®	Oxygen Releasing Compounds
ORP	Oxidation-Reduction Potential
PAH	Polynuclear Aromatic Hydrocarbons
PPE	Personal Protective Equipment

ACRONYMS (CONTINUED)

QA	Quality Assurance
QC	Quality Control
Regenesis	Regenesis Bioremediation Products
RPM	Remedial Project Manager
SAR	Site Assessment Report
SOPs	Standard Operating Procedures
SOUTHNAVFACENGCOM	Southern Division, Naval Facilities Engineering Command
TOC	Total Organic Carbon
TRPH	Total Recoverable Petroleum Hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

This Enhanced Natural Attenuation Treatability Study Work Plan has been prepared by Tetra Tech NUS, Inc. (TtNUS) under the Comprehensive Long-term Environmental Action Navy (CLEAN) Contract Number N62467-94-D-0888 Contract Task Order (CTO) 0302. This work plan has been prepared to develop an application and testing methodology to evaluate if enhanced natural attenuation is an appropriate remedial technology for Site 1120 at Outlying Landing Field (OLF) Bronson, Pensacola, Florida. The scope of this Treatability Study is limited to the documented groundwater contamination that had been previously identified at this site.

The purpose of this Treatability Study is to determine if the application of Oxygen Releasing Compounds (ORC®) can significantly reduce petroleum impacted groundwater. This work plan incorporates data presented in the Second Quarterly Groundwater Monitoring Letter Report (TtNUS, 2002).

1.1 DOCUMENT ORGANIZATION

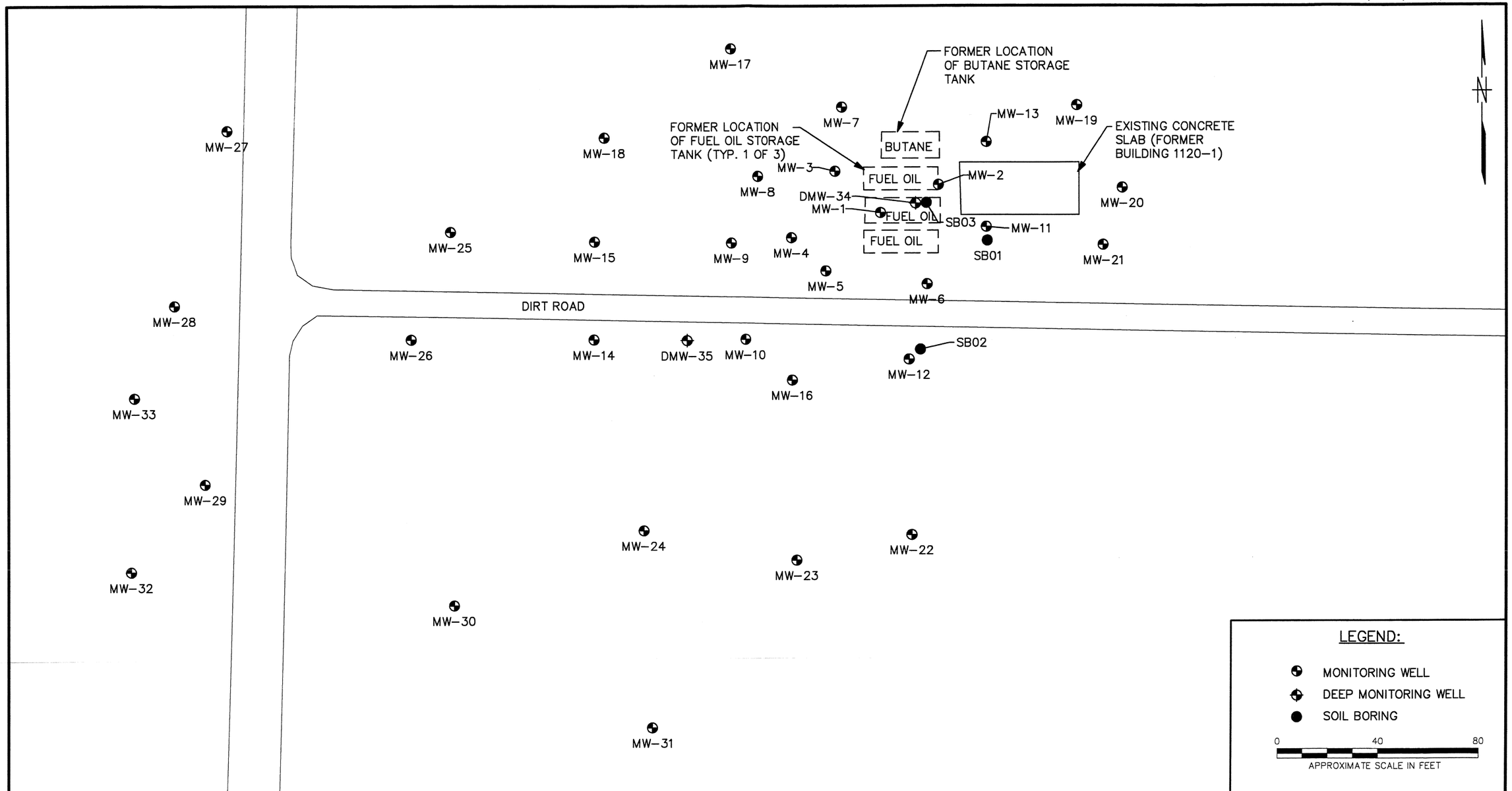
Section 1.0 of this report presents this introduction, a site description, the project scope, and project goals. Section 2.0 describes the proposed field investigation activities. Section 3.0 describes the environmental sampling and analysis activities. Section 4.0 describes management aspects of the project such as management structure, reporting requirements, and quality assurance (QA) activities. ORC® Material Safety Data Sheets (MSDS) and the manufacturer-provided ORC® mixing and injection instructions are included in Appendices A and B, respectively.

1.1.1 Site Operations and History

Site 1120 is the former location of a boiler room at OLF Bronson. Three USTs were used to supply fuel oil to the boiler. The USTs have been removed from the site and the building demolished. The site plan is depicted on Figure 1-1.

Previous investigations at the site include the Underground Storage Tank (UST) Closure Assessments completed in July 1994 and May 1995, and the initial Site Assessment field investigation completed in August 1997. In March 1998, the Naval Air Station (NAS) Pensacola Navy Public Works Center submitted the Site Assessment Report (SAR) based on the findings of these investigations.

Upon review of the SAR, the Florida Department of Environmental Protection (FDEP) issued a technical review letter which requested additional site assessment in order to meet the requirements of Chapter 62-770, Florida Administrative Code (FAC). The SAR addendum investigation was conducted



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SITE PLAN
SITE 1120
TREATABILITY STUDY WORK PLAN
OLF BRONSON
PENSACOLA, FLORIDA

CONTRACT NO. 5967	
APPROVED BY	DATE
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in July 2000. Based on the additional site assessment data, the SAR addendum report (submitted May 23, 2001) recommended that monitored natural attenuation was a suitable course of action for the site. On August 8, 2001, FDEP issued a technical review letter agreeing with the recommendation and requesting a Monitoring Only Plan (MOP) proposal for the site. On December 12, 2001, TtNUS submitted to FDEP the MOP proposal for Site 1120. On April 2, 2002, the FDEP MOP Approval Order, that outlined the requirements for natural attenuation monitoring at the site, was issued. During April 2002, TtNUS personnel conducted the first quarterly monitoring event. The First Quarterly Groundwater Monitoring Report was issued on June 28, 2002. During July 2002, TtNUS personnel conducted the second quarterly monitoring event. The Second Quarterly Groundwater Monitoring Report was issued on October 4, 2002. This report stated that groundwater flow was generally to the southwest.

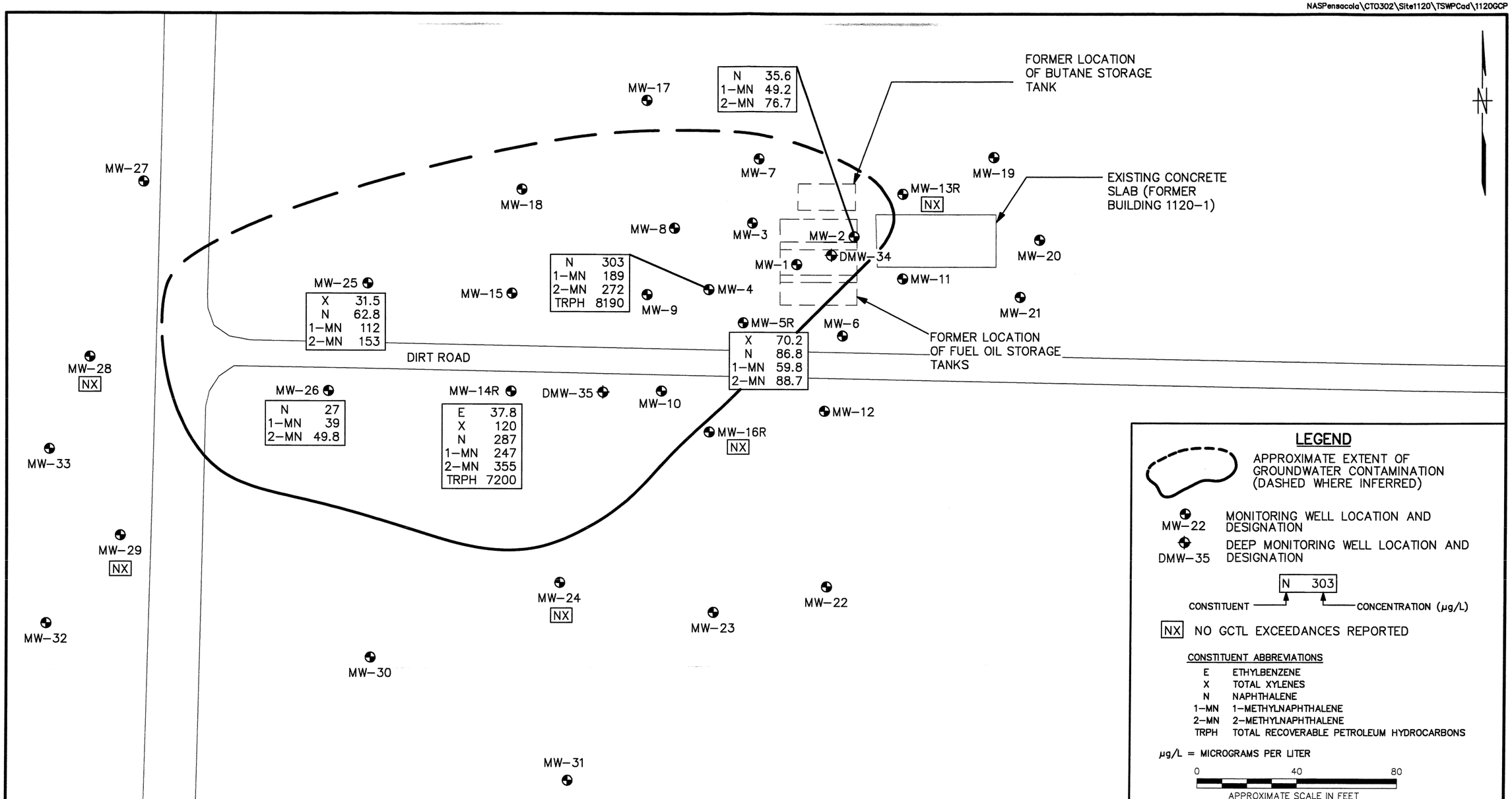
1.2 NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

1.2.1 Groundwater Contamination

Groundwater contamination has been documented at the site during the previous assessment activities. The groundwater contamination appears to be fuel related and extends from monitoring well MW-2 southwest to just east of perimeter well MW-28 (Figure 1-2). Figure 1-2 illustrates the estimated aerial extent of groundwater contamination. Table 1-1 includes results of the second quarterly groundwater sampling event. Volatile Organic Compounds (VOCs), Polynuclear Aromatic Hydrocarbons (PAHs), and Total Recoverable Petroleum Hydrocarbons (TRPH) are the primary constituents of concern (COCs) in the contaminant plume. The highest levels of contamination were reported at source monitoring wells MW-14R and MW-4 and extended downgradient to perimeter monitoring well MW-28 and upgradient to MW-2, at concentrations in excess of the FDEP Groundwater Cleanup Target Levels (GCTLs). The Treatability Study will address this groundwater contamination plume.

1.3 SCOPE AND GOALS

ORC® is a proprietary product produced by Regenesis Bioremediation Products (Regenesis), of San Clemente, California. ORC® is a patented formulation of magnesium peroxide (MgO_2) intercalated with food-grade phosphate that slowly releases molecular oxygen into the aquifer when hydrated. The phosphate gives it the time-release properties that are critical in a passive, low-cost oxygen application system. The hydrated product becomes magnesium hydroxide [$Mg(OH)_2$]. The oxygen consumption rate is dependent upon the level of the contaminant flux. This allows ORC® to release oxygen at a relatively constant rate over an extended period of time. The increase in dissolved oxygen in the aquifer creates aerobic conditions that will stimulate in-situ bioremediation of the petroleum hydrocarbon plume.



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APPROXIMATE EXTENT OF GROUNDWATER CONTAMINATION, JULY 2002
SITE 1120
TREATABILITY STUDY WORK PLAN
OLF BRONSON
PENSACOLA, FLORIDA

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TABLE 1-1
SUMMARY OF DETECTED ANALYTES IN GROUNDWATER-SITE 1120
CONTAMINATED AREA MONITORING WELLS
TREATABILITY STUDY WORK PLAN
OLF BRONSON, PENSACOLA, FLORIDA

Sample Location			MW-2	MW-4	MW-5R	MW-13R	MW-14R	MW-16R	MW-24	MW-24	MW-25	MW-26
Sample No.			BRN1120MW02	BRN1120MW04	BRN1120MW05R	BRN1120MW13R	BRN112014R	BRN1120MW16R	BRN1120MW24	BRN1120MW24D	BRN1120MW25	BRN1120MW26
Collect Date			07/24/02	07/24/02	07/24/02	07/25/02	07/25/02	07/25/02	07/23/02	07/23/02	07/24/02	07/24/02
	GCTL[1] (µg/L)	Action Levels[2] (µg/L)										
Volatile Organic Compounds (USEPA Method SW-846-8260B) (µg/L)												
Ethylbenzene	30	300	0.89 J	13.2	18.1	--	**37.8**	--	--	--	7.9	1.5
Total xylenes	20	200	2.5 J	19.9	**70.2**	--	**120**	--	--	--	**31.5**	--
Carbon disulfide	700	NA	--	--	--	--	--	--	--	--	--	--
Chloroform	5.7	NA	--	--	--	1.1	--	2.1	--	--	--	--
Methylene chloride	5	NA	--	--	--	--	--	--	--	--	--	--
2-Chloroethyl vinyl ether	175	1,750	--	--	--	--	--	--	--	--	--	--
Polynuclear Aromatic Compounds (USEPA Method SW-846-8310) (µg/L)												
1-Methylnaphthalene	20	200	**49.2**	**189**	**59.8**	0.61 J	**247**	1.4	3.4	3.2	**112**	**39**
2-Methylnaphthalene	20	200	**76.7**	**272**	**88.7**	0.61 J	**355**	2.3	5	4.7	**153**	**49.8**
Acenaphthene	20	NA	--	2.7	0.66 J	--	3.2	--	--	--	--	0.84 J
Fluorene	280	NA	1.2	4.5	1.4	--	6.0	--	0.8 J	0.77 J	3.1 J	1.9
Naphthalene	20	200	**35.6**	**303**	**86.8**	--	**287**	--	--	--	**62.8**	**27**
Phenanthrene	210	NA	0.47 J	1.4	1	--	3.8	--	--	--	1.2 J	0.83 J
TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (TRPH) (FL-PRO) (µg/L)												
TRPH	5,000	50,000	3,670	**8,190**	1,990	--	**7,200**	--	1,400	1,620	3,190	3,260

[1] Groundwater Cleanup Target Level (GCTL) as provided in Chapter 62-777,FAC.
[2] Action levels established for contaminated monitoring wells in MOP Approval Order dated April 2, 2002.
NA = Action Level not specified.
µg/L = micrograms per liter.
Sample Number ending in D indicates that sample is a field duplicate.
J = Estimated concentration between method detection limit and practical quantitation limit.
Bold = concentration exceeding GCTLs.
Concentrations in shaded boxes exceed action levels.
-- = analyte not detected above the instrument detection limit.

During this Treatability Study, an ORC® and water mixture (slurry) will be injected into the area of impacted groundwater that exceeded the FDEP GCTLs for VOCs, PAHs, and TRPH to provide dissolved oxygen in this area.

A baseline sampling event (prior to ORC® injection) and four quarters of post-injection groundwater sampling will be conducted using 20 on-site monitoring wells: MW-1, MW-2, MW-4, MW-5R, MW-7, MW-8, MW-11, MW-13R, MW-14R, MW-15, MW-16R, MW-17, MW-18, MW-24, MW-25, MW-26, MW-27, MW-28, MW-29, and deep monitoring well DMW-35. Quarterly performance monitoring letter reports will be prepared and a Final Treatability Study Evaluation Report will be submitted after the post-injection sampling. These sampling events and reports are explained in greater detail in Sections 2.0, 3.0, and 4.0 of this Treatability Study Work Plan.

The objective of the Treatability Study is to determine the effectiveness of ORC® at reducing the contaminant concentrations within the source area. This strategy is relying on the released dissolved oxygen to increase the microbial activity, thereby facilitating contaminant reduction through aerobic respiration.

2.0 FIELD OPERATIONS

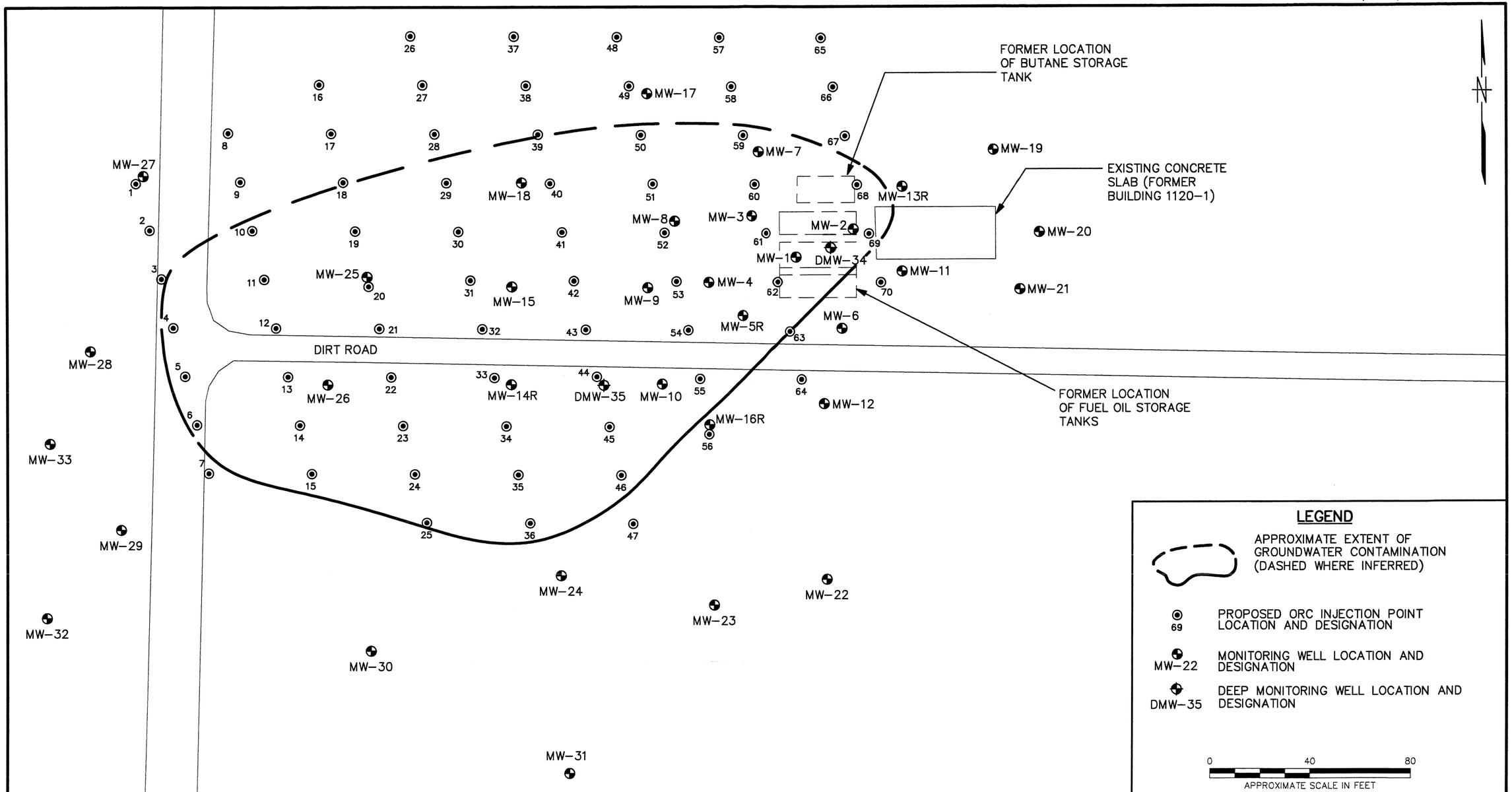
2.1 FIELD OPERATIONS SUMMARY

The treatability study consists of the following field activities:

- Sampling and analysis of 20 selected monitoring wells to evaluate baseline contaminant and geochemistry concentrations.
- Installation of 70 ORC® injection borings in the source area and injection of an ORC® enriched slurry into each of the borings.
- Quarterly sampling and analysis of 20 selected monitoring wells to evaluate water quality parameters and contaminant concentrations.

This Treatability Study will target the groundwater contaminant plume previously identified at the site. The plume, as illustrated on Figure 1-2, is defined as the approximate boundary of the reported contaminant plume. For this Treatability Study, TtNUS is focusing on treating the entire estimated contamination plume to achieve significant reductions in contaminant concentrations.

This pilot-scale study involves installation of eight banks of ORC® injection borings that will create zones of passive treatment. Each of the banks will have injection borings installed cross-gradient to the groundwater flow (southwest). These banks will be installed in the approximate locations shown on Figure 2-1. A detailed plan view of the typical injection point bank, as well as a cross-section of a typical injection point, are presented as Figure 2-2. These banks are intended to create an oxygen-enriched barrier and an aerobic reaction zone to reduce petroleum hydrocarbon concentrations in the areas where concentrations are anticipated to be above GCTLs. The dry ORC® powder [4 pounds per foot (ft) or approximately 40 pounds per injection point] will be mixed into a slurry with potable water and injected into the ORC® borings for a one-time treatment. Based on the recommendations of Regenesis, sugar will also be added at approximately 2 percent per weight of ORC® to provide a carbon source for the microbial population. The site geochemistry will be monitored for changes in water quality parameters indicative of increased microbial activity along with laboratory analysis of COCs to detect reductions in dissolved petroleum concentrations. Details of the sampling and analysis program are presented in Section 3.0.



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PROPOSED ORC INJECTION POINT LOCATIONS
SITE 1120
TREATABILITY STUDY WORK PLAN
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PENSACOLA, FLORIDA

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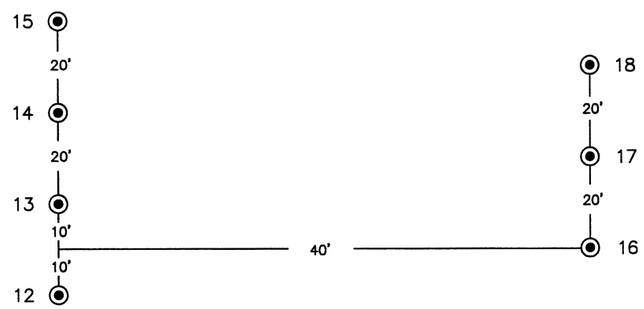
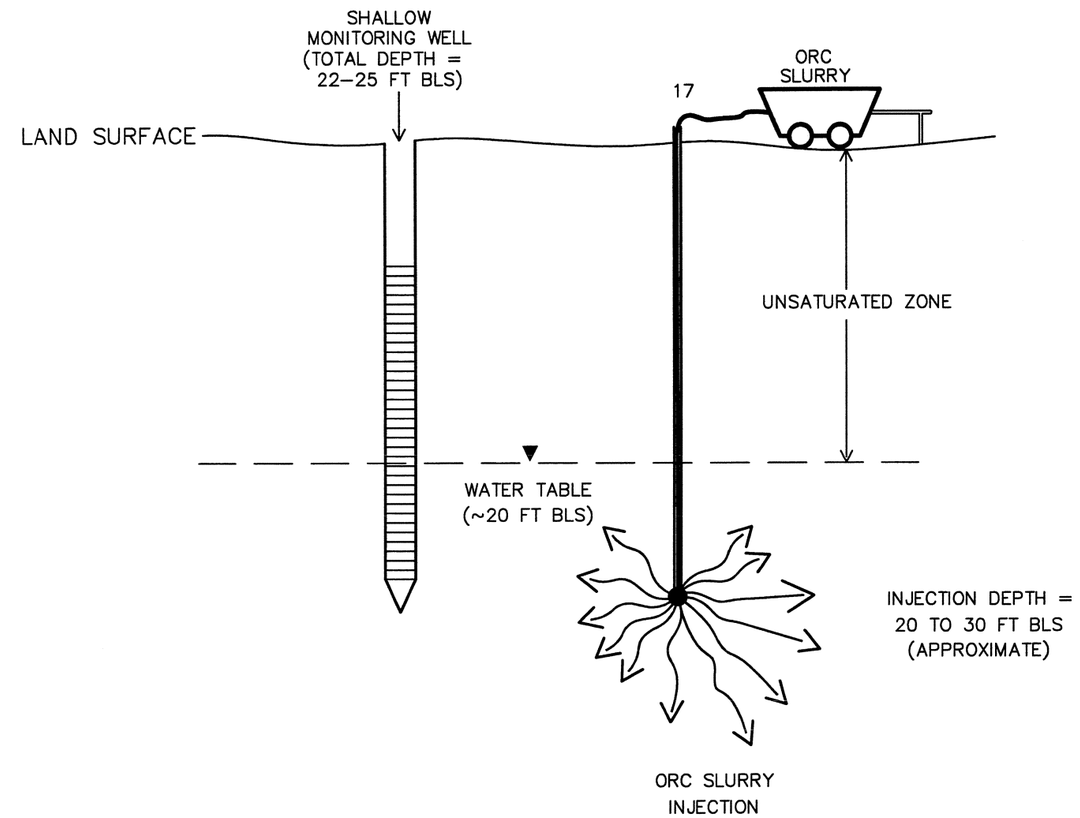


PLAN VIEW SHOWING TYPICAL ADJACENT PAIR OF PROPOSED ORC INJECTION POINT BANKS

14 ◎ ORC INJECTION POINT AND DESIGNATION (Typ.)

NOTES:

1) 70 total injection points: 8 rows spaced approximately 40 ft apart
2) See previous figure (Figure 2–1) for proposed locations of injection points relative to monitoring wells and hydrocarbon plume
3) 40 lbs. ORC slurry to be injected at each point one time only



CROSS–SECTIONAL VIEW SHOWING TYPICAL INJECTION POINT AND MONITORING WELL WITHIN TREATMENT ZONE

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PROPOSED ORC SLURRY INJECTION PLAN
SITE 1120
TREATABILITY STUDY WORK PLAN
OLF BRONSON
PENSACOLA, FLORIDA

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2.2 MOBILIZATION/DEMOBILIZATION

Following approval of this work plan, TtNUS will procure the required subcontractors and begin mobilization activities. Mobilization/demobilization includes the following:

- Obtain utility clearance in the proposed boring areas.
- Mobilize subcontractors, equipment, and materials to the site.
- Obtain drilling and/or well permits via subcontractor.
- Conduct an approximately 1-hour long site-specific health and safety review meeting.
- Delineate the work zones (exclusion zone, contamination reduction zone, and support zone) as required by the Health and Safety Plan (HASP) (See Appendix D).
- Arrange an area to perform decontamination procedures.
- Demobilize equipment and materials from the site.
- Perform general site clean-up and removal of trash.

Field team members will review the work plan, the Site Emergency Procedures Plan, and the HASP. Mobilization includes attendance at a site-specific health and safety meeting during the initiation of on-site activities. This meeting will also include field team orientation in order to familiarize personnel with the scope of the field activities.

The Field Operations Leader (FOL) will coordinate the mobilization activities. These include responsibilities such as initiating and conducting equipment inventories to ensure equipment is available, purchasing equipment as required, staging equipment for efficient loading and transport from the TtNUS Tallahassee office to the site, and after field activities are completed, demobilizing the equipment.

The Direct Push Technology (DPT) subcontractor will furnish a truck-mounted DPT rig, support crew, all necessary tools required, personal protective equipment (PPE) for their crew, and any miscellaneous equipment and materials required to complete the described activities. The down-hole DPT equipment, sampling tools, and the rear of the DPT rig will be steam-cleaned prior to arrival on site. Safety shut-off equipment will be in full working condition and will be tested by the FOL prior to initiating DPT activities.

2.3 INJECTION POINT INSTALLATION

The 70 injection points will be installed using DPT (e.g., Geoprobe) and will be divided into eight banks. Each bank will contain 5 to 11 injection points as depicted on Figure 2-1. Shallow groundwater contamination is assumed to extend to approximately 30 ft below land surface (bls), based on the depth of the shallow monitoring wells previously installed at the site. Therefore, each of the injection points will be

installed to a depth of 10 feet below the estimated depth to water (approximately 30 ft bls) and the ORC® slurry injected across the wetted depth of the injection point (approximately 10 ft).

2.4 ORC MIXING AND INJECTION

The ORC® bulk powder will be drop-shipped from the Regenesis manufacturing facility in Inwood, New York. For the ORC® injection borings, approximately 0.63 gallons of potable water are required per 10 pounds of ORC® powder for a 65 percent mixture. As recommended by Regenesis, approximately 2 percent sugar by weight will also be added to the mixture to provide a carbon source. Mixing and injection of ORC® will be performed in general accordance with the Regenisis instructions in Appendix B. Mixing will be performed in a 55-gallon drum or equivalent tank and will be injected through the DPT rig's pump or any slurry/grout pump. The mixed ORC® powder is a thin liquid, similar in chemical composition to diluted Milk of Magnesia™. A standard environmental slurry mixer or grout pump will be used to mix the slurry. The ORC® slurry must be mixed immediately before and during injection. It cannot be allowed to stand for more than 30 minutes, since it will settle and eventually harden. MSDSs for the ORC® powder are provided in Appendix A.

2.5 WATER LEVEL MEASUREMENTS

A round of groundwater level measurements will be obtained during each sampling event from the Site 1120 monitoring wells selected in Section 1.3. The synoptic measurements will be taken within a 2-hour period of consistent weather conditions to minimize atmospheric/precipitation effects on groundwater levels. Measurements will be taken with an electronic water level indicator or interface probe using the marked location on the top of the well casing as the reference point. Groundwater level measurements will be recorded to the nearest 0.01-ft on the appropriate field log. This information will be used to confirm groundwater flow direction.

2.6 INVESTIGATION-DERIVED WASTE (IDW) MANAGEMENT

All IDW accumulated during DPT installation, well purging and sampling, and decontamination proceedings will be collected, containerized, and stored in Department of Transportation (17C)/UN (1A2)-approved, 55-gallon drums. The drums will be labeled as soon as possible after they are filled. The drums will be left on site pending analytical results.

Upon receipt of the analytical results (approximately 35 days after completion of sampling), TtNUS will mobilize a certified waste management contractor, as required, to dispose of the IDW. NAS Pensacola personnel will sign all manifests and bills of lading prior to transportation off site. TtNUS will coordinate with station personnel for this activity.

2.7 DECONTAMINATION

The field team's PPE will be disposed as required. These items, such as Tyvek™ suits, disposable latex gloves and paper towels, will be disposed of using procedures required by the HASP. Personnel will also perform decontamination procedures as required by the HASP.

The equipment involved in field sampling activities will be decontaminated prior to and upon completion of drilling and sampling activities. This equipment includes drilling rigs, down-hole tools, augers, and all non-dedicated sampling equipment.

Major Equipment

All down-hole DPT equipment and sampling tools will be decontaminated by the DPT crew prior to beginning work and at the completion of the DPT installation/injection program. The decontamination procedures will comply with the FDEP Standard Operating Procedures (SOPs). Due to the nature of this study and previous delineation of impacted groundwater, the DPT equipment will not be decontaminated between injection points.

Sampling Equipment

Sampling equipment used for collecting the groundwater samples will be disposable equipment. Therefore, no decontamination of this equipment will be required. Field analytical equipment such as water level probes, and water quality meters will be first wiped down with laboratory-grade detergent solution, then rinsed with a isopropanol and analyte free water mix, and then with a final rinse of analyte free water.

3.0 ENVIRONMENTAL SAMPLING

3.1 SAMPLE ANALYSIS SUMMARY

Both field and laboratory analyses will be conducted in order to quantify any increase in the rate of microbial activity within the aerobic reaction zones and to determine the contaminant reduction rates.

3.1.1 Laboratory Sample Analysis Summary

A certified laboratory will be subcontracted by TtNUS to perform the routine chemical analyses for the environmental samples collected for Site 1120 during the treatability study.

The laboratory analytical methods, bottle requirements, preservation requirements, and holding times are as follows:

Laboratory Groundwater Analyses

Parameter	Analytical Method	Bottle/Preservation Requirements	Holding Time
Total Organic Carbon (TOC)	US Environmental Protection Agency (USEPA) 415.1	One 250 milliliter (ml) high density polyethylene (HDPE); sulfuric acid (H_2SO_4) < 2; cool to 4 degrees Celsius (°C)	28 days to analysis
Sulfate	USEPA 300	One 250 ml HDPE; cool to 4°C	28 days to analysis
VOCs	USEPA SW846 8260B	3 - 40ml vials; hydrochloric acid(HCl) pH< 2; cool to 4°C	14 days to analysis
PAHs	USEPA SW846 8310	Two 1-Liter amber jar; H_2SO_4 pH< 2; cool to 4°C	28 days to analysis
TRPH	Florida Petroleum Range Organics (FL-PRO)	Two 1-Liter amber jar; cool to 4°C	28 days to analysis

3.1.2 Field Analysis Summary

Field geochemical analyses will be performed during field sampling activities on the five selected monitoring wells for the parameters specified as follows:

Field Analyses

Parameter	Analytical Method	Holding Time	Analyze
Dissolved oxygen	CHEMetrics K-7501/7512	Analyze immediately	Field
Carbon dioxide	CHEMetrics K-1910/1920/1925	Analyze immediately	Field
Alkalinity	CHEMetrics K-9810/9815/9820	Analyze immediately	Field
Ferrous iron	HACH IR-18C	Analyze immediately	Field
Hydrogen sulfide	HACH HS-C	Analyze immediately	Field
Temperature	Horiba U-22	Analyze immediately	Field
pH	Horiba U-22	Analyze immediately	Field
Conductivity	Horiba U-22	Analyze immediately	Field
Turbidity	LaMotte Turbidimeter	Analyze immediately	Field
Oxydation Reduction Potential (ORP)	Horiba U-22	Analyze immediately	Field

3.2 GROUNDWATER SAMPLING PROCEDURES

Groundwater samples will be obtained from three-selected groundwater monitoring wells during the baseline sampling and four quarters of sampling. Samples will be collected quarterly for the above laboratory groundwater analyses and reference field analytical tests. Groundwater sampling will be conducted in general accordance with FDEP SOPs (FDEP, 2002).

The wells will be purged with a peristaltic pump using low flow quiescent purging techniques per FDEP SOPs. The data will be recorded on a low flow purge data sheet (Appendix C). Depending on the groundwater parameters, up to five well volumes may be purged. If wells are purged dry with less than three well volumes removed, the water level in the well will be allowed to recover enough to collect five field readings (pH, temperature, turbidity, dissolved oxygen, and specific conductance) prior to collecting a water sample. If the well does not purge dry using the low flow purging technique, groundwater characteristics will be taken at no less than 2 minute intervals, depending on the flow rate. Stabilization is defined by SOP FS 2200 according to the following scenarios:

I. When purging a well that has a partially submerged well screen, a minimum of one well volume will be purged prior to collecting measurements of field parameters listed below. If the well screen is fully submerged, then a minimum of one volume of the pump, associated tubing, and flow cell will be purged prior to collecting field parameters listed below. Purging will be considered complete when three consecutive measurements in which the field parameters are within the desired limits as shown below.

- Temperature ± 0.2 °C
- pH ± 0.2 Standard Units
- Specific Conductivity ± 5 percent of reading
- Dissolved oxygen is not greater than 20 percent of saturation at the field measured temperature
- Turbidity is not greater that 20 Nephelometric Turbidity Units (NTUs).

II. When purging a well and Scenario I is impossible to achieve, three consecutive measurements of the following parameters are required.

- Dissolved oxygen ± 0.2 milligrams per liter (mg/L) or 10 percent, whichever is greater
- Temperature ± 0.2 °C
- pH ± 0.2 Standard Units
- Specific Conductivity ± 5 percent of reading
- Turbidity ± 5 NTUs or 10 percent, whichever is greater

If stabilization is not achieved, five screen volumes must be removed prior to samples being collected in the appropriate sample containers.

Teflon® and surgical-grade silicon tubing will be used for sample collection. Groundwater samples will be collected using the "purge and trap" method for PAHs and TRPH and the "straw" method for VOCs and discharged into the appropriate sample bottles for analysis. Samples requiring preservation will be collected in prepreserved bottles provided by the laboratory.

Pertinent sampling data will be recorded using the appropriate sample log sheet and field logbook. (See Appendix C for forms to be used during the Treatability Study.)

3.3 SAMPLE HANDLING

Sample handling including the field-related considerations concerning sample identification, packaging, and shipping will be addressed throughout this section.

3.3.1 Sampling Identification System

Each sample collected will be assigned a unique sample tracking number. The sample tracking number will consist of a four-segment, alphanumeric code that identifies the site, sample location, and sample round. The groundwater samples collected during the initial groundwater monitoring events for natural attenuation were designated as the first and second rounds; therefore, baseline samples will be designated as the third sample round. Therefore, the quarterly sampling rounds for the ORC® Treatability Study will be designated as the fourth through seventh rounds. Pertinent information regarding sample identification will be recorded in the field logbooks.

The appropriate alphanumeric sample identification code is explained as follows:

(Site Location) - (Site) - (Sample Number) – (Sample round)

Site Location: BRN (Outlying Landing Field Bronson)

Site: 1120 (Site 1120)

Sample Number: Groundwater sample = well identifier. No duplicates samples will be collected.

Sample Round: For groundwater samples = designated sample round number (e.g., 03, 04, 05, 06, and 07)

For example, a groundwater sample collected from monitoring well MW-04 during the baseline sampling before the ORC® Treatability Study will be designated as BRN-1120-MW04-03.

3.3.2 Sample Packaging and Shipping

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

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

All samples will be packaged and shipped in accordance with FDEP SOPs.

3.4 SAMPLE CUSTODY

Custody of samples must be maintained and documented at all times. Chain-of-custody begins with the collection of the samples in the field. TtNUS SOP SA-6.3 (Appendix E) provides a description of the chain-of-custody procedures to be followed.

3.5 QUALITY CONTROL (QC) SAMPLES

Work at Site 1120 will be conducted under the FDEP SOPs updated in 2002. In addition to regular calibration of field equipment and appropriate documentation, minimal QC samples will be collected during the Treatability Study sampling activities, since dedicated and/or disposable equipment is to be used for

sampling. A trip blank will be included with all VOC samples. In addition, a field clean equipment blank will also be included. No other QC samples are proposed.

Duplicate samples will not be collected as they are not required under current FDEP SOPs.

3.6 EQUIPMENT CALIBRATION

Several monitoring instruments may be used during field activities including the following:

- Photoionization or flame ionization detector
- Horiba U-22 water quality meter/probe
- Electronic water-level meter

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

3.7 EQUIPMENT MAINTENANCE

Measuring equipment used in environmental monitoring or analysis and test equipment used for calibration and maintenance shall be maintained by established procedures.

TtNUS maintains an inventory of sampling and measurement equipment. In the event that failed equipment cannot be repaired, replacement equipment will be shipped to the site by overnight carrier to minimize downtime.

3.8 RECORD KEEPING

In addition to chain-of-custody records, certain standard forms will be completed for sample description and documentation. These shall include sample log sheets, daily record of subsurface investigation reports, and logbooks. Field documentation and example field log forms are provided in Appendix C.

A bound/weatherproof site logbook shall be maintained by the FOL. All information related to sampling or field activities will be recorded in the site logbook. This information will include, but is not limited to, sampling time, weather conditions, unusual events, field measurements, descriptions of photographs, etc.

4.0 PROJECT MANAGEMENT

The management and technical aspects of this project are the ultimate responsibility of TtNUS. Each contractor assigned to individual tasks has the responsibility to fulfill the objectives of that task and to ensure the quality of the data generated by the task. At the direction of the United States Navy (Navy), TtNUS has overall responsibility for the investigations to be performed at Site 1120.

4.1 PROJECT ORGANIZATION

The various quality assurance and management responsibilities of key TtNUS project personnel are defined in the following paragraphs.

CLEAN Program Manager - The TtNUS Program Manager is responsible for the execution of all contractual obligations. The Program Manager serves as the primary point of contact for the client and provides an interface between the Navy and the project staff. The TtNUS CLEAN Program Manager is Ms. Debbie Wroblewski.

CLEAN Project Manager - The Project Manager is responsible for project performance, budget, and schedule, and for ensuring the availability of necessary personnel, equipment, subcontractors, and services. He/she will direct the development of the field program, evaluation of findings, determination of conclusions and recommendations, and preparation of technical reports. The TtNUS Project Manager is Mr. Gerald Walker, Professional Geologist.

FOL - The FOL is responsible for providing on-site supervision of day-to-day activities on the project. The FOL serves as the primary on-site contact with the client and subcontractors. In addition, the FOL is responsible for all field QA/QC and safety-related issues as defined in the HASP. The FOL for this project will be designated later by the Project Manager.

Health and Safety Manager (HSM) - The Program HSM will review and internally approve the HASP tailored to the specific needs of the investigation. In consultation with the Project Manager/FOL, the HSM will ensure that an adequate level of personal protection exists for anticipated potential hazards for all field personnel. As the HSM does not report to either the Program or Project Manager, his/her actions are not dictated by Program or project constraints (such as budget and schedule) other than the assurance of appropriate safeguards while conducting investigation activities. The TtNUS HSM is Mr. Matthew Soltis, Certified Industrial Hygienist.

QA Manager/Sampling Coordinators - The Project Manager/FOL will coordinate the schedule of field sampling activities with the schedule and capacity requirements of the selected analytical laboratory. All sampling will be coordinated to assure that environmental sampling is conducted in a manner that complies with all QA/QC requirements and is in compliance with holding time and analytical procedure requirements. All Program-wide, QA issues are the responsibility of the QA Manager. The TtNUS QA Manager for Navy CLEAN activities is Mr. Paul Frank.

Project Laboratory – The project laboratory has not been selected at this time.

4.2 PROJECT RESPONSIBILITIES

Throughout the field activities, NAS Pensacola personnel, as described below, will provide various support functions:

- Locate and mark underground utilities and issue digging or other required permits prior to the commencement of digging or drilling operations.
- Take custody of all drill cuttings, well development fluids, decontamination fluids, or drill cuttings.
- Secure staging areas for decontamination operations and for storing equipment and supplies. It is anticipated that access can be gained to Site 1120.
- A supply of electricity and potable water for equipment cleaning, slurry mixing, etc.

4.3 CONTINGENCY PLAN

In the event of problems that may be encountered during the site investigation activities, the TtNUS Project Manager will notify the Navy Remedial Project Manager (RPM) and the NAS Pensacola Point of Contact. The Project Manager will determine a course of action so as to minimize impacts to the project schedule and/or budget. Contingency plans will be approved through the Navy RPM and the NAS Pensacola Point of Contact before being enacted.

4.4 REPORTING

During performance of the ORC® Treatability Study, TtNUS will prepare the following reports:

ORC® Application and Baseline Monitoring Report

Upon completion of the Baseline Sampling and ORC® injection, TtNUS will prepare the ORC® Application and Baseline Monitoring Report, which will include the following:

- The results of the pre-installation sampling and ORC® injection activities.
- The ORC® installation procedures and any other data developed as part of the pilot-scale field activities.
- The groundwater sampling procedures and sample results.
- The groundwater flow conditions.

The Baseline Monitoring Report will be prepared and submitted to Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), NAS Pensacola, and the FDEP.

First, Second, and Third Quarterly Performance Monitoring Results Reports

Upon completion of the first, second, and third quarters of performance monitoring, TtNUS will prepare a brief letter report presenting the sample results.

Treatability Study Evaluation Report

Upon completion of the fourth quarter of performance monitoring, TtNUS will prepare the Treatability Study Evaluation Report. The report will present information on the groundwater flow conditions, sample results, and any other data collected during the performance of the Treatability Study. In addition, the report will present conclusions and recommendations for follow up actions for the site. The Treatability Study Evaluation Report will be prepared in draft form for SOUTHNAVFACENGCOM and NAS Pensacola review and in final form for SOUTHNAVFACENGCOM, NAS Pensacola, and the FDEP.

REFERENCES

FDEP (Florida Department of Environmental Protection), 2002. Chapter 62-160 FAC, Standard Operating Procedures. April

TtNUS (Tetra Tech NUS, Inc.), 2002. Quarterly Groundwater Monitoring Report Underground Storage Tank Site 1120, Outlying Landing Field Bronson, Pensacola, Florida. October.

APPENDIX A

ORC® MSDS

(As retrieved from Regenesis' Website.)

ORC® MATERIAL SAFETY DATA SHEET
Last Revised : April 17, 1998

****

SECTION# 1 - MATERIAL IDENTIFICATION

****

SUPPLIER:

REGENESIS Bioremediation Products

1011 Calle Sombra
San Clemente, CA 92673

Tel: 949-366-8000
Fax: 949-366-8090
Email: orc@regenesis.com

CHEMICAL DESCRIPTION:
A mixture of Magnesium Peroxide [MgO2], Magnesium Oxide [MgO], and Magnesium Hydroxide [Mg(OH)2]

CHEMICAL FAMILY:
Inorganic Chemicals

PRODUCT NAME:
Oxygen Release Compound (ORC®)

PRODUCT USE:
Used for environmental remediation of contaminated soil and groundwater

****

SECTION# 2 - CHEMICAL IDENTIFICATION

****

CHEMICAL CHARACTERIZATION

Magnesium Peroxide [MgO2]: CAS Reg. No. 14452-57-4

Magnesium Oxide [MgO]: CAS Reg. No. 1309-48-4

Magnesium Hydroxide ((Mg(OH)2): CAS Reg. No. 1309-42-8

FORM : powder

COLOR: white

ODOR: odorless

ASSAY: 25 - 35% Magnesium Peroxide (MgO2)

****

SECTION# 3 - PHYSICAL AND TECHNICAL SAFETY DATA

****

MELTING POINT: Not Determined

BOILING POINT: Not Determined

DENSITY: .6 - .8 g/cc

BULK DENSITY: ---

VAPOR PRESSURE: Data not available

VISCOSITY: ---

SOLUBILITY: Reacts with water. Soluble in acid

pH VALUE: Approx. 10 in saturated solution

FLASH POINT: Not applicable

SELF-IGNITION TEMPERATURE: Not applicable

EXPLOSION LIMITS % BY VOLUME: ---

THERMAL DECOMPOSITION: Spontaneous decomposition possible about 150° C

HAZARDOUS DECOMPOSITION PRODUCTS: Not known

HAZARDOUS REACTIONS: Hazardous polymerization will not occur

FURTHER INFORMATION: Non-combustible, but will support combustion

****

SECTION# 4 - REACTIVITY DATA

****

STABILITY: Product is stable unless heated above 150°C. Magnesium Peroxide reacts with water to slowly release oxygen. React by product is magnesium hydroxide

CONDITIONS TO AVOID: Heat above 150°C. Open flames

INCOMPATIBILITY: Strong Acids. Strong chemical agents

HAZARDOUS POLYMERIZATION: None known

****

SECTION# 5 - REGULATIONS

****

PERMISSIBLE EXPOSURE LIMITS IN AIR: Not established. Should be treated as a nuisance dust.

****

SECTION# 6 - PROTECTIVE MEASURES, STORAGE, AND HANDLING

****

TECHNICAL PROTECTIVE MEASURES

STORAGE: Keep container tightly closed. Keep away from combustible material

HANDLING: Use only in well-ventilated areas

PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY PROTECTION: Recommended (HEPA Filters)

HAND PROTECTION: Wear suitable gloves

EYE PROTECTION: Use chemical safety goggles
OTHER: ---

INDUSTRIAL HYGIENE: Avoid contact with skin and eyes

PROTECTION AGAINST FIRE AND EXPLOSION: ---

DISPOSAL: Dispose via sanitary landfill per state/local authority

FURTHER INFORMATION: Not flammable, but may intensify fire

****

SECTION# 7 - MEASURES IN CASE OF ACCIDENTS AND FIRE

****

AFTER SPILLAGE/LEAKAGE/GAS LEAKAGE: Collect in suitable containers. Wash remainder with copious quantities of water.

EXTINGUISHING MEDIA
SUITABLE: Carbon dioxide, dry chemicals, foam
NOT TO BE USED: ---

FURTHER INFORMATION: Self contained breathing apparatus or approved gas mask should be worn due to small particle size. Use extinguishing media appropriate for surrounding fire.

FIRST AID: After contact with skin, wash immediately with plenty of water and soap. In case of contact with eyes, rinse immediately with plenty of water and seek medical attention.

FURTHER INFORMATION: ---

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SECTION# 8 - INFORMATION ON TOXICOLOGY

****

TOXICITY DATA: Data not available

****

SECTION# 9 - INFORMATION ON ECOLOGY

****

WATER POLLUTION HAZARD RATING (WGK): 0

****

SECTION# 10 - FURTHER INFORMATION

****

After the reaction of magnesium peroxide to form oxygen the resulting material, magnesium hydroxide is mildly basic. The amounts of magnesium oxide (magnesia) and magnesium hydroxide in the initial product have an effect similar to lime, but with lower alkalinity.

The information contained in this document is the best available to the supplier at the time of writing, but is provided without warranty of any kind. Some possible hazards have been determined by analogy to similar classes of material. The items in this document are subject to change and clarification, as more information becomes available.

APPENDIX B

ORC® MIXING & INJECTING INSTRUCTIONS

(As retrieved from Regenesis' Website.)

DIRECTIONS FOR ORC® SLURRY MIXING

1. OPEN 5 GALLON BUCKET, AND REMOVE PRE-MEASURED BAG OF ORC.

2. MEASURE AND POUR WATER INTO THE 5-GALLON BUCKET ACCORDING TO THE FOLLOWING DESIRED CONSISTENCY:

65% Solids Slurry	Mix .63 gallons of water per 10 pounds of ORC powder.	
	Example:	Mix 20 pounds of ORC with 1.26 gallons of water.
		Mix 30 pounds of ORC with 1.89 gallons of water.

60% Solids Slurry	Mix .79 gallons of water per 10 pounds of ORC powder.	
	Example:	Mix 20 pounds of ORC with 1.58 gallons of water.
		Mix 30 pounds of ORC with 2.37 gallons of water.

50% Solids Slurry	Mix 1.19 gallons of water per 10 pounds of ORC powder.	
	Example:	Mix 20 pounds of ORC with 2.38 gallons of water.
		Mix 30 pounds of ORC with 3.57 gallons of water.

25% Solids Slurry	Mix 3.57 gallons of water per 10 pounds of ORC powder.	
	Example:	Mix 10 pounds of ORC with 3.57gallons of water.

3. ADD THE APPROPRIATE ORC QUANTITY TO THE WATER . Check weight of each bucket (see label). The 5-gallon shipping bucket weighs 2 pounds. An additional 4 pounds of ORC would require one additional quart of water, at the 65% solids level.

4. USE AN APPROPRIATE MIXING DEVICE TO THOROUGHLY MIX ORC AND WATER. A hand held drill with a "jiffy mixer" or a stucco mixer on it may be used in conjunction with a small paddle to scrape the bottom and sides of the container. Standard environmental slurry mixers may also be used, following the equipment instructions for operation. For small quantities a usable slurry can be mixed by hand, if care is taken to blend all lumps into the mixture thoroughly.

CAUTION: ORC MAY SETTLE OUT OF SLURRY IF LEFT STANDING. ALSO, ORC EVENTUALLY HARDENS INTO A CEMENT-LIKE COMPOUND, AND CANNOT BE RE-MIXED AFTER THAT HAS HAPPENED. THEREFORE:
Mix immediately before using. Do not let stand more than 30 minutes, and re-mix immediately before use, to be sure the mixture has not settled out. If a mechanical slurry mixer attached to a pump is being used, the material may be cycled back through the mixer to maintain slurry suspension and consistency.

5. CHECK SLURRY CONSISTENCY FOR POURABILITY. ADD WATER IF NECESSARY (IN 1 CUP INCREMENTS) TO ACHIEVE THE CORRECT CONSISTENCY.

ORC® Slurry Installation Instructions

Geoprobe® Hole Back-Fill Method

SAFETY:
Pure ORC is shipped to you as a fine powder rated at -325 mesh (passes through a 44 micron screen). It is considered to be a mild oxidizer and as such should be handled with care while in the field. Field personnel should take precautions while applying the pure ORC. Typically, the operator should work upwind of the product as well as use appropriate safety equipment. These would include eye and respiratory protection, and gloves as deemed appropriate by exposure duration and field conditions.

Personnel operating the field equipment utilized during the installation process should have appropriate training, supervision and experience.

GENERAL GUIDELINES:
ORC may be installed in the contaminated saturated zone in the ground utilizing hand augered holes, Geoprobe® type hydraulic punch equipment, or hollow stem augers. This set of instructions is specific for Geoprobe equipment. Alternate instructions may be obtained from the Regenesis Technical Support Department.

For optimum results the ORC slurry installation should span the entire vertical contaminated saturated thickness, including the capillary fringe and "smear zone".

Two general installation approaches are available. The first is to backfill only the probe hole with slurry. This is a simple approach, in that it is easy, straightforward, and the location of the ORC slurry is precisely known after installation. However, this method requires significantly more probe holes than the alternative, and may take more time for the completion of the remediation process. A separate set of instructions for this method utilizing Geoprobe equipment is available from Regenesis.

The second method is to inject the slurry through the probe holes into the contaminated saturated zone. This method requires fewer probe holes, is less disruptive to the site, and aids the spread of oxygen by spreading the ORC source material. However, it may be difficult to know the exact, final disposition of the ORC installed with this method. This is the method described in these instructions.

Note: It is important that the installation method and specific ORC slurry point location be established prior to field installation. It is also important that the ORC slurry volume and solids content for each drive point be predetermined. The Regenesis Technical Service Department is available to discuss these issues, and Helpful Hints at the end of these instructions offers relevant information. Regenesis also has available Technical Bulletins covering source treatments with ORC.

SPECIFIC INSTALLATION PROCEDURES

1. Identify the location of all underground structures, including utilities, tanks, distribution piping, sewers, drains, and landscape irrigation systems.
2. Identify surface and aerial impediments.
3. Adjust planned installation locations for all impediments and obstacles.
4. Pre-mark the installation grid point locations, noting any that have special depth requirements.
5. Set up the Geoprobe unit over each specific point, following manufacturer recommended procedures. Care should be taken to assure approximate vertical probe holes.
6. Penetrate surface pavement, if necessary, following standard Geoprobe procedures.
7. Drive the 1 1/2" (one-and-one-half inch) pre-probe (part #AT-148B) with the expendable tip (part #AT142B) to the desired maximum depth. Standard 1" (one inch) drive rods (part AT104B) should be used, after the pre-probe. (Hint: Pre-counted drive rods should be positioned prior to the installation driving procedure to assure the desired depth is reached.)
8. Disconnect the drive rods from the expendable tip, following standard Geoprobe procedures.

9. Mix the appropriate quantity of ORC slurry for the current drive point. (See separate "Directions for ORC® Slurry Mixing" and Helpful Hints). **Note: Do not mix more slurry than will be used within a 30 minute period.**
10. Set up and operate an appropriate slurry pump according to manufacturer's directions. Based on our experience, a Geoprobe model GS-1000 pump is recommended. Connect the pump to the probe grout pull cap (GS-1054) via a 1 inch diameter delivery hose. The hose is then attached to the 1" drive rod with its quick connector fitting. Upon confirmation of all connections add the ORC slurry to the pump hopper/tank.
11. Withdraw the pre-probe and drive stem 4'(four feet). (Also note Helpful Hints - Operations at end of instructions.)
12. Optional pretreatment step. (See Helpful Hints - Operations at end of instructions). Pump one to two gallons of tap water into the aquifer to enhance dispersion pathways from the probe hole.
13. Pump the predetermined quantity of ORC slurry for the depth interval being injected. Observe pump pressure levels for indications of slurry dispersion or refusal into the aquifer. (Increasing pressure indicates reduced acceptance of material by the aquifer).
14. Remove one 4' section of the 1" drive rod. The drive rod will contain slurry. This slurry should be returned to the ORC bucket for reuse.
15. Repeat steps 11, 13, and 14 until treatment of the entire affected thickness has been achieved. It is generally recommended that the procedure extend to the top of the capillary fringe/smear zone.
16. Install an appropriate seal, such as bentonite, above the ORC slurry through the entire vadose zone. This helps assure that the slurry stays in place and prevents contaminant migration from the surface. Depending on soil conditions and local regulations, a bentonite seal can be pumped through the slurry pump or added via chips or pellets after probe removal.
17. Remove and decontaminate the drive rods and pre-probe.
18. Finish the probe hole at surface as appropriate (concrete or asphalt cap, if necessary).
19. Move to the next probe point, repeating steps 5 through 18.

HELPFUL HINTS:

A. Physical characteristics

B. A1. Slurry

The ORC slurry is made using the dry ORC powder (rated at -325 mesh). It makes a smooth slurry, with a consistency that depends on the amount of water used.

A thick, but pumpable, slurry that approaches a paste can be made by using 65-67% solids. This material would normally be used for back-filling a bore or probe hole. It is especially useful where maximum density is desired such as where ground water is present in the hole or there are heaving sands.

Thinner slurries can be made by using more water. Typical solids for the thinner slurries content will range from 35% to 62%. Such slurries are useful for injecting through a probe or bore hole into the saturated aquifer.

As a rule, it is best to mix the first batch of slurry at the maximum solids content one would expect to use. It can then be thinned by adding additional water in small increments. By monitoring this process, the appropriate quantities of water for subsequent batches can be determined.

The slurry should be mixed at about the time it is expected to be used. It is best to not hold it for more than 30 minutes. Thinner slurries, especially, can experience a separation upon standing. All ORC slurries have a tendency to form cements when left standing. If a slurry begins to thicken too much, it should be mixed again and additional water added if necessary.

Care should be taken with slurry that may be left standing in a grout pump or hose. Problems can generally be avoided by periodically re-circulating the slurry through the pump and hose back into the pump's mixing or holding tank.

A2. Equipment

Most geotechnical grout pumping equipment has a holding tank with a capacity sufficient for injection.

When applying measured volumes of ORC slurry to probe holes, it is sometimes useful to know the volumes and content of the delivery system lines. The following information may be useful in this regard.

Geoprobe pump: At the end of a pump stroke virtually no deliverable slurry remains in the pump.

5/8" O.D. connecting hose (10 feet long):	0.2 gallons (26 fluid ounces).
Four foot (4') length of 1" drive rod:	.04 gallons (5 fluid ounces).
Three foot (3') length of 1 1/2" pre-probe:	.03 gallons (4 fluid ounces).

Cleaning and maintenance:

Pumping equipment and drive rods can be lightly cleaned by circulating clear water through them. Further cleaning and decontamination (if necessary due to subsurface conditions) should be performed according to the equipment supplier's standard procedures and local regulatory requirements.
B. Operating characteristics
B1. Operations - General
Judgment will be needed in the field when injecting ORC slurries. In general, it is relatively easy to inject ORC slurries into sandy soils, and this can usually be accomplished at very moderate pressures. Silts and clays require more pressure, and may accept less slurry.

Careful observation of pressure during slurry pumping is the best indication of the effectiveness of the slurry injection. To test the soil's ability to accept the slurry and to "precondition" the injection point for the slurry, it is sometimes useful to inject a small volume of plain water prior to the slurry. Normally, one-half (0.5) gallons to two (2) gallons would be appropriate.

During injection, increasing pressure and decreasing flow rate are signs of refusal by the soil matrix to accept the slurry. The site geologist should determine whether to increase pressure, and possibly fracture ("frac") the soil matrix to achieve ORC slurry installation in a tight site that has refused the slurry at lower pressures.

B2. Fill Volumes
Probe hole back-filling
Probe hole capacities:

Per 10' (Ten Foot) Length			
Theoretical		**Operating Volume**	
(Gallons/Fluid Ounces/Cubic Inches)		**(Gallons/Fluid Ounces)**	
Sand, Silts & Clay		**Sand**	**Silts & Clay**
1" Diameter	.41 gal/52 fl. oz./94.2 cu. in.	.61 gal/78 fl. oz.	.51 gal/65 fl. oz.
1 1/2" Diameter	.92 gal/117 fl. oz./212.0 cu. in.	1.38 gal/176 fl. Oz.	1.15 gal/146 fl. oz.
2" Diameter	1.63 gal/209 fl. oz./376.8 cu. in.	2.44 gal/313 fl. Oz.	2.04 gal/261 fl. oz.
2 1/4" Diameter	2.06 gal/264 fl. oz./476.9 cu. in	3.09 gal/396 fl. Oz.	2.57 gal/330 fl. oz.

Note that the operating volumes include a 50% excess above the theoretical volume in sands and 25% in clays and silts. This is important to successful treatment. The additional material allows for a small degree of infiltration of the slurry into the surrounding soil and fractures, as well as hole diameter variability. It is important to assure that the entire contaminated saturated zone is treated (including the capillary fringe), since this is often the area of highest pollution concentration. Failure to treat this area due to improper installation can undermine an otherwise successful remediation effort.

APPENDIX C

FIELD FORMS

Tetra Tech NUS, Inc.

GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: Site 1120 Treatability Study **Project No.:** N5967

Location: OLF Bronson **Personnel:**

Weather Conditions: **Measuring Device:**

Tidally Influenced: Yes ___ No ___ **Remarks:**

Well or Piezometer Number	Date	Time	Elevation of Reference Point (feet)*	Total Well Depth (feet)*	Water Level Indicator Reading (feet)*	Thickness of Free Product (feet)*	Groundwater Elevation (feet)*	Comments

* All measurements to the nearest 0.01 foot

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: OLF Bronson Site 1120
Project No.: N5967

[ ] Domestic Well Data
[X] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.:
Sample Location:
Sampled By:
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[ ] High Concentration

SAMPLING DATA

Date: / Time:	Color Visual	pH Standard	S.C. mS/cm	Turbidity NTU	DO mg/l	Temp. °C	ORP mV	Other
Method: Low Flow Peristaltic								

PURGE DATA

Date:	Time	pH	S.C.	Turbidity	DO	Temp (°C)	ORP	
Method: Low Flow Peristaltic								
Monitor Reading (ppm):								
Well Casing Diameter:								
Well Casing Material:								
Total Well Depth (TD):								
Static Water Level (WL):								
One Casing Volume(gal/L):								
Start Purge (hrs):								
End Purge (hrs):								
Total Purge Time (min):								
Total Vol. Purged (gal/L):								

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Collected
PAH	None	2 - 1 litre amber bottle	
VOCs	HCl	3 - 40 mL vials	
TRPH	H2SO4	2 - 1 litre amber bottle	
TOC	H2SO4	1 - 250 mL HDPE bottle	
Sulfate	None	1 - 250 mL HDPE bottle	

OBSERVATIONS / NOTES

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: OLF Bronson Site 1120
PROJECT NUMBER: N5967

WELL ID.: BRN-1120-
DATE: _____

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	Volume (L)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments

SIGNATURE(S): _____

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: OLF Bronson Site 1120

Project No.: N5967

Sampled By:

Field Analyst:

Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.:

Sample Location:

Duplicate: ☐

Blank: ☐

SAMPLING DATA:

Date: / Time:	Color Visual	pH Standard	S.C. mS/cm	Turbidity NTU	DO mg/l	Temp. °C	ORP mV	
Method: Peristaltic								

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Ferrous Iron:

Equipment: HACH IR-18C Test Kit

Analysis Time: _____

Concentration: _____ mg/L

Notes:

Hydrogen Sulfide (H_2S):

Equipment: HS-C

Analysis Time: _____

Concentration: _____ mg/L

Notes:

Alkalinity:

Analysis Time: _____

Equipment:

CHEMetrics (Range: _____mg/L)

Filtered: ☐

CHEMetrics: _____mg/L

Notes:

Carbon Dioxide:

Equipment: HACH Digital Titrator CA-DT

CHEMetrics (Range: _____mg/L)

Analysis Time: _____

CHEMetrics: _____mg/L

Notes:

Dissolved Oxygen:

Equipment:

CHEMetrics Range ☐ 0 - 1.0 mg/L ☐ 1 - 12 mg/L

Analysis Time: _____

CHEMetrics: _____mg/L

QA/QC Checklist:

All data fields have been completed as necessary: ☐

Correct measurement units are cited in the SAMPLING DATA block: ☐

Mulitplication is correct for each *Multiplier* table: ☐

Final calulated concentration is within the appropriate *Range Used* block: ☐

Alkalinity *Relationship* is determined appropriatly as per manufacturer instructions: ☐

QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents: ☐

Nitrite Interference treatment used for Nitrate test if Nitrite was detected: ☐

Title block is initialized by person who performed the QA/QC Checklist: ☐

Tetra Tech NUS, Inc.

PROJECT:	Site 1120 Treatability Study	**LOCATION:**	OLF Bronson
JOB & CTO #:	N5967, CTO 302	**DEPART:**	
TOM:		**RETURN:**	

SAMPLING FIELD CHECKLIST

EQUIPMENT

- ___ Well Key/ Gate Key
- ___ Submersible Pump
- ___ Peristaltic Pump
- ___ Horiba
- ___ Umbrella
- ___ Chair
- ___ Measuring cup
- ___ Clips
- ___ Well Tool (9/16)
- ___ Drum Wrench (15/16)
- ___ Buckets/lids
- ___ Water Level Indicator
- ___ Hach Kit Tests for NA
- ___ Box cutter knife
- ___ Machete
- ___ Batteries
- ___ Charger
- ___ Car Adaptor for batteries
- ___ Scrub Brush
- ___ OVA/FID
- ___ Bungee cords
- ___ Drum/Pallets
- ___ Cell Phone/charger
- ___ Secondary Spill pans
- ___ Sampling Filters

DOCS

- ___ Work Plan
- ___ HASP Addendum
- ___ EISOPQAM
- ___ COMPQAP

EXPENDABLES

- ___ Silicone Tubing
- ___ Teflon Tubing
- ___ DI Cube
- ___ DI Sprayer
- ___ Paper Towels
- ___ Gloves
- ___ Trash Bags
- ___ Liquinox
- ___ Bottleware (extra VOA vials)
- ___ Isopropyl
- ___ Ziplock Bags
- ___ Tape/dispenser
- ___ Bubblewrap
- ___ Ice
- ___ Sharpie Pens
- ___ Drinks
- ___ Small cups (if water in wells)
- ___

FORMS

- ___ Labels
- ___ COC's
- ___ Low Flow Purge Sheet
- ___ Development sheet
- ___ Field Book
- ___ Drum Labels
- ___ Custody seals
- ___ Fed Ex Air bill
- ___ Field Calibration Sheet
- ___ Groundwater Sample sheet
- ___ Site Map

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODEL : _____

MANUFACTURER : _____

PROJECT NAME : OLF Bronson Site 1120

PROJECT NUMBER : N5967

CALIBRATION DATE	INSTRUMENT/ SERIAL #	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS

APPENDIX D

HEALTH AND SAFETY PLAN

SITE 1120

Health and Safety Plan
for
Site 1120 Quarterly Groundwater Sampling
for
Naval Air Station Pensacola
Pensacola, Florida

Southern Division
Naval Facilities Engineering Command
Contract No. N62467-94-D-0888
Contract Task Order 0302

April 2003

HEALTH AND SAFETY PLAN

SITE 1120 QUARTERLY GROUNDWATER SAMPLING
FOR
NAVAL AIR STATION PENSACOLA
PENSACOLA, 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:
Tetra Tech NUS, Inc.
661 Andersen Drive
Pittsburgh, Pennsylvania 15222

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0302

APRIL 2003

PREPARED UNDER THE SUPERVISION OF:

Gerald Walker

GERALD WALKER, PG
TASK ORDER MANAGER
TETRA TECH NUS, INC.
TALLAHASSEE, FLORIDA

APPROVED FOR SUBMITTAL BY:

Matthew M. Soltis

MATTHEW M. SOLTIS, CIH, CSP
CLEAN HEALTH & SAFETY MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

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1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been written to encompass site activities that are to be conducted at the Naval Air Station Pensacola (NAS Pensacola), Pensacola, Florida as part of Contract Task Order (CTO) 0302. Specifically, this HASP addresses the quarterly groundwater sampling and additional investigation activities that will be conducted at Site 1120 of NAS. This HASP is being prepared for NAS Pensacola as part of an overall effort conducted under Comprehensive Long-Term Environmental Action Navy (CLEAN III) administered through the U.S. Navy Southern Division Naval Facilities Engineering Command (NAVFAC), as defined under Contract Number N62467-94-D-0888. In addition to the HASP, a copy of the Tetra Tech NUS, Inc. (TtNUS) Environmental Health and Safety Guidance Manual must be present at the site during the performance of site activities. The Guidance Manual provides detailed information pertaining to the HASP, as well as TtNUS Standard Operating Procedures (SOP's). Both documents must be present at the site to comply with the requirements stipulated in the Occupational Safety and Health Administration (OSHA) standard 29 CFR 1910.120.

This HASP has been developed using the latest available information regarding known or suspected chemical contaminants and potential physical hazards associated with the proposed work and site, and will be subject to review and (possible) modification. The HASP will be modified if new information becomes available. All changes to the HASP will be made by the Project Health & Safety Officer (PHSO) and approved by the TtNUS Health and Safety Manager (HSM) and the Task Order Manager (TOM). The TOM will notify affected personnel of all changes.

The elements of this HASP are in compliance with the requirements established by OSHA 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response" (HAZWOPER), and sections of 29 CFR 1926, "Safety and Health Regulations for Construction". The information contained in this plan, as well as policies on conducting on-site operations, have been obtained from the TtNUS Health and Safety Program.

1.1 KEY PROJECT PERSONNEL AND ORGANIZATION

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

  i. Providing information regarding site contaminants and physical hazards associated with the site.
  ii. Establishing air monitoring and decontamination procedures.
  iii. Assigning personal protective equipment based on task and potential hazards.
  iv. Determining emergency response procedures and emergency contacts.
  v. Stipulating training requirements and reviewing appropriate training and medical surveillance certificates.
  vi. Providing standard work practices to minimize potential injuries and exposures associated with hazardous waste work.
  vii. Modify this HASP, as it becomes necessary.

- The TtNUS Field Operations Leader (FOL) is responsible for implementation of the HASP with the assistance of an appointed SSO. The FOL manages field activities, executes the work plan, and enforces safety procedures as applicable to the work plan.

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

  i. Coordinates all health and safety activities with the FOL.
  ii. Selects, applies, inspects, and maintains personal protective equipment.
  iii. Establishes work zones and control points in areas of operation.
  iv. Implements air monitoring program for on-site activities.
  v. Verifies training and medical clearance of on-site personnel status in relation to site activities.
  vi. Implements Hazard Communication, Respiratory Protection Programs, and other associated health and safety programs as they may apply to site activities.
  vii. Coordinates emergency services.
  viii. Provides site-specific training for all on-site personnel.
  ix. Investigates all accidents and injuries (see Attachment I - Illness/Injury Procedure and Report Form)
  x. Provides input to the PHSO regarding the need to modify, this HASP, or applicable health and safety associated documents as per site-specific requirements.

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

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

1.2 SITE INFORMATION AND PERSONNEL ASSIGNMENTS

Site Name: Naval Air Station Pensacola Address: Pensacola, Florida

Navy Remedial Project Manager: Byas Glover Phone Number: (843) 820-5651

Navy Environmental Coordinator: Greg Campbell Phone Number: (850) 452-4611 ext. 103

Purpose of Site Visit: This activity is divided into a multi-task operation (see Section 4.0), including ORC Injection, groundwater sampling, installation of replacement wells, well abandonment, and other related activities.

Proposed Dates of Work: April 2003 – April 2004, which includes quarterly groundwater sampling.

Project Team:

TtNUS Personnel:	**Discipline/Tasks Assigned:**
Gerald Walker	Task Order Manager (TOM)
TBD	Field Operations Leader (FOL)
Matthew M. Soltis, CIH, CSP	CLEAN Health and Safety Manager (HSM)
Clyde J. Snyder	Project Health and Safety Officer (PHSO)
TBD	Site Safety Officer (SSO)

Non-TtNUS Personnel	**Affiliation/Discipline/Tasks Assigned**
TBD	Drilling Subcontractor
TBD	IDW Disposal

Hazard Assessment (for purposes of 29 CFR 1910.132) for HASP preparation has been conducted by: Clyde J. Snyder

TBD - To be determined

2.0 EMERGENCY ACTION PLAN

2.1 INTRODUCTION

This section is part of a preplanning effort to direct and guide field personnel in the event of an emergency. Site activities are to be coordinated with NAS Pensacola fire protection and emergency services prior to commencement. In the event of an emergency that cannot be mitigated using on-site resources, personnel will evacuate to a safe place of refuge and the FOL will contact "911" to report the emergency. Site personnel may transport ill workers or those who have non-serious injuries to medical facilities, provided that such transport can be done safely. The emergency response agencies listed in this plan are capable of providing the most effective response, 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 Pensacola Emergency Dispatch will be notified anytime 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, include initial response measures for incidents such as:

- Initial fire-fighting support and prevention
- Initial spill control and containment measures and prevention
- Removal of personnel from emergency situations
- Provision of initial medical support for injury/illness requiring only first-aid level support
- Provision of site control and security measures as necessary

2.2 PRE-EMERGENCY PLANNING

Through the initial hazard/risk assessment effort, injury or illness resulting from exposure to chemical or physical hazards or fire are the most probable emergencies that can be encountered during site activities. To minimize and eliminate these potential emergency situations, pre-emergency planning activities associated with this project include the following. The SSO and/or the FOL are responsible for:

- Coordinating response actions with NAS Pensacola Emergency Services personnel to ensure that TtNUS emergency action activities are compatible with existing facility emergency response procedures.
- Establishing and maintaining information at the project staging area (Support Zone) for easy access in the event of an emergency. This information includes the following:

  - Chemical Inventory (for substances used on site), with Material Safety Data Sheets.

- On-site personnel medical records (medical data sheets).
- A logbook identifying personnel on site each day.
- Emergency notification phone numbers in all site vehicles

- Identifying a chain or 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.

It is the responsibility of the TtNUS FOL to ensure that this information is available and present at the site.

2.3 EMERGENCY RECOGNITION AND PREVENTION

2.3.1 Recognition

Foreseeable emergency situations that may be encountered during site activities will generally be recognizable by visual observation. A clear knowledge of the signs and symptoms of overexposure to contaminants of concern may alert personnel of the potential hazards concerning themselves or their fellow workers. These potential hazards, the activities with which they have been associated, and the recommended control methods are discussed in detail in sections 5.0 and 6.0 of this document. Additionally, early recognition will be supported by periodic site surveys to eliminate any conditions that may predispose site personnel or properties to an emergency. The FOL and the SSO will constitute the site evaluation committee responsible for these periodic surveys. Site surveys will be conducted at least once a week during the initiation of this effort.

The above actions will provide early recognition for potential emergency situations. Should an incident take place, TtNUS will take defensive and offensive measures to control these situations. However, if the FOL and/or the SSO determine that an incident has progressed to a serious emergency situation, TtNUS will withdraw, and notify the appropriate response agencies.

2.3.2 Prevention

TtNUS and subcontractor personnel will minimize the potential for emergencies by ensuring compliance with the HASP, the Health and Safety Guidance Manual, applicable OSHA regulations, and through periodic site surveys of work areas.

2.4 SAFE DISTANCES AND PLACES OF REFUGE

In the event that the site must be evacuated, all personnel will immediately stop activities and report to the FOL at the place of safe refuge. Safe places of refuge will be determined prior to commencement of site

activities and will be conveyed to personnel as part of the daily safety meeting conducted each morning. Upon reporting to the refuge location, personnel will remain there until directed otherwise by the TtNUS FOL. The FOL or the SSO will take a head count at this location to confirm the location of all site personnel. The site logbook will be used to take the head count. Places of refuge will ideally be selected which offer a point for communication purposes should this be required.

2.5 EVACUATION ROUTES AND PROCEDURES

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

Evacuation procedures will be discussed prior to the initiation of any work at the site. This shall include identifying primary and secondary evacuation routes and assembly points. Evacuation routes from the site 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) will influence the designation of evacuation routes. As a result, assembly points at NAS Pensacola will be selected, and in the event of an emergency, field personnel will proceed to these points by the most direct route possible without further endangering themselves.

2.6 EMERGENCY ALERTING AND ACTION/RESPONSE PROCEDURES

Since TtNUS personnel will not always be working in the proximity of each other, hand signals, voice commands, air horns, and/or two-way radios may comprise the mechanisms to alert site personnel of an emergency.

If an incident occurs, site personnel will initiate the following procedures:

- Initiate incident alerting procedures (if needed) verbally, by air horn, or using two-way radios.
- Evacuate non-essential personnel.
- Initiate initial response procedures.
- Describe to the FOL (who will serve as the Incident Commander) what has occurred in as much detail as possible.

In the event that site personnel cannot control the incident through offensive and/or defensive measures, the FOL and/or the SSO will enact emergency notification procedure to secure additional outside assistance in the following manner:

- Call 911 for outside emergency service and report the emergency to the NAS Pensacola Emergency Dispatch (See Table 2-1)
- Give the emergency operator the location of the emergency and a brief description of what has occurred.
- Stay on the phone follow the instructions given by the operator
- The appropriate agency will be notified and dispatched

If an incident occurs at outside of our designated operating areas impacting field personnel, the following procedures are to be initiated:

- Initiate an evacuation (if needed) by voice commands, hand signals, air horns, or two-way radio.
- Call Navy On-Site Representative
- Proceed to the assembly points as directed by NAS Pensacola or other Navy personnel.

2.7 EMERGENCY CONTACTS

Prior to performing work at the site, all personnel will be thoroughly briefed on the emergency procedures to be followed in the event of an incident. A mobile phone shall be available at the sites. Table 2-1 provides a list of emergency contacts and their corresponding telephone numbers. These numbers will be used for all of the sites to be visited during this project. This table must be posted at the sites where it is readily available to all site personnel.

TABLE 2-1

EMERGENCY CONTACTS
NAS PENSACOLA

AGENCY	TELEPHONE
EMERGENCY (outside services) (Police, Fire, and Ambulance Services)	**911**
NAS Pensacola - Emergency Dispatch	(850) 452-3333
Navy Engineer-in-Charge Byas Glover	(843) 820-5651
Facility Point of Contact Greg Campbell	(850) 452-4611 ext 103
Navy Hospital	(850) 505-6600
Baptist Hospital	(850) 469-2313
Poison Control Center	(800) 222-1222
Florida Game and Fresh Water Fish Commission Northwest Region Office	(850) 265-3676
WorkCare	(800) 229-3674
TtNUS Tallahassee Office and Task Order Manager (Gerry Walker)	(850) 385-9899
CLEAN Health and Safety Manager Matthew M. Soltis, CIH, CSP	(412) 921-8912
Project Health and Safety Officer Clyde J. Snyder	(412) 921-8904

2.8 ROUTE TO HOSPITALS

Two hospitals could potentially be used during this project depending on the circumstances. For emergency situations the Naval Hospital Pensacola (NHP) should be utilized. The hospital is closer to the site and is fully prepared to accept chemically contaminated patients. Baptist Hospital will be used for all non-emergency care services. Routes and directions to these hospitals are provided in Figures 2-1 and 2-1-1.

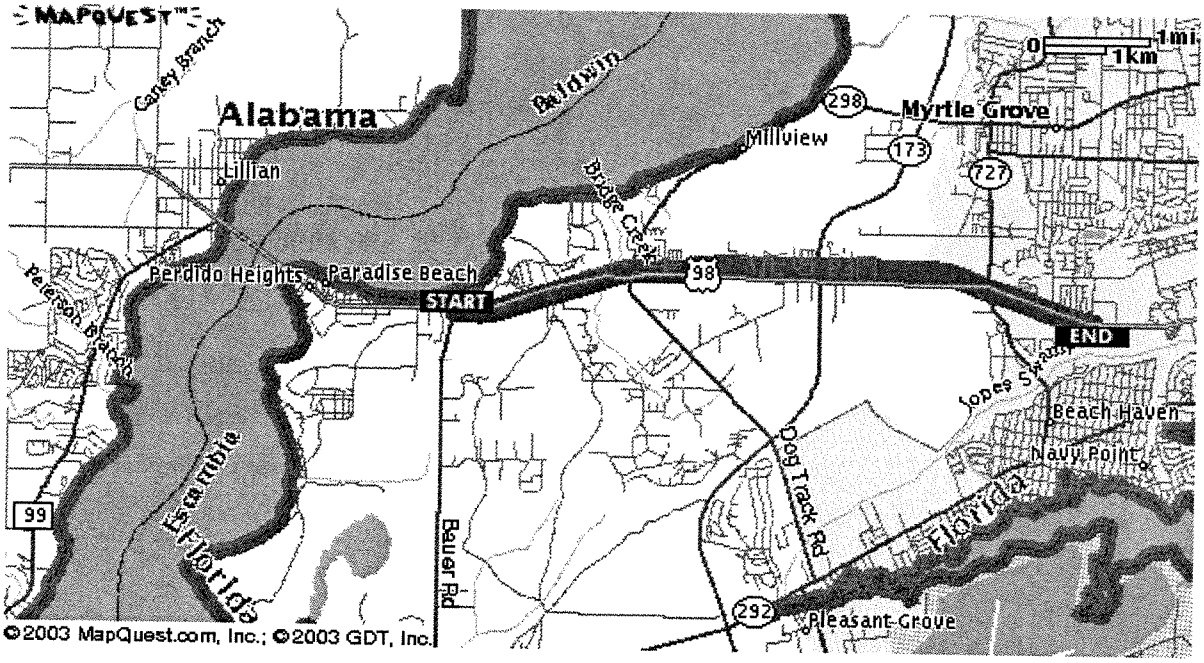
For emergency care only, non-Navy personnel are permitted to go to the Navy Hospital.

Navy Hospital
6000 West Highway 98
(850) 505-6600/6601

Proceed out of Main Gate (Navy Blvd) heading north to US Highway 98. Turn left (heading west) on US 98 and proceed approximately 1 mile. Hospital will be on the right (Building 2268).

Figure 2-1-1

Route to Naval Hospital Pensacola



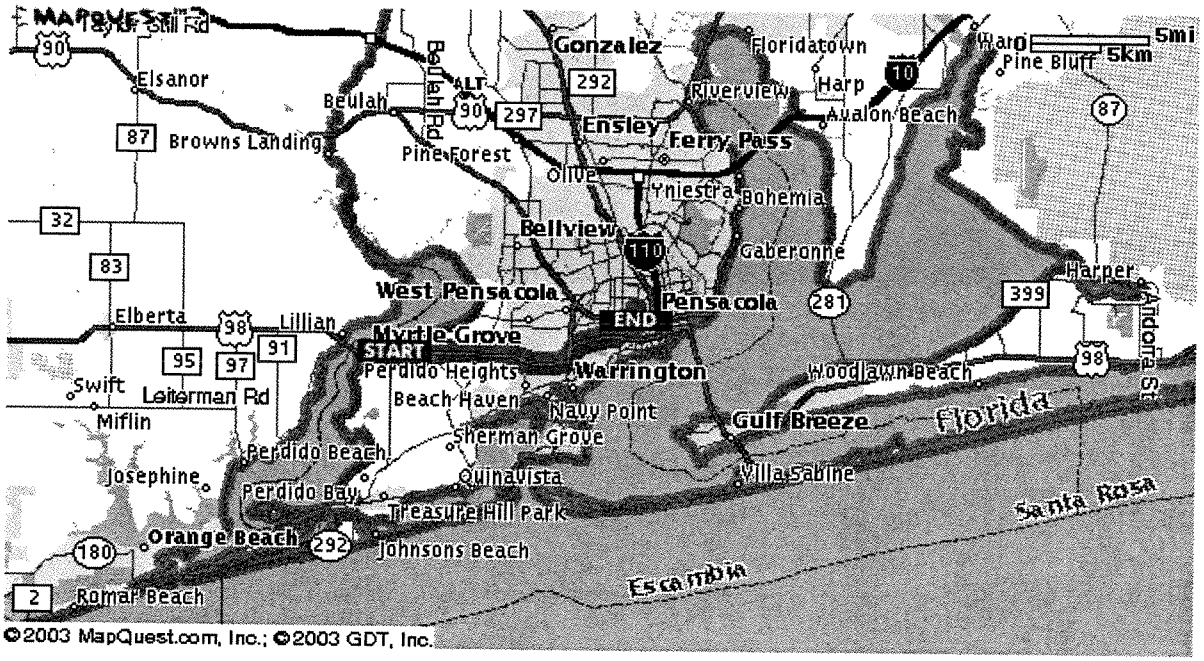
Baptist Hospital will be used for all non-emergency care services.

Baptist Hospital
1000 West Morino Street
(850-469-2313)

Proceed out of Main Gate of OLF Bronson, turning north on State Route (SR) 293. Continue on SR 293 approx. 7.5 miles, then turn right (heading south) on SR 295. Proceed approx. 0.5 miles to SR 292. Turn left (heading east) on Highway 292 and continue until it turns into Garden Street (approx. 3 miles). Take Garden Street to intersection with "E" Street. Turn left onto "E" Street and proceed approx. 1 mile to Hospital on left.

Figure 2-1-1

Route to Baptist Hospital Pensacola



2.9 DECONTAMINATION PROCEDURES/EMERGENCY MEDICAL TREATMENT

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

TtNUS personnel will perform removal of personnel from emergency situations and may provide initial medical support for injury/illnesses requiring only first-aid level support. Medical attention above that level will require assistance and support from the designated emergency response agencies. **If the emergency involves personnel exposures to chemicals, follow the steps provided in Figure 2-2.**

2.10 INJURY/ILLNESS REPORTING

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

FIGURE 2-2
EMERGENCY RESPONSE PROTOCOL

The purpose of this protocol is to provide guidance for the medical management of injury situations. In the event of a personnel injury or accident:

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

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

WorkCare will compile the results of 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. A personalized letter describing the individual findings/results will accompany this generalized summary. A copy of the personal letter will be filed in the continuing medical file maintained by WorkCare.

FIGURE 2-2 (continued)
POTENTIAL EXPOSURE REPORT

Name: _____ Date of Exposure: _____

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

Client Contact: _____ Phone No.: _____

Company Name: _____

I. Exposing Agent

Name of Product or Chemicals (if known): _____

_____

Characteristics (if the name is not known)

Solid Liquid Gas Fume Mist Vapor

II. Dose Determinants

What was individual doing? _____

How long did individual work in area before signs/symptoms developed? _____

Was protective gear being used? If yes, what was the PPE? _____

Was there skin contact? _____

Was the exposing agent inhaled? _____

Were other persons exposed? If yes, did they experience symptoms? _____

III. Signs and Symptoms (check off appropriate symptoms)

Immediately With Exposure:

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

Delayed Symptoms:

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

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

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

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

Improved: _____ Worsened: _____ Remained Unchanged: _____

V. Treatment of Symptoms (check off appropriate response)

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

3.0 SITE BACKGROUND

3.1 NAS PENSACOLA

NAS Pensacola is approximately 5,800-acres and is located on a peninsula bounded on the east and south by Pensacola Bay and Big Lagoon, and on the north by Bayou Grande.

3.2 OLF BRONSON

OLF Bronson is located in Escambia County, in Florida's northwest coastal area, approximately 5 miles west of the Pensacola City limits. The 950-acre installation was constructed in the early 1940s. Prior to construction, the site was undeveloped and sparsely vegetated. Several unpaved roads or airstrips were visible at the site leading to the paved circular area. The original name of the airfield, Tarklin Field, was changed to OLF Bronson during the installation construction activities. The base was used a training base for Naval aviators during World War II and the Korean War. The western portion of OLF Bronson was also used to maintain sea planes and train sea plane pilots. OLF Bronson was closed as an active airfield in 1950, but the runways were still used for touch-and-go landing for helicopter training. After 1950, base dismantling activities were conducted. By 1968, all buildings located at OLF Bronson were razed. Aerial photographs identify areas to the south, east, and north of the facility as undeveloped with the exception of some residential properties along U.S. Highway 98, and Perdido Bay (0.5 miles north of the facility).

3.2.1 Site 1120

Site 1120 is located to the southwest side of the remains of Building 1120, in an area where two former USTs were removed. To the north, east, and west of the site are dense woods, and to the south is a dirt road running east to west. Concrete risers and old building debris are located to the north and east of the site. Petroleum contamination was observed at the site on June 27, 1994 during the removal of three concrete USTs (1,500-gallon capacity) and steel butane UST (250-gallon capacity) from Building 1120. The USTs, approximately 50 years old, were used to store heating fuel oil and butane. Approximately 200 cubic yards of soils were removed from the excavation during removal of the tanks. The Closure Assessment Form for Site 1120 documents petroleum hydrocarbon vapor levels in the soils, and analytical results of the groundwater sample collected from the monitoring well indicated petroleum contaminant levels at the site greater than the allowable state target levels.

4.0 SCOPE OF WORK

The following is a list of activities that are covered in this HASP for the CTO 0302 project:

- Mobilization/demobilization
- Groundwater Sampling / Water Level Measurements
- Replacement Well Installation using DPT methods
- Well Abandonment
- Decontamination of sampling and heavy equipment
- IDW management
- Soil boring injection of ORC© (Oxygen Release Compound). This material is to be injected into specified borings using a pump and tremie method with injection discharge taking place at the bottom of the borings and advancing toward the ground surface. This material is a bioremediation product. The MSDS for this compound is available in Attachment V. Additional health and safety considerations are available in Section 6.1.1.

For more detailed description of the associated tasks, refer to the Plan of Action (POA), the Work Plan (WP) and/or Sampling and Analysis Plan (SAP). Any tasks to be conducted outside of the elements listed here will be considered a change in scope requiring modification of this document. The TOM or a designated representative will submit all requested modifications to this document to the HSM.

5.0 TASKS/HAZARDS/ASSOCIATED CONTROL MEASURES

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

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

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

Safe Work Permits issued for all Exclusion Zone activities (See Section 9.4 and Attachment IV) will use elements defined in Table 5-1 as its primary reference. The FOL and/or the SSO completing the Safe Work Permit will add additional site-specific information. In situations where the Safe Work Permit is more conservative than the direction provided in Table 5-1 due to the incorporation of site-specific elements, the Safe Work Permit will be followed.

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6.0 HAZARD ASSESSMENT

This section provides information regarding the chemical, physical, and natural hazards associated with the sites to be investigated and the activities that are to be conducted as part of the scope of work. Table 6-1 provides various information, exposure limits, symptoms of exposure, physical properties, and air monitoring and sampling data for the substances that have been identified as contaminants of concern for this project. Section 6.1 provides general information regarding all contaminants that may be present in the planned work areas.

6.1 CHEMICAL HAZARDS

The potential health hazards associated with work to be conducted at NAS Pensacola include inhalation, ingestion, and dermal contact of various contaminants that may be present in shallow and deep soils and groundwater. Based on the site histories and prior sampling efforts, the types of contaminants anticipated include petroleum products and associated compounds. The following have been identified as the primary classes of these contaminants, including the specific compound(s) of interest:

- Volatile Organic Compounds (VOCs), specifically ethylbenzene and xylenes
- Semi-Volatile Organic Compounds (SVOCs), including Total Petroleum Hydrocarbons (TPHs) and general Polycyclic Aromatic Hydrocarbons (PAHs).

Based on available data and the nature of planned activities, inhalation of site contaminants at levels that could represent an exposure concern is considered to be very unlikely. Direct-reading instrumentation (e.g. PID) will be used as a precaution to monitor for this concern. It is anticipated that the greatest potential for exposure to site contaminants is during intrusive activities (monitoring well installations and groundwater sampling, etc.). Exposure to these compounds is most likely to occur through ingestion of contaminated soil or water, or hand-to-mouth contact during soil disturbance activities. For this reason, PPE and basic hygiene practices (washing face and hands before leaving site) will be extremely important. Exposure will be avoided by using appropriate PPE and engineering controls where necessary.

6.1.2 Oxygen Release Compound (ORC®)

ORC® will be injected into specified soil borings using a pump and tremie method. This method introduces the ORC® from the bottom of the boring in a retracting up-ward fashion. The material to be injected is a registered material the Material Safety Data Sheet is provided in Attachment V. Health effects associated with overexposure to magnesium products are as indicated below:

TABLE 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
NAVAL AIR STATION PENSACOLA, FLORIDA – CTO 0225

Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
Diesel Fuel No.2-D	Mixture	Components of this substance will be detected readily; however, no documentation exists as to the relative response ratio of either PID or FID.	Air sampling use charcoal tube as a collection media; carbon disulfide desorption; GC/FID detection. Sampling and analytical protocol in accordance with NIOSH Method #1550.	OSHA; NIOSH; ACGIH: 5 mg/m^3 as mineral oil mist. In addition NIOSH and ACGIH establish 10 mg/m^3 as a STEL.	Kerosene odor **Recommended air-purifying cartridges:** Organic vapor **Recommended gloves:** Nitrile	**Boiling Pt:** <300-550°F; 149-288°C **Melting Pt:** Not available **Solubility:** Negligible **Flash Pt:** 95-145°F; 35-62°C **Autoignition:** 475°F, 246°C **LEL/LFL:** 0.6% **UEL/UFL:** 8.0% **Vapor Density:** >5 **Vapor Pressure:** <0.1 mmHg @ 70°F; 21°C **Specific Gravity:** 0.80 **Incompatibilities:** strong oxidizers, halogens, and hypochlorites **Appearance and odor:** Colorless to amber with a kerosene odor	Prolonged or repeated exposures to this product may cause skin and eye irritation. Because of the defatting capabilities ,this exposure may lead to a dermatitis condition. High vapor concentrations are irritating to the eyes and respiratory tract. Exposure to high airborne concentrations may result in narcotic effects, including dizziness, headaches, and anesthetic capabilities leading to unconsciousness. High concentrations in a confined space may adequately displace oxygen thereby resulting in suffocation.
AVGas (Aviation Gasoline) Composition Naphtha (petroleum), light alkylation; 64741-66-8 (>90%) Toluene; 108-88-3(up to 10%) Benzene; 71-43-2 (up to 0.1%) Hexane; 110-54-3 (0-3%) 1,2,4-Trimethylbenzene; 95-63-6 (0-2%) Organic lead additives (up to 0.14%)	See component list	PID (10.6 eV Lamp Strength Correction factor = 0.6 FID = Unknown LEL Meter = 0.85	Air sample using charcoal tube. Sampling and analytical protocol shall proceed in accordance with NIOSH Method #1501. See also OSHA CSI Method application	Manufacturer's Recommendation – 100 ppm (300 mg/m^3) for 8-Hour work day. No regulatory or advisory limits have been set.	Petroleum odor threshold ~ 800 ppm Rating - Poor to Adequate **Recommended Air Purifying cartridges:** Organic vapor **Recommended gloves:** NitrilSolve 727 (>480 minutes) or Neporene 6780 (287 minutes)	**Characteristics vary by fuel blending, grade, and manufacturer (e.g., impuritities and additives)** **Boiling Pt: 158°F, ~70°C** **Melting Pt: -72° F; -58°C** **Molecular Weight: ~86-170** **Flash Pt: -50°F, -45°C** **LEL: 1.4%** **UEL: 7.6%** **Autoignition Temp.:824°F; 439°C** **Vapor Density: ~4** **Vapor Pressure: 5.5 to 7.0 psi** **SG: 0.71@ 60° F; 15.6°C** **PH: ~7.0** **Solubility in water: Negligible (<0.1%) @ 77°F; 25°C** **Viscosity: 0.6 cST@ 77°F; 25°C** **Appearance and Odor: Clear green liquid with gasoline hydrocarbon odor** **Avoid contact with heat, sparks and flame**	AVGas is irritating to the eyes, skin, respiratory tract, and CNS (This through direct contact or reaching concentrations >1000 ppm). **Direct contact** may result in mild irritation with a possible drying and defatting of the skin. **Ingestion** may result in gastrointestinal irritation, nausea, and vomiting and may be harmful or even fatal. **Inhalation** of vapors or mists of AVGas may result in headache, nausea, confusion, narcotic effect, and drowsiness. Acute exposures to extreme airborne concentration can result in death. Chronic inhalation of aviation gas vapors may produce symptoms such as fatigue, anxiety, mood changes, liver and kidney damage, and memory difficulties in exposed workers. Repeated exposures to the skin may cause skin cancer. This product does contain components which have demonstrated carcinogenic capabilities.

TABLE 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
NAVAL AIR STATION PENSACOLA, FLORIDA – CTO 0225

Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
Waste Oils All information is based on mineral oil	Mixture 8012-95-1 for mineral oil	Varies between fractions however waste oils tend to be less volatile. The FID tends to handle the longer chained aliphatic hydrocarbons more efficiently than its PID counterpart and would be selected as the instrument of choice.	Sampling and analytical protocol shall be in accordance with NIOSH Method #5026 (the recommended method for mineral oil mist).	ACGIH; NIOSH: 5 mg/m^3 (oil mists); 10 mg/m^3 STEL. OSHA; 5 mg/m^3 (Oil mists)	**Respiratory Protection:** Non-volatile substance, therefore no respiratory protection is required. In an aerosol form, dust and mist respirator would be considered acceptable for up to 500 mg/m^3. **Recommended gloves:** Any glove suitable to prevent skin contact (Nitrile has been the one most widely used for the other substances, and will be acceptable). Natural rubber gloves should be avoided. Recommended gloves: Nitrile	**Boiling Pt:** 680°F; 360°C **Melting Pt:** Not available **Solubility:** Insoluble **Flash Pt:** 275-500°F; 135-260°C depends on the distillation fraction **LEL/LFL:** Not available **UEL/UFL:** Not available **Vapor Density:** Not available **Vapor Pressure:** <0.5 mmHg **Specific Gravity:** 0.90 **Incompatibilities:** None reported **Appearance and odor:** Colorless, oily, with an odor of burned lubricating oil.	Minor irritation to the eyes, skin, and respiratory system.
Ethylbenzene	100-41-4	PID: I.P 8.76, High response with PID and 10.2 eV lamp. FID: 100% response with FID.	Air sample using charcoal tube; carbon disulfide desorption; GC/FID detection. Sampling and analytical protocol in accordance with OSHA Method #07 or NIOSH Method #1501 Aromatic Hydrocarbon.	ACGIH & NIOSH: 100 ppm; 125 ppm STEL OSHA: 100 ppm IDLH: 800 ppm	Adequate - Can use air-purifying respirator with organic vapor cartridge up to 1,000 ppm. **Recommended gloves:** Neoprene or nitrile w/ silver shield when potential for saturation; Teflon >3.00 hrs	**Boiling Pt:** 277°F; 136°C **Melting Pt:** -139°F; -95°C **Solubility:** 0.01% **Flash Pt:** 55°F; 13°C **LEL/LFL:** 1.0% **UEL/UFL:** 6.7% **Vapor Density:** 3.66 **Vapor Pressure:** 10 mmHg @ 79°F; 26° C **Specific Gravity:** 0.87 **Incompatibilities:** Strong oxidizers **Appearance and odor:** Colorless liquid with an aromatic odor. Odor Threshold of 0.092-0.60.	Regulated primarily because of its potential to irritate the eyes and respiratory system. In addition, effects of overexposure may include headaches, narcotic effects, CNS changes (i.e., coordination impairment, impaired reflexes, tremoring) difficulty in breathing, possible chemical pneumonia, and potentially respiratory failure or coma.

TABLE 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
NAVAL AIR STATION PENSACOLA, FLORIDA – CTO 0225

Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
Xylene All isomers o-,m-, p-	1330-20-7	PID: I.P. 8.56 eV, High response with PID and 10.2 eV lamp. FID: 110% response with FID.	Air sample using charcoal tube; carbon disulfide desorption; GC/FID detection. Sampling and analytical protocol shall proceed in accordance with OSHA 07, or NIOSH Method 1500.	ACGIH, & NIOSH: 100 ppm, 150 ppm STEL OSHA: 100 ppm IDLH: 900 ppm	Adequate - Odor thresholds for the following isomers: 0.6 m-; 5.4 p-; 20 o- ppm. Can use air-purifying respirator with organic vapor cartridge up to 1,000 ppm concentrations. **Recommended gloves:** PV Alcohol >12.67 hrs; Viton >8.00 hrs; CPE >1.00 hr; Butyl 0.87 hrs; Nitrile is acceptable for limited operations and contact (>0.20 hrs)	**Boiling Pt:** 269-281°F; 132-138°C **Melting Pt:** -13o/-54m/56p°F; -25o/-48m/13p °C **Solubility:** 0.02 % **Flash Pt:** 81-90°F;27-32°C **LEL/LFL:** 0.9% **UEL/UFL:** 7.0% **Vapor Density:** 3.66 **Vapor Pressure:** 7-9 mmHg @ 70°F; 21° C **Specific Gravity:** 0.86-0.88 **Incompatibilities:** Strong oxidizers and strong acids **Appearance and odor:** Colorless liquid with an aromatic odor.	Effects may of overexposure include irritation at all points of contact, CNS changes (i.e. dizziness, excitement, drowsiness, incoherent, staggering gait), difficulty in breathing, pulmonary edema, and possibly respiratory failure. Chronic effects may include dermatitis and cornea vacuolization.
General PAHs / Coal Tar Pitch Volatiles / Creosote / cresol (Fluoranthene, pyrene, benzo(a) anthracene, benzo(a) pyrene, benzo(f)fluoranthene, benzo(k)fluoranthene), etc.)	(CAS Numbers vary depending on specific compound)	PID: I.P. of 8.97 eV, relative response ratio unknown. FID: Response factor unknown but given the substances flammability, detection by FID can be anticipated.	Refer to NIOSH methods for each specfic compound for appropriate air sampilng protocols. Many PAHs can be sampled using NIOSH Method 5506 or 5515 - Teflon filter with support ring - High pressure liquid chromatography with UV detector. For cresol (a major constituent of creosote) by silica gel or xad-7 sorbent tube; Acetone desorption and analysis by gas chromatography - flame ionization detector or high-pressure liquid chromatography. (NIOSH Method #2001, or OSHA Method #32)	**General PAHs**: Most PAHs have no established exposure limits. Coal Tar Pitch Volatiles / PAHs (including chrysene and benzo(a)pyrene) have an exposure limit of 0.2 mg/m^3 (OSHA and ACGIH). 0.1 mg/m^3 - (NIOSH) **Creosote / Cresol:** OSHA; ACGIH: 5 ppm NIOSH: 2.3 ppm IDLH: 80 mg/m^3	Adequate - use a full-face air-purifying respirator with organic vapor / dust/mist cartridge up to 250 ppm. Cresol has an Odor Threshold of 0.00005-0.0079 ppm. **Recommended gloves:** Viton >96.00 hrs; butyl rubber >90.00 hrs; neoprene >4.50 hrs	Properties of various PAHs/Coal Tar Pitch Volatiles vary depending upon the specific compound. *For Creosote/Cresol:* **Boiling Pt:** 376-397°F; 191-203°C **Melting Pt:** 52-96°F; 10.9-35.5°C **Solubility:** Insoluble **Flash Pt:** 178°F; 81°C **LEL/LFL:** Not available **UEL/UFL:** Not available **Vapor Density:** 3.72 **Vapor Pressure:** 1 mmHg @ 100-127°F; 38-53°C **Specific Gravity:** 1.030-1.038 **Incompatibilities:** Nitric acid, oleum, chlorosulfonic acid, oxidizers **Appearance and Odor:** Yellowish or colorless, flammable, oily liquid (often brownish because of impurities or oxidation)	Regulated based on effects on respiratory tract and skin irritation. Other effects may include eye irritation and central nervous system, distrubances. Acute exposures may result in difficulty breathing, respiratory failure and skin and eye irritation and burns. Chronic exposure may damage the liver, kidneys, lungs and skin. Skin exposure may result in photosensitivity. IARC, NTP, NIOSH, ACGIH, and the EPA list some PAHs such as benzo(a)pyrene as a potential carcinogen (ARC 2A, NTP-2, ACGIH TLV-A2, NIOSH-X, EPA-B2).

TABLE 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
NAVAL AIR STATION PENSACOLA, FLORIDA – CTO 0225

Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
Naphthalene	91-20-3	PID: I.P. 8.12 eV, relative response ratio unknown. No information was found as to the relative response for FID, however it is certain it is detectable at a high response.	Air sample using charcoal tube; carbon disulfide desorption; GC/FID detection. Sampling and analytical protocol in accordance with OSHA Method #35 or NIOSH Method #1501.	OSHA; NIOSH; ACGIH: 10 ppm NIOSH; ACGIH: have established a STEL of 15 ppm. IDLH: 250 ppm	Odor Threshold 0.038 ppm, Adequate - Use an air purifying respirator with organic vapors and dust/mists cartridges for concentrations up to 250 ppm. **Recommended glove:** Nitrile >6.00 hrs; Neoprene >6.00 hrs	**Boiling Pt:** 424°F; 218°C **Melting Pt:** 176°F; 80°C **Solubility:** 0.003% **Flash Pt:** 174°F; 79°C **LEL/LFL:** 0.9% **UEL/UFL:** 5.9% **Vapor Density:** Not available **Vapor Pressure:** 1 mmHg **Specific Gravity:** 1.15 **Incompatibilities:** Strong oxidizers, chromic anhydride **Appearance and odor:** Colorless to brown solid with and odor of mothballs	Overexposure to this substance may result in irritation to the eyes, headache, confusion, excitement, nausea, vomiting, abdominal pain, irritation of the bladder, profuse sweating, jaundice, blood in the urine, renal (kidney shutdown), and dermatitis. Prolonged or chronic exposure may further cause optical neuritis, and corneal damage. Target organs are listed as eyes, blood, liver, kidneys, skin, red blood cells, and central nervous system.
Methylnaphthalene	90-12-0 (1-) 91-57-6 (2-) 1321-94-4	There is no information available regarding this substance. It is assumed that this substance based on its characteristics is detectable using an FID however, relative response ratio was not available.	Air sample using charcoal tube; carbon disulfide desorption; GC/FID detection; Sampling and analytical protocol in accordance with OSHA 07 or NIOSH Method #1501.	None established for this compound. However, it is recommended that 0.2 mg/m^3 for coal tar pitch volatiles be employed where excessive concentrations may exist. This is more relevant for those PAHs considered carcinogenic.	Information regarding this substance was limited. This material is a natural constituent of coal tar. Adequate - Odor threshold 0.012-0.023 mg/m^3. OSHA accepts the use of air-purifying respirators with organic vapor cartridge/HEPA filter up to 10 ppm, providing cartridges are changed at the beginning of each shift. **Recommended gloves:** Butyl - >8.00 hrs; are recommended for other coal tar pitch associated substances; Neoprene >4.00 hrs; Nitrile >1.00 hrs	**Boiling Pt:** 434-507°F; 241-264°C **Melting Pt:** -8°F(1-),94°F (2-); -22°C (1-), 35°C (2-) **Solubility:** Insoluble in water **Flash Pt:** Not available **LEL/LFL:** Not available **UEL/UFL:** Not available **Density:** 1.0058 (Beta isomer); 1.02 (alpha isomer) **Vapor Density:** 4.91 (1-) **Vapor Pressure:** 180-260 mmHg **Specific Gravity:** 0.994 (2-); 1.025(1-) **Incompatibilities:** Strong oxidizers, alkalis, and acids. **Appearance and Odor:** Colorless liquid (alpha isomer) with an acrid odor. The Beta isomer is a solid with slight odor.	Overexposure to this substance has shown to be a skin, eye, and mucous membrane irritant. This substance is not considered a photosensitizer. This substance is considered mildly to moderately toxic by ingestion.

Magnesium oxide fume – Metal fume fever – Flu-like symptoms

Magnesium particles or alloys which enter through perforations in the skin have been recorded to produce a severe local reaction (evolution of gas and severe irritation locally) resulting in necrosis or killing of the cells within the impacted area (See chemical gas gangrene for more information). These injuries are very slow to heal. It is estimated based on the physical properties and ingredients (magnesium oxide, magnesium peroxide, and magnesium hydroxide) evaluated that this material will be irritating to the eyes and skin and upper respiratory tract as well as other exposed mucous membranes. This material as reported in the MSDS has a pH of 10 in solution. If swallowed, this material is slow to be absorbed, however, will result in vomiting and diarrhea. These health effects reported are considered acute responses to overexposure. Based on limited use and application chronic responses are not addressed. It is imperative to control the dust when dispensing this product.

Physical hazards conveyed by this material will include:

Incompatibilities with acids, certain bases and interhalogen compounds(i.e., maleic anhydride, sodium hydroxide, bromine pentafluoride, chlorine trifluoride). The result will be violent reaction and potentially ignition. This material should be maintained and used away from potential ignition sources because of the potential violent reaction (i.e., oxidizer + any fuel source/combustible material = fire and/or explosion) given suitable conditions (i.e., closed container; insufficient media to absorb the heat of reaction). This material will intensify a fire.

This material (25-35% Magnesium peroxide) will react with water to release oxygen. The magnesium oxide component will react with water to create magnesium hydroxide, both of which will slowly release oxygen to the water. To control the release of oxygen and the reaction, it is recommended that this material when mixing is added slowly to the prescribed amount of water. Upon completing the mixture and the injection flush the container and pump with copius amounts of water.

Specified control measures have been provided in Table 5-1 and the Safe Work Permit for this task (See Attachment IV).

6.2 PHYSICAL HAZARDS

In addition to the chemical hazards discussed above, the following physical hazards may be present during the performance of the site activities.

- Heavy equipment hazards (pinch/compression points, rotating equipment, etc.).
- Slips, trips, and falls

- Energized systems (contact with underground or overhead utilities)
- Lifting (strain/muscle pulls)
- Noise in excess of 85 decibels (dBA)
- Flying projectiles
- Ambient temperature extremes (heat stress)
- Pinches and compressions
- Vehicular and foot traffic

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

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

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

- Site personnel will be aware of the location and operation of this equipment.

- Each drill rig must be equipped with emergency stop devices which will be tested daily to ensure that they are operational.

- Long handled shovels or equivalent shall be used to clear cuttings from the borehole and advancing equipment.

- Additional requirements during DPT/drilling activities are discussed in Table 5-1. The SSO will thoroughly discuss safe DPT/drilling procedures during the pre-activities training session. All site personnel will sign the form in Figure 8-2 documenting that they received the training and understand the procedures.

6.2.2 Energized Systems (Contact with Underground or Overhead Utilities)

Underground utilities such as pressurized lines, water lines, telephone lines, buried utility lines, and high voltage power lines may be present throughout the facility. **Therefore, all subsurface activities must be conducted following the requirements of the Tetra Tech NUS SOP for "Utility Locating and**

Excavation Clearance (HS-1.0)". A copy of this SOP is provided as Attachment II. Clearance of underground and overhead utilities for each sample location will be coordinated with NAS Pensacola personnel. Greg Campbell is the point-of-contact for NAS Pensacola and can be reached at (850) 452-4611 ext. 103. Additionally, drilling operations will be conducted at a safe distance from overhead power lines as discussed in Attachment II. In certain cases, NAS Pensacola personnel may need to de-energize electrical cables using facility lockout/tagout procedures to insure electrical hazards are eliminated.

6.2.3 Ambient Temperature Extremes (Heat Stress)

Overexposure to high ambient temperatures (heat stress) may exist during performance of this work depending on the project schedule. Work performed when ambient temperatures exceed 70°F may result in varying levels of heat stress (heat rash, heat cramps, heat exhaustion, and/or heat stroke) depending on variables such as wind speed, humidity, and percent sunshine, as well as physiological factors such as metabolic rate and skin moisture content. Additionally, workload and level of protective equipment will affect the degree of exposure. Site personnel will be encouraged to drink plenty of fluids to replace those lost through perspiration. Additional information such as Work-Rest Regimens and personnel monitoring may be found in Section 4 of the Health and Safety Guidance Manual. The SSO will recommend additional heat stress control measures as they are deemed necessary as per ACGIH guidelines.

6.3 NATURAL HAZARDS

Insect/animal bites and stings, poisonous plants, and inclement weather are natural hazards that may be present given the location of activities to be conducted. In general, avoidance of areas of known infestation or growth will be the preferred exposure control for insects/animals and poisonous plants. Specific discussion on principle hazards of concern follows:

6.3.1 Insect/Animal Bites and Stings

Various insects and animals may be present and should be considered. Areas to be investigated could be prime nesting and/or hiding locations for snakes and other insects. Personnel should avoid reaching into areas that are not visibly clear of snakes or insects. Site personnel who are allergic to stinging insects such as bees, wasps, and hornets must be particularly careful since 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 notified.

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 unique health threat. The sting injects venom (formic acid) that

causes an extreme burning sensation. Pustules form which can become infected if scratched. Allergic reactions of people sensitive to the venom include dizziness, swelling, shock and in extreme cases unconsciousness and death. People exhibiting such symptoms should see a physician. Fire ants can be identified by their habitat. They build mounds in open sunny areas 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 which are in excess of two feet or more in height and diameter. When disturbed they defend it by swarming out and over the mound, even running up grass blades and sticks.

Mosquitoes

In the year 2001 Fifty-three counties in Florida were under a medical alert for West Nile Virus (WNV) and Eastern Equine Encephalitis (EEE). However the alerts were lifted at the end of the year. The Florida Departments of Health (DOH), Agriculture and Consumer Services (FDACS), Fish and Wildlife Conservation Commission (FWCC), Mosquito Control Association, along with state universities are continuing to work together to provide protection against mosquito-borne disease. These agencies continue to encouraged people to take basic precautions to help limit their exposure to mosquitoes. Remember, mosquito-born illnesses are preventable. While on-site take basic precautions against mosquito bites:

- Avoid outdoor activities at dusk and dawn when mosquitoes are likely to be looking for blood meals.
- If outdoors when mosquitoes are active cover up by wearing long-sleeved shirts or Tyvek suits
- Use commercially available mosquito repellant containing DEET.
- Avoid stagnant water in any receptacles in which mosquitoes might breed.

Ticks

There are various areas throughout the U.S. where Lyme Disease is endemic. Fortunately, Florida is not one of these areas. Nonetheless, personnel should be aware of the hazards of tick bites and Lyme Disease. The longer a disease carrying tick remains attached to the body, the greater the potential for contracting the disease. Wearing long sleeved shirts and long pants (tucked into boots). As well as performing frequent body checks will prevent long term attachment. Site first aid kits should be equipped with medical forceps and rubbing alcohol to assist in tick removal. For information regarding tick removal procedures, and symptoms of exposure consult Section 4.0 of the Health and Safety Guidance Manual.

Alligators

Alligators live in all Florida counties but are most common in the major river drainage basins and large lakes in the central and southern portions of the state. They also can be found in marshes, swamps,

ponds, drainage canals, phosphate-mine settling ponds, and ditches. Alligators are tolerant of poor water-quality and occasionally inhabit brackish marshes along the coast. A few even venture into salt water.

Mature alligators seek open water areas during the April-to-May courtship and breeding season. After mating, the females move into marsh areas to nest in June and early July where they remain until the following spring. Males generally prefer open and deeper water year-round. Alligators less than four feet long typically inhabit the marshy areas of lakes and rivers. Dense vegetation in these habitats provides protective cover and many of the preferred foods of young alligators.

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

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

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

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

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

Snakes

Areas to be investigated on this project could be prime nesting and/or hiding locations for snakes. 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.

Although 45 species of snakes are found in Florida, only the 6 are poisonous and a danger to humans. If you find a snake and you do not know whether or not it is poisonous, the safest thing to do is leave it alone. Florida snakes are not aggressive and, unless they are cornered, most will flee when humans approach. Occasionally, you might encounter one that is reluctant to leave because it is basking in the sun to get warm. Among snakebite victims, an unacceptably high number are bitten on the hands and arms when they are handling the snake. **Do not catch a snake and do not handle one unless you are sure it is not poisonous.** In addition, for a short time after a snake is killed, its reflexes may continue to work. Those reflexes typically cause the body to writhe slowly for awhile, but they can cause a convulsive contraction and a bite, so you should not handle a freshly killed venomous snake.

Cottonmouth - Average adult size is 20-48 inches (51-121 cm), record is 74.5 inches (189 cm) and is a dark-colored, heavy-bodied snake. Juveniles are brightly colored with reddish-brown cross bands on a brown ground color. The dark cross bands contain many dark spots and speckles. The pattern darkens with age so adults retain only a hint of the former banding or are a uniform black. The eye is camouflaged by a broad, dark, facial stripe. The head is thick and distinctly broader than the neck, and when viewed from above, the eyes cannot be seen. The top of head in front of the eyes is covered with large plate-like scales. The pupil is vertical (catlike). There is a deep facial pit between the nostril and the eye. Its habitat is any wetlands or waterway in the state. Cottonmouths can be found along streams, springs, rivers, lakes, ponds, marshes, swamps, sloughs, reservoirs, retention pools, canals, and roadside ditches. It occasionally wanders far from water, and has been found in bushes and trees. Cottonmouth bites can be quite dangerous. The victim should seek immediate medical care from a physician or hospital experienced in treating snakebite.

Eastern Diamondback Rattlesnake - Average adult size is 36-72 inches (91-183 cm), record is 96 inches (244 cm). It is a large, heavy-bodied snake with a row of large dark diamonds with brown centers and cream borders down its back. The ground color of the body is brownish. The tail ends in a rattle. The tail is usually a different shade, brownish or gray, and toward the end of the tail the diamonds fade out or break into bands. The large and thick head has a light bordered dark stripe running diagonally through the eye and there are vertical light stripes on the snout. The pupil is vertical (catlike) and there is a deep facial pit between the nostril and the eye. Diamondbacks are often found in pine flat woods, longleaf pine

and turkey oak, and sand pine scrub areas. These habitats contain palmetto thickets and gopher tortoise burrows in which the Diamondback may seek refuge. This is a large and potentially dangerous snake. It can strike up to 2/3 its body length; a 6-foot (183 cm) specimen may strike 4 feet (122 cm).

Dusky Pygmy Rattlesnake - Average adult size is 12-24 inches (30-61 cm), record is 31 inches (79 cm). This is a small snake, but very thick for its size. The top of the triangular shaped head is covered with 9 large scales. The body color is light to dark gray. A longitudinal row of black or charcoal transverse blotches disrupts a reddish brown stripe running down the middle of the back. Dark spots on the side line up with the blotches. The tail is slender and ends in a miniature rattle. The belly is heavily mottled with black and white. The pupil of the eye is vertical (catlike), and there is a deep facial pit between the nostril and the eye. This snake is common in lowland pine flat woods, prairies, around lakes and ponds, and along the borders of many freshwater marshes and cypress swamps. This small snake has a reputation for being very aggressive. Its bite, while usually not life threatening, is extremely painful and can result in the loss of a digit. However, In some cases it can be fatal. The rattle is so small it is seldom heard. When it is heard, it sounds like an insect buzzing. Florida's two hognose snakes occasionally are confused with the Pygmy Rattlesnake. It is easy to distinguish between the harmless hognose snakes and the Pygmy Rattlesnake. The harmless hognose snakes defend themselves against potential predators by spreading (flattening) their heads and necks. If this does not scare the threat away, the hognose snakes will turn onto their backs and play dead. The hognose snakes have upturned noses and round pupils, and they also have no facial pits or rattles.

Eastern Coral Snake - Average adult size is 20-30 inches (51-76 cm), record is 47.5 inches (121 cm). Body ringed with black, yellow, and red; narrow yellow rings separating the wider red and black rings. The rings continue across the belly of the snake. From tip of snout to just behind the eye the head is black. The tail is black and yellow, without any red rings. The red rings usually contain black flecks or spots. The pupil is round. This snake occupies a variety of habitats, from dry, well-drained flat woods and scrub areas to low, wet hammocks and the borders of swamps. They are quite secretive and are usually found under debris and in the ground, but occasionally they are found in the open, and have even been seen climbing the trunks of live oaks. Good numbers of them are turned up when pine flat woods are bulldozed. Because they also are ringed with red, black, and yellow or white, two harmless snakes in Florida, the Scarlet Kingsnake and the Scarlet Snake, often are confused with the Coral Snake. Both of these mimics (look-a-likes) can be distinguished from the Coral Snake by their red snouts and red on their tails. In addition, the red bands of the Scarlet Kingsnake and the Scarlet Snake never touch the yellow bands (the red and yellow are separated by the black). Also, on both the Coral Snake and the Scarlet Kingsnake the rings go around the body, but not on the Scarlet Snake which has a white belly. If you have difficulty separating the harmless mimics from the Coral Snake, the following mnemonic rhymes will

identify the Coral Snake for you: 'If red touches yellow, it can kill a fellow,' and 'If its nose is black, it's bad for jack.' Because the Coral Snake is a relative of the cobras, people believe its bite is nearly always fatal. While its bite is serious and should receive immediate medical attention, statistics suggest that the bite of the Coral Snake is less threatening than the bite of a Diamondback Rattlesnake.

6.3.2 Inclement Weather

As the State of Florida is located in a tropical storm, hurricane prone area, the following information is supplied to explain the potential severity of these natural hazards. The decision to curtail operations and evacuate the area should be made by the FOL, TOM, and the HSM.

Tropical Storms and Hurricanes

During the months of June through November, the State of Florida is subject to threat of tropical and extra tropical cyclones. Occasionally during the winter months, low pressure systems; either migrating northward from the Carolinas or form off the New England coast; will deepen in the Atlantic and produce high winds and surf along the coastline, resulting in coastal and inland flooding. The decision to curtail operations and evacuate the area should be made by the FOL, TOM, and the HSM. There are three main threats associated with tropical storms and hurricanes:

- High winds
- Excessive rainfall
- Storm surge

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

High Winds

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

Table 6-2
Tropical Storm/Hurricane Rating Scale

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

NA – Not Applicable

* Based on the Saffir-Simpson scale

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

Excessive Rainfall

Heavy rains associated with tropical storms and hurricanes also vary greatly from storm to storm. On average, an inch of rainfall an hour is not uncommon with major hurricanes, somewhat lesser amounts with tropical storms. However, the primary threat is not the intensity of rain, but the duration of rainfall. Since many tropical storms and hurricanes are slow-movers, they are capable of producing sustained heavy rainfall over a long period of time. It is not uncommon for an area to receive nearly 20 inches of rain in 24 hours. Under these conditions, street; stream and creek flooding is inevitable only to be exacerbated by locally heavier rains from thunderstorms.

Storm Surge

The storm surge is an abnormal rise in sea level accompanying a hurricane or tropical storm. The height of the storm surge (usually measured in feet) is the difference in sea level from the observed level (during the storm) and the level that would have occurred in the absence of the storm or hurricane. The more intense the storm or hurricane the higher the storm surge. Storm surges become even higher if they occur during periods of high tide. The following table defines some of the terminology and possible calls to action regarding tropical cyclones:

Table 6-3
TROPICAL STORM/HURRICANE
WATCH AND WARNING

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

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

7.0 AIR MONITORING

Direct reading instruments will be used at the site to detect and evaluate the presence of site contaminants and other potentially hazardous conditions. As a result, specific air monitoring measures and requirements are established in Table 5-1 pertaining to the 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 of various instruments.

7.1 INSTRUMENTS AND USE

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

7.1.1 Photoionization Detector or Flame Ionization Detector

In order to accurately monitor for any substances which may present an exposure potential to site personnel, a Photoionization Detector (PID) using a lamp energy of 10.6 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 with this lamp strength has been selected because it is capable of detecting the organic vapors of concern.

Prior to the 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 and the task-specific Safe Work Permits in Attachment IV present the frequencies that 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 increases 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 manufacturer's recommendations (for example, the PID must be field calibrated daily and an additional field calibration must be performed at the end of each day to determine any significant instrument drift). These operational checks and calibration efforts will be performed in a manner that complies with the employees health and safety training, the manufacturer's recommendations, and with the applicable manufacturer standard operating procedure (copies of which can be found in the Health & Safety Guidance Manual which will be maintained on-site 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 of the information specified in Figure 7-1 is recorded. This required information includes the following:

- Date calibration was performed
- Individual calibrating the instrument
- Instrument name, model, and serial number
- Any relevant instrument settings and resultant readings (before and after) calibration
- Identification of the calibration standard (lot no., 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 both TtNUS and subcontractor personnel participating in site activities.

8.1.1 Requirements for TtNUS Personnel

All TtNUS personnel must complete 40 hours of introductory hazardous waste site training prior to performing work at the NAS Pensacola facility. Additionally, TtNUS personnel who have had introductory training more than 12 months prior to site work must have completed 8 hours of refresher training in 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 this requirement.

8.1.2 Requirements for Subcontractors

All TtNUS subcontractor personnel must have completed introductory hazardous waste site training or equivalent work experience as defined in OSHA Standard 29 CFR 1910.120 (e). Additionally, personnel who have had the introductory training more than 12 months ago, are required to have 8 hours of refresher training meeting the requirements of 29 CFR 1910.120 (e)(8) prior to performing field work at the NAS Pensacola facility if required. 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 as in Figure 8-1 and by providing copies of certificates for all subcontractor personnel participating in site activities.

FIGURE 8-1
TRAINING LETTER

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

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

Month, day, year

Mr. Gerry Walker, PG
Tetra Tech NUS, Inc.
Task Order Manager
1401 Oven Park Drive, Suite 201
Tallahassee, Florida 32312

Subject: HAZWOPER Training for NAS Pensacola, Pensacola, Florida

Dear Mr. Walker:

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 1926.

I also understand that Title 29 CFR 1910.120, entitled "Hazardous Waste Operations and Emergency Response," requires 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 hour 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)

Enclosed: Training Certificates

8.2 SITE-SPECIFIC TRAINING

TtNUS will provide site-specific training to all TtNUS employees and subcontractor personnel who will perform work on this project. Site-specific training will also be provided to all personnel (U.S. Department of Defense, EPA, etc.) who may enter the site to perform functions that may or may not be directly related to site operations. Site-Specific training will include:

- Names of designated personnel and alternates responsible for site safety and health
- Safety, health, and other hazards present at the sites
- Use of personal protective equipment
- 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)
- Initial response procedures
- Review of the contents of relevant Material Safety Data Sheets
- Review of the use of Safe Work Permits
- Review of ORC MSDS and Section 6.1.2 ORC.

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

8.3 MEDICAL SURVEILLANCE

8.3.1 Medical Surveillance Requirements for TtNUS Personnel

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

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

FIGURE 8-2

SITE-SPECIFIC TRAINING DOCUMENTATION

My signature below indicates that I am aware of the potential hazardous nature of performing remedial investigation activities at NAS Pensacola, Pensacola, Florida and that I have received site-specific training which included the elements presented below:

- Names of designated personnel and alternates responsible for site safety and health
- Safety, health, and other hazards present at the sites
- Use of personal protective equipment
- 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)
- Initial response procedures
- Review of the contents of relevant Material Safety Data Sheets
- Review of the use of Safe Work Permits
- Review of ORC MSDS and Section 6.1.2 ORC.

I state that I have been given the opportunity to ask questions and that all of my questions have been answered to my satisfaction. I further state, by presence of my signature below, that the date of my training (introductory, refresher, and supervisory, as applicable) and my medical surveillance requirements are accurate and correct to the best of my knowledge.

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

8.3.2 Medical Surveillance Requirements for Subcontractors

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

Subcontractors who have a company medical surveillance program meeting the requirements of paragraph (f) of OSHA 29 CFR 1910.120 can substitute "Subcontractor Medical Approval Form" (See Figure 8-3) with a letter, on company letterhead, containing all of the information in the example letter presented in Figure 8-4 of this HASP.

8.3.3 Requirements for All Field Personnel

Each field team member (including subcontractors) and visitors entering the Exclusion Zone(s) shall be required to complete and submit a copy of Medical Data Sheet found in the TtNUS Health and Safety Guidance Manual. This shall 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

Subcontractors who will not enter the Exclusion Zone during operation, and whose activities involve no potential for exposure to site contaminants, will not be required to meet the requirements for training/medical surveillance other than site-specific training as stipulated in Section 8.2. This exception may only be granted by the CLEAN Health and Safety Manager, Matt Soltis.

FIGURE 8-3

SUBCONTRACTOR MEDICAL APPROVAL FORM

For employees of _____
Company Name

Participant Name: _____ Date of Exam: _____

Part A

The above-named individual has:

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

   ( ) qualified to perform work at the NAS Pensacola, work site
   ( ) not qualified to perform work at the NAS Pensacola, work site

and,

2. Undergone a physical examination as per OSHA 29 CFR 1910.134(b)(10) and found to be medically -

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

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

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

Part B

I, _____, have examined _____
Physician's Name (print) Participant's Name (print)
and have determined the following information:

FIGURE 8-3
SUBCONTRACTOR MEDICAL APPROVAL FORM
PAGE TWO

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

   _____
   _____
   _____

2. Any detected medical conditions 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 Pensacola work site, this participant

( ) may
( ) may not

perform his/her assigned task.

Physician's Signature _____

Address _____

Phone Number _____

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

_____
Address

FIGURE 8-4

MEDICAL SURVEILLANCE LETTER

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

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

Month, day, year

Mr. Gerry Walker, PG
Tetra Tech NUS, Inc.
Task Order Manager
1401 Oven Park Drive, Suite 201
Tallahassee, Florida 32312

Subject: HAZWOPER Training for NAS Pensacola, Pensacola, Florida

Dear Mr. Walker:

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

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

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

Sincerely,

(Name and Title of Company Officer)

9.0 SITE CONTROL

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

9.1 EXCLUSION ZONE

The Exclusion Zone will be considered those areas of the site of known or suspected contamination. It is not anticipated that significant amounts of surface contamination are in the proposed work areas of this site. It is anticipated that this will remain so until/unless contaminants are brought to the surface by intrusive activities such as well installation. Furthermore, once such activities have been completed and surface contamination has been removed, the potential for exposure is again diminished and the area can then be reclassified as part of the Contamination Reduction Zone. Therefore, the Exclusion Zones for this project will be limited to those areas if the site where active work is being performed plus so many feet surrounding the point of operation (See Table 5-1 for specific operation). The Exclusion Zone for this activity will represent the areas where the soils are disturbed through DPT/well installation and sampling activities. Exclusion Zones will be delineated (as necessary) using barrier tape, cones and/or drive poles, and postings to inform and direct facility personnel.

9.1.1 Exclusion Zone Clearance

A pre-startup site visit will be conducted by members of the field team in an effort to identify proposed subsurface investigation locations, conduct utility clearances, and provide up-front notices concerning scheduled activities within the facility. In all cases, no subsurface activities will proceed without utility clearance. In the event that a utility is struck during a subsurface investigative activity, the Navy Engineer-in-Charge identified in Section 2.7, Table 2-1 will be notified.

When base personnel are working within the proximity of this investigation, they will be moved or their operation temporarily discontinued to protect them from potential hazards associated with this operation.

9.2 CONTAMINATION REDUCTION ZONE

The Contamination Reduction Zone (CRZ) will be a buffer area between the Exclusion Zone and any area of the site where contamination is not suspected. This area will also serve as a focal point in supporting Exclusion Zone activities. This area may be delineated using barrier tape, cones, and postings to inform and direct facility personnel. Decontamination will be conducted at a central location. All equipment potentially contaminated will be bagged and taken to that location for decontamination.

9.3 SUPPORT ZONE

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

9.4 SAFE WORK PERMITS

All Exclusion Zone work conducted in support of this project will be performed using Safe Work Permits to guide and direct field crews on a task by task basis. An example of the Safe Work Permit to be used is illustrated in Figure 9-1. Partially completed Permits for the work to be performed are included in Attachment I. The daily meetings conducted at the site will further support these work permits. This effort will ensure all site-specific considerations and changing conditions are incorporated into the planning effort. All permits will require the signature of the FOL and/or the SSO.

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

All permits will be turned into the FOL and/or the SSO upon reaching their termination period or upon completion of the task for which the permit was issued.

FIGURE 9-1
SAFE WORK PERMIT

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

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

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

II. Names: _____

III. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____ _____
TtNUS NAS Pensacola

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

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

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

Modifications/Exceptions: _____

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

VI. Additional Safety Equipment/Procedures

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

Modifications/Exceptions: _____

VII. Procedure review with permit acceptors

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

VIII. Equipment Preparation

	Yes	NA
Equipment drained/depressured	☐	☐
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, fill out appropriate section(s) on safety work permit addendum

X. Special instructions, precautions: _____

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

9.5 SITE VISITORS

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

- Personnel invited to observe or participate in operations by TtNUS
- Regulatory personnel (DOD, OSHA, etc.)
- Southern Division Navy Personnel
- Other authorized visitors

It is not anticipated that this operation will result in a large number of site visitors. However, as some visitors can reasonably be expected, the following requirements will be enforced:

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

- All site visitors will be required to produce the necessary information supporting clearance onto the site. This includes information attesting to applicable training (40-hours of HAZWOPER training required for all Southern Division Navy personnel) and medical surveillance, as stipulated in Section 8 of this document. In addition, to enter the site's 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 document.

NOTE: All site visitors will be escorted at all times while at the site.

Following this, the site visitor will be permitted to enter the site and applicable operational areas. All visitors are required to observe the protective equipment and site restrictions in effect at the area of their visit. Any and all visitors not meeting the requirements as stipulated in this plan for site clearance will not be permitted to enter the site operational zones during planned activities. Any incidence of unauthorized site visitation will cause all on-site 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 Navy On-site Representative will be notified of any unauthorized visitors.

9.6 SITE SECURITY

Site security will be accomplished using TtNUS field personnel. TtNUS will retain complete control over active operational areas. As this activity takes place at Navy facilities open to public access, and along public highways, the first line of security will take place using traffic permit restrictions, Exclusion Zone barriers, and any existing barriers at the sites to restrict the general public. The second line of security will take place at the work site referring interested parties to the FOL or designee. The FOL will serve as a focal point for all non-project interested parties, and serve as the final line of security and the primary enforcement contact.

9.7 SITE MAP

Once the areas of contamination, access routes, topography, and dispersion routes are determined, a site map will be generated and adjusted as site conditions change. When possible, these maps will be posted to illustrate up-to-date collection of contaminants and adjustment of zones and access points.

9.8 BUDDY SYSTEM

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

9.9 MATERIAL SAFETY DATA SHEET (MSDS) REQUIREMENTS

TtNUS and subcontractor personnel will provide MSDSs for all chemicals brought on-site. 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 on-site. A chemical inventory of all chemicals used at the sites will be developed using the Health and Safety Guidance Manual. The MSDSs will then be maintained in a central location (i.e., temporary office) and will be available for anyone to review upon request. The MSDS for the ORC process can be found in Attachment V.

9.10 COMMUNICATION

As personnel will be working in proximity to one another during field activities, a supported means of communication between field crews members will not be necessary. External communication will be accomplished by using the telephones at predetermined and approved locations. External communication will primarily be used for the purpose of resource and emergency resource communications. Prior to the commencement of activities, the FOL will determine and arrange for telephone communications.

10.0 SPILL CONTAINMENT PROGRAM

10.1 SCOPE AND APPLICATION

It is not anticipated that bulk hazardous materials (over 55-gallons) will be handled at any given time as part of this scope of work. It is also not anticipated that such spillage would constitute a danger to human health or the environment. However, as the job progresses, the potential may exist for accumulating Investigative Derived Wastes (IDW) such as decontamination fluids, soil cuttings, and purge and well development waters, in a central staging area. Once these fluids and other materials have been characterized, they can be removed from this area and properly disposed.

10.2 POTENTIAL SPILL AREAS

Potential spill areas will be periodically monitored in an ongoing attempt to prevent and control further potential contamination of the environment. Currently, limited areas are vulnerable to this hazard including:

- Resource deployment
- ORC Injection
- Waste transfer
- Central staging

It is anticipated that all IDW generated as a result of this scope of work will be containerized, labeled, and staged to await further analyses. The results of these analyses will determine the method of disposal.

10.3 LEAK AND SPILL DETECTION

To establish an early detection of potential spills or leaks, a periodic walk-around by the personnel staging or disposing of drums or in the Resource Deployment area will be conducted during working hours to visually determine that storage vessels are not leaking. If a leak is detected, the contents will be transferred, using a hand pump, into a new vessel. The leak will be collected and contained using absorbents such as Oil-Dry, vermiculite, or sand, which are stored at the vulnerable areas in a conspicuously marked drum. This used material, too, will be containerized for disposal pending analysis. All inspections will be documented in the project logbook.

10.4 PERSONNEL TRAINING AND SPILL PREVENTION

All personnel will be instructed in the procedures for initial spill prevention, containment, and collection of hazardous materials in the site-specific training. The FOL and the SSO will serve as the Spill Response Coordinators for this operation, should the need arise.

10.5 SPILL PREVENTION AND CONTAINMENT EQUIPMENT

The following represents the minimum equipment that may be maintained (depending on anticipated need) at the staging areas at all times for the purpose of supporting this Spill Prevention/Containment Program.

- Sand, clean fill, vermiculite, or other non combustible absorbent (Oil-dry)
- Drums (55-gallon U.N 1A2)
- Shovels, rakes, and brooms
- Container labels

10.6 SPILL CONTROL PLAN

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

1. Notify the SSO or FOL immediately upon detection of a leak or spill. Activate emergency alerting procedures for that area to remove all non-essential personnel.

2. Employ the personal protective equipment stored at the staging area. Take immediate actions to stop the leak or spill by plugging or patching the container or raising the leak to the highest point in the vessel. Spread the absorbent material in the area of the spill, covering it completely.

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

4. Recontainerize spills, including 2-inch of top cover impacted by the spill. Await test results for treatment or disposal options.

It is not anticipated that a spill will occur that the field crew cannot handle. Should this occur, notification of the appropriate Emergency Response agencies will be carried out by the FOL or SSO in accordance with the procedures discussed in Section 2.0 of this HASP.

11.0 CONFINED-SPACE ENTRY

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

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

A Permit-Required Confined Space is one that:

- Contains or has a potential to contain a hazardous atmosphere.
- Contains a material that has the potential to engulf an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor 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 shall ensure the following materials/documents are taken to the project site and used when required.

- A complete copy of this HASP
- Health and Safety Guidance Manual
- Incident Reports
- Medical Data Sheets
- Material Safety Data Sheets for all chemicals brought on-site, including decon solution, fuels, sample preservations, calibration gases, etc.
- A full size OSHA Job Safety and Health Poster
- Training/Medical Surveillance Documentation Form (blank)
- Emergency Reference Form (Section 2.0, extra copy for posting)

12.1 MATERIALS TO BE POSTED OR MAINTAINED AT THE SITE

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

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

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

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

Site Clearance (maintained) - This list is found within the training section of the HASP (See Figure 8-2). This list identifies all site personnel, dates of training (including site-specific training), and medical surveillance. The lists indicate not only clearance but also status. If personnel do not meet these requirements, they do not enter the site while site personnel are engaged in activities.

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

Medical Data Sheets/Cards (maintained) - Medical Data Sheets will be filled out by on-site 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.

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

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

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

13.0 GLOSSARY

ACGIH	American Conference of Governmental Industrial Hygienists
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action - Navy
CNS	Central Nervous System
CTO	Contract Task Order
CZR	Contamination Reduction Zone
DOD	United States Department of Defense
eV	electron Volts
FOL	Field Operations Leader
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSM	Health and Safety Manager
IDLH	Immediate Dangerous to Life or Health
IDW	Investigative-Derived Wastes
LEL/LFL	Lower Explosive Limit / Lower Flammable Limit
MSDS	Material Safety Data Sheets
N/A	Not Available
NAS	Naval Air Station
NIOSH	National Institute for Occupational Safety and Health
NTP	National Toxicity Program
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor)
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PPE	Personal Protective Equipment
SAP	Sampling and Analyses Plan
SOPs	Standard Operating Procedures
SSO	Site Safety Officer
TBD	To be determined
TLV	Threshold Limit Value
TOM	Task Order Manager
TWA	Time-Weighted Average
WP	Work Plan

ATTACHMENT I

INJURY/ILLNESS PROCEDURE AND REPORT FORM

CASE NO. _____

TETRA TECH NUS, INC.

INJURY/ILLNESS PROCEDURE
WORKER'S COMPENSATION PROGRAM

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

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

ADDITIONAL QUESTIONS REGARDING WORKER'S COMPENSATION:

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

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

WHO IS COVERED:

All employees of Tetra Tech, whether they are on a full-time, part-time or temporary status, working in an office or in the field, are entitled to worker's compensation benefits. All

employees must follow the above injury/illness reporting procedures. Consultants, independent contractors, and employees of subcontractors are 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

STANDARD OPERATING PROCEDURE FOR UTILITY LOCATING AND EXCAVATION CLEARANCE

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1.0 PURPOSE

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

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

2.0 SCOPE

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

3.0 GLOSSARY

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

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

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

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

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

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

4.0 RESPONSIBILITIES

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

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

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

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

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

5.0 PROCEDURES

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

5.1 Buried Utilities

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

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

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

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

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

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

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

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

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

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

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

5.2 Overhead Power Lines

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

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

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

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

6.0 UNDERGROUND LOCATING TECHNIQUES

6.1 Geophysical Methods

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

Electromagnetic Induction

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

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

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

Magnetics

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

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

Ground Penetrating Radar

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

6.2 Passive Detection Surveys

Acoustic Surveys

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

Thermal Imaging

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

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

6.3 Intrusive Detection Surveys

Vacuum Excavation

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

Hand-auger Surveys

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

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

Tile Probe Surveys

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

7.0 INTRUSIVE ACTIVITIES SUMMARY

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

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

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

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

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

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

8.0 REFERENCES

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

ATTACHMENT 1
LISTING OF UNDERGROUND UTILITY CLEARANCE RESOURCES

ALABAMA
Alabama Line Location (800) 292-8525

Tucson Blue Stake Center (800) 782-5348

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

Arizona
Arizona Blue Stake Inc. (800) 782-5348

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

California
Underground Service Alert North (800) 227-2600

Underground Service Alert South (800) 227-2600

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

Connecticut
Call Before You Dig (800) 922-4455

Delaware
Miss Utility of Delmarva
(800) 282-8555

District of Columbia
Miss Utility (800) 257-7777

Florida
Call Sunshine (800) 432-4770

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

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

Utilities Underground Location Center
(800) 424-5555

Kootenai Country Utility Coordinating Council
(800) 428-4950

Shoshone County One Call (800) 398-3285

Dig Line (800) 342-1585

One Call Concepts (800) 626-4950

Illinois
Julie Inc. (800) 892-0123

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

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

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

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

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

Louisiana
Louisiana One Call (800) 272-3020

Maine
Dig Safe – Maine (800) 225-4977

Maryland
Miss Utility (800) 257-777

Miss Utility of Delmarva (800) 282-8555

Massachusetts
Dig Safe – Massachusetts (800) 322-4844

Michigan
Miss Dig System (800) 482-7171

Minnesota
Gopher State One Call (800) 252-1166

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

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

Montana
Utilities Underground Location Center
(800) 424-5555

Montana One Call Center (800) 551-8344

Nebraska
Diggers Hotline of Nebraska (800) 331-5666

Nevada
Underground Service Alert North (800) 227-2600

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

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

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

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

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

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

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

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

Ohio
Ohio Utilities Protection Service
(800) 362-2764

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

Oklahoma
Call Okie (800) 522-6543

Oregon
Utilities Underground Location Center
(800) 424-5555

Douglas Utilities Coordinating Council
(503) 673-6676

Josephine Utilities Coordinating Council
(503) 476-6676

Rogue Basin Utility Coordinating Council
(503) 779-6676

Utilities Notification Center
(800) 332-2344

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

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

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

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

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

Texas
Texas One Call System (800) 245-4545

Texas Excavation Safety System (800) 344-8377

Lone Star Notification Center (800) 669-8344

Utah
Blue Stakes Location Center (800) 662-4111

Vermont
Dig Safe – Vermont (800) 225-4977

Virginia
Miss Utility of Virginia (800) 552-7001

Miss Utility (800) 257-7777

Miss Utility of Delmarva (800) 441-8355

Washington
Utilities Underground Location Center
(800) 424-5555

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

Utilities County of Cowlitz County
(360) 425-2506

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

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

Inland Empire Utility Coordinating Council
(509) 456-8000

Palouse Empire Utilities Coordinating Council
(800) 822-1974

Utilities Notification Center (800) 332-2344

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

Wisconsin
Diggers Hotline Inc. (800) 242-8511

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

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

Fremont County Utility Coordinating Council
(800) 489-8023

Central Wyoming Utilities Coordinating Council
(800) 759-8035

Southwest Wyoming One Call (307) 362-8888

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

Albany County Utility Coordinating Council
(307) 742-3615

Southeast Wyoming Utilities Coordinating Council
(307) 638-6666

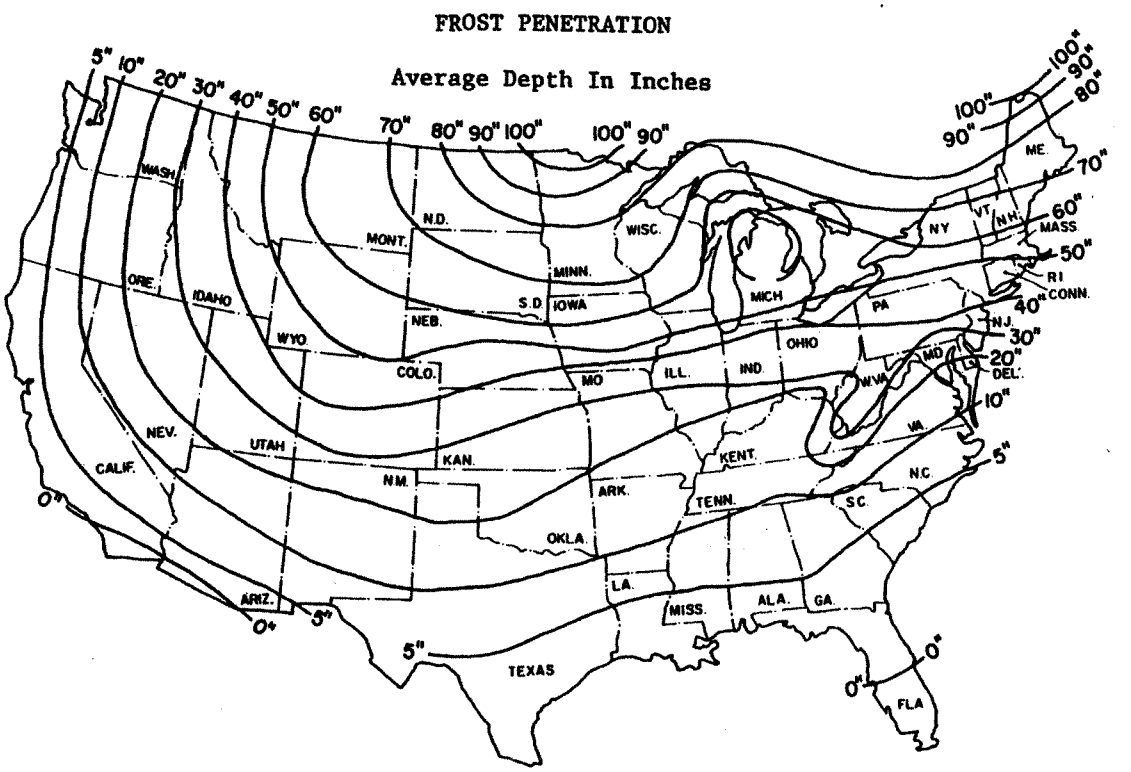
Wyoming One-Call
(800) 348-1030

Utilities Underground Location Center
(800) 454-5555

Converse County Utility Coordination Council
(800) 562-5561

ATTACHMENT 2

FROST LINE PENETRATION DEPTHS BY GEOGRAPHIC LOCATION



Courtesy U.S. Department Of Commerce

ATTACHMENT 3
UTILITY CLEARANCE FORM

Client: _____ Project Name: _____

Project No.: _____ Completed By: _____

Location Name: _____ Work Date: _____

Excavation Method/Overhead Equipment: _____

1. Underground Utilities

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

2. Overhead Utilities

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

3. Notes:

_____

_____

_____

Approval:

_____ _____

Site Manager/Field Operations Leader Date

c: PM/Project File
Program File

ATTACHMENT III

EQUIPMENT INSPECTION CHECKLIST

EQUIPMENT INSPECTION

COMPANY:_____ **UNIT NO.**_____

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

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

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

Safety Guards:

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

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

Portable Power Tools:

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

Cleanliness:

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

Operator Qualifications (as applicable for all heavy equipment):

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

Identification:

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

Additional Inspection Required Prior to Use On-Site

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

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

Approved for Use: ❒ Yes ❒ No

_____
Site Safety Officer Signature

ATTACHMENT IV

SAFE WORK PERMITS

SAFE WORK PERMIT FOR
MOBILIZATION AND DEMOBILIZATION ACTIVITES

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

SECTION I: General Job Scope

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

II. Required Monitoring Instrument(s): None required.

III. Field Crew: _____

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

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

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

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

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes, and safety glasses.

V. Chemicals of Concern / Action Level(s) / Response Measures
None anticipated

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

Modifications/Exceptions: Safety glasses will be required if eye hazard are present. Reflective vests for high traffic areas. Tyvek coverall if there is a potential for soiling work clothes. Hard hats at SSO discretion if overhead hazards exist. Hearing protection at SSO discretion.

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: Obtain MSDS for chemicals brought on site, add them to Chemical Inventory, and review them for any additional PPE requirements. Use safe lifting practices. Preview work locations for slip, trip, fall and other hazards that need to be communicated to field personnel.

Permit Issued by: _____ Permit Accepted by: _____

Job Completed by: _____ Date: _____

SAFE WORK PERMIT FOR DECONTAMINATION ACTIVITIES

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

SECTION I: General Job Scope

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

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

III. Field Crew: _____

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

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

IV. Protective equipment required

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

Respiratory equipment required

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

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes, and surgical style gloves and safety glasses.

V.

Chemicals of Concern	Action Level(s)	Response Measures
Site contaminants include VOC and SVOCs (from diesel fuel)	Any sustained reading above background	Repeat Decontamination process.

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
Boot covers	☒ Yes	☐ No			

Modifications/Exceptions: PE or PVC coated Tyvek coveralls when operating pressure washer at SSO's discretion if the potential for saturating work clothes exists. Face shield if heavy equipment is decontaminated. Face shield and hearing protection if pressure washers are used.

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: Potential exposures via skin contact and hand to mouth activities will be prevent through the use of PPE and appropriate decontamination and personal hygiene practices.

Permit Issued by: _____ Permit Accepted by: _____

Job Completed by: _____ Date: _____

SAFE WORK PERMIT FOR
IDW HANDLING

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

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): IDW handling activities.

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

III. Field Crew: _____

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

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

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

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

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes, surgical style gloves and safety glasses.

V.

Chemicals of Concern	Action Level(s)	Response Measures
Site contaminants include VOC and SVOCs (from diesel fuel)	Any sustained reading >25 ppm 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: Tyvek coveralls and disposable boot covers if there is a potential for soiling work clothes. Hard hat and hearing protection at SSO's discretion. Cotton work/over surgeons gloves acceptable alternative to nitrile.

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: Potential exposures via skin contact and hand to mouth activities will be prevented through the use of PPE and appropriate decontamination and personal hygiene practices. Use proper lifting techniques particularly when handling heavy and awkward objects like drums. Appropriately label all IDW containers.

Permit Issued by: _____ Permit Accepted by: _____

Job Completed by: _____ Date: _____

SAFE WORK PERMIT
ORC®Monitoring Well Injection

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): ORC®Monitoring Well Injection – This process will use a trash pump and tremie pipe to inject ORC® bioremediation product into the monitoring wells. The material will be mixed in a container withdrawn using the pump suction and discharged through the tremie pipe from the bottom of the well upward.

II. Required Monitoring Instrument(s): _____

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

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

IV. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required
Full face APR ☐ Escape Pack ☐
Half face APR ☐ SCBA ☐
Escape Pack- SAR ☐ Bottle Trailer ☐
Skid Rig ☐ None ☒

Modifications/Exceptions: _____

V.

Chemicals of Concern	Action Level(s)	Response Measures
Site contaminants include VOC and SVOCs (from diesel fuel)	Any sustained reading >25 ppm above background in worker breathing zones.	Suspend site activities and report to an unaffected area.

VI. Additional Safety Equipment/Procedures – Check appropriate box for ALL entries

Hardhat	☒ Yes	☐ No	Hearing Protection (Plugs or Muffs)	☒ Yes	☐ No
Safety Glasses (See Note)	☒ Yes	☐ No	Safety belt/harness	☐ Yes	☒ No
Chemical/splash goggles	☒ Yes	☐ No	Radio	☐ Yes	☐ No
Splash Shield(See Note)	☒ Yes	☐ No	Barricades	☐ Yes	☐ No
Splash suit/coveralls (See Note)	☐ Yes	☐ No	Gloves (Type- Nitrile) Inner & outer	☒ Yes	☐ No
Steel toe Work-boots	☒ Yes	☐ No	Work/rest regimen	☐ Yes	☒ No

Modifications/Exceptions: Safety glasses and splash shield may be used in lieu of chemical splash goggles at the SSO's discretion. A rubber apron may be used in lieu of the splash suit to prevent soiling and saturation of work clothes. Hearing protection should be worn when working around the motorized pump. Use insect repellants. Work-boots should have aggressive lug to control slip, trip, and fall hazards. Tyvek, boot covers, and reflective vests at SSO discretion.

VII. Procedure review with permit acceptors

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

VIII. Site Preparation

Utility Clearances Obtained for any areas of subsurface investigations	☐ Yes	☐ No
Physical hazards removed or blockaded	☐ Yes	☐ No
Site control boundaries/pathways and demarcated/signage	☐ Yes	☐ No

IX.. 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	☐	☒

X. Additional Permits required (Hot work, Confined Space Entry, Excavation etc.). ☐ Yes ☒ No
If yes, contact the Health Sciences Department, Pittsburgh Office (412/921-7090)

XI. Special instructions, precautions: The above selected PPE and safety control measures are intended to protect individuals from hazards associated with this task. Rope handrails shall be used for traversing, ascending, and descending hillside angles greater than 45° slope (Dike walls) as applicable.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT FOR MULTI-MEDIA SAMPLING

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

SECTION I: General Job Scope

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

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

III. Field Crew: _____

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

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

IV. Protective equipment required

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

Respiratory equipment required

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

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes, and surgical style gloves. Coveralls and snake chaps will be worn near insect/snake areas.

V.

Chemicals of Concern	Action Level(s)	Response Measures
Site contaminants include VOC and SVOCs (from diesel fuel)	Any sustained reading >25 ppm 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 - Surgeons)	☒ Yes	☐ No
Steel toe Work shoes or boots	☒ Yes	☐ No	Work/rest regimen	☐ Yes	☒ No

Modifications/Exceptions: Safety glasses, hard hats, and hearing protection will be required at SSO discretion. 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. 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: Based on available data, site contaminants are not anticipated to be present at detectable concentrations in worker breathing zones. Potential exposures via skin contact and hand to mouth activities will be prevented through the use of PPE and appropriate decontamination and personal hygiene practices. Avoid areas of known or suspected insect/animal nesting or habitat, tape up, and use repellants.

Permit Issued by: _____ Permit Accepted by: _____

Job Completed by: _____ Date: _____

SAFE WORK PERMIT FOR
WELL INSTALLATION USING DPT METHODS

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

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): Installation of replacement wells using DPT methods.

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

III. Field Crew: _____

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

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

IV. Protective equipment required

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

Respiratory equipment required

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

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes, hard hats, hearing protection, and surgical style gloves. Coveralls will be worn near insect/vegetated areas

V. Chemicals of Concern	Action Level(s)	Response Measures
Site contaminants include VOC and SVOCs (from diesel fuel)	Any sustained reading >25 ppm 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: Reflective vests for high traffic areas. Tyvek coveralls and disposable boot covers if there is a potential for soiling work clothes. Leather gloves over surgeon's are an acceptable alternative to nitrile.

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: Based on available data, site contaminants are not anticipated to be present at detectable concentrations in worker breathing zones. Potential exposures via skin contact and hand to mouth activities will be prevent through the use of PPE and appropriate decontamination and personal hygiene practices. Avoid areas of known or suspected insect/animal nesting or habitat use repellants and tape up pants legs to boots..

Permit Issued by: _____ Permit Accepted by: _____

Job Completed by: _____ Date: _____

SAFE WORK PERMIT FOR
WELL ABANDONMENT ACTIVITIES

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

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): Well abandonment activities.

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

III. Field Crew: _____

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

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

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

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

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes, and surgical style gloves and safety glasses. Tyvek or chemical resistant coveralls will be used when there is a potential for soiling or saturating work clothing. Hard hat and hearing protection will be required if work involves the use of heavy equipment.

V. Chemicals of Concern	Action Level(s)	Response Measures
Site contaminants include VOC and SVOCs (from diesel fuel)	Any sustained reading >25 ppm 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: Safety glasses will be required if eye hazard are present. Reflective vests for high traffic areas. Tyvek coveralls and disposable boot covers if there is a potential for soiling work clothes. Leather gloves over surgeons are an acceptable alternative to nitrile.

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: Based on available data, site contaminants are not anticipated to be present at detectable concentrations in worker breathing zones. Potential exposures via skin contact and hand to mouth activities will be prevented through the use of PPE and appropriate decontamination and personal hygiene practices. Avoid areas of known or suspected insect/animal nesting or habitat use repellants and tape up pants legs to boots.

Permit Issued by: _____ Permit Accepted by: _____

Job Completed by: _____ Date: _____

ATTACHMENT V

ORC MATERIAL SAFETY DATA SHEET

ORC MATERIAL SAFETY DATA SHEET
Last Revised : April 17, 1998

****

SECTION# 1 - MATERIAL IDENTIFICATION

****

SUPPLIER:

REGENESIS Bioremediation Products

1011 Calle Sombra
San Clemente, CA 92673

Tel: 949-366-8000
Fax: 949-366-8090
Email: orc@regenesis.com

CHEMICAL DESCRIPTION:
A mixture of Magnesium Peroxide [MgO2], Magnesium Oxide [MgO], and Magnesium Hydroxide [Mg(OH)2]

CHEMICAL FAMILY:
Inorganic Chemicals

PRODUCT NAME:
Oxygen Release Compound (ORC®)

PRODUCT USE:
Used for environmental remediation of contaminated soil and groundwater

****

SECTION# 2 - CHEMICAL IDENTIFICATION

****

CHEMICAL CHARACTERIZATION

Magnesium Peroxide [MgO2]: CAS Reg. No. 14452-57-4

Magnesium Oxide [MgO]: CAS Reg. No. 1309-48-4

Magnesium Hydroxide ((Mg(OH)2): CAS Reg. No. 1309-42-8

FORM : powder

COLOR: white

ODOR: odorless

ASSAY: 25 - 35% Magnesium Peroxide (MgO2)

****

SECTION# 3 - PHYSICAL AND TECHNICAL SAFETY DATA

****

MELTING POINT: Not Determined

BOILING POINT: Not Determined

DENSITY: .6 - .8 g/cc

BULK DENSITY: ---

VAPOR PRESSURE: Data not available

VISCOSITY: ---

SOLUBILITY: Reacts with water. Soluble in acid

pH VALUE: Approx. 10 in saturated solution

FLASH POINT: Not applicable

SELF-IGNITION TEMPERATURE: Not applicable

EXPLOSION LIMITS % BY VOLUME: ---

THERMAL DECOMPOSITION: Spontaneous decomposition possible about 150° C

HAZARDOUS DECOMPOSITION PRODUCTS: Not known

HAZARDOUS REACTIONS: Hazardous polymerization will not occur

FURTHER INFORMATION: Non-combustible, but will support combustion

****

SECTION# 4 - REACTIVITY DATA

****

STABILITY: Product is stable unless heated above 150°C. Magnesium Peroxide reacts with water to slowly release oxygen. React by product is magnesium hydroxide

CONDITIONS TO AVOID: Heat above 150°C. Open flames

INCOMPATIBILITY: Strong Acids. Strong chemical agents

HAZARDOUS POLYMERIZATION: None known

****

SECTION# 5 - REGULATIONS

****

PERMISSIBLE EXPOSURE LIMITS IN AIR: Not established. Should be treated as a nuisance dust.

****

SECTION# 6 - PROTECTIVE MEASURES, STORAGE, AND HANDLING

****

TECHNICAL PROTECTIVE MEASURES
STORAGE: Keep container tightly closed. Keep away from combustible material

HANDLING: Use only in well-ventilated areas

PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY PROTECTION: Recommended (HEPA Filters)

HAND PROTECTION: Wear suitable gloves

EYE PROTECTION: Use chemical safety goggles
OTHER: ---

INDUSTRIAL HYGIENE: Avoid contact with skin and eyes

PROTECTION AGAINST FIRE AND EXPLOSION: ---

DISPOSAL: Dispose via sanitary landfill per state/local authority

FURTHER INFORMATION: Not flammable, but may intensify fire

****

SECTION# 7 - MEASURES IN CASE OF ACCIDENTS AND FIRE

****

AFTER SPILLAGE/LEAKAGE/GAS LEAKAGE: Collect in suitable containers. Wash remainder with copious quantities of water.

EXTINGUISHING MEDIA
SUITABLE: Carbon dioxide, dry chemicals, foam
NOT TO BE USED: ---

FURTHER INFORMATION: Self contained breathing apparatus or approved gas mask should be worn due to small particle size. Use extinguishing media appropriate for surrounding fire.

FIRST AID: After contact with skin, wash immediately with plenty of water and soap. In case of contact with eyes, rinse immediately with plenty of water and seek medical attention.

FURTHER INFORMATION: ---

****

SECTION# 8 - INFORMATION ON TOXICOLOGY

****

TOXICITY DATA: Data not available

****

SECTION# 9 - INFORMATION ON ECOLOGY

****

WATER POLLUTION HAZARD RATING (WGK): 0

****

SECTION# 10 - FURTHER INFORMATION

****

After the reaction of magnesium peroxide to form oxygen the resulting material, magnesium hydroxide is mildly basic. The amounts of magnesium oxide (magnesia) and magnesium hydroxide in the initial product have an effect similar to lime, but with lower alkalinity.

The information contained in this document is the best available to the supplier at the time of writing, but is provided without warranty of any kind. Some possible hazards have been determined by analogy to similar classes of material. The items in this document are subject to change and clarification as more information becomes available.

APPENDIX E

TtNUS SOP SA-6.3

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1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to identify and designate the field data record forms, logs and reports generally initiated and maintained for documenting Tetra Tech NUS field activities.

2.0 SCOPE

Documents presented within this procedure (or equivalents) shall be used for all Tetra Tech NUS field activities, as applicable. Other or additional documents may be required by specific client contracts or project planning documents.

3.0 GLOSSARY

None

4.0 RESPONSIBILITIES

Project Manager (PM) - The Project Manager is responsible for obtaining hardbound, controlled-distribution logbooks (from the appropriate source), as needed. In addition, the Project Manager is responsible for placing all field documentation used in site activities (i.e., records, field reports, sample data sheets, field notebooks, and the site logbook) in the project's central file upon the completion of field work.

Field Operations Leader (FOL) - The Field Operations Leader is responsible for ensuring that the site logbook, notebooks, and all appropriate and current forms and field reports illustrated in this guideline (and any additional forms required by the contract) are correctly used, accurately filled out, and completed in the required time-frame.

5.0 PROCEDURES

5.1 Site Logbook

5.1.1 General

The site logbook is a hard-bound, paginated, controlled-distribution record book in which all major onsite activities are documented. At a minimum, the following activities/events shall be recorded or referenced (daily) in the site logbook:

- All field personnel present
- Arrival/departure of site visitors
- Arrival/departure of equipment
- Start and/or completion of borehole, trench, monitoring well installation, etc.
- Daily onsite activities performed each day
- Sample pickup information
- Health and Safety issues (level of protection observed, etc.)
- Weather conditions

A site logbook shall be maintained for each project. The site logbook shall be initiated at the start of the first onsite activity (e.g., site visit or initial reconnaissance survey). Entries are to be made for every day that onsite activities take place which involve Tetra Tech NUS or subcontractor personnel. Upon completion of the fieldwork, the site logbook must become part of the project's central file.

The following information must be recorded on the cover of each site logbook:

- Project name
- Tetra Tech NUS project number
- Sequential book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks (see Section 5.2), but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable). An example of a typical site logbook entry is shown in Attachment A.

If measurements are made at any location, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the field notebook in which the measurements are recorded (see Attachment A).

All logbook, notebook, and log sheet entries shall be made in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, the data shall be crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook pages used must be signed and dated. The site logbook must also be signed by the Field Operations Leader at the end of each day.

5.1.2 Photographs

When movies, slides, or photographs are taken of a site or any monitoring location, they must be numbered sequentially to correspond to logbook/notebook entries. The name of the photographer, date, time, site location, site description, and weather conditions must be entered in the logbook/notebook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook/notebook. If possible, such techniques shall be avoided, since they can adversely affect the accuracy of photographs. Chain-of-custody procedures depend upon the subject matter, type of film, and the processing it requires. Film used for aerial photography, confidential information, or criminal investigation require chain-of-custody procedures. Once processed, the slides of photographic prints shall be consecutively numbered and labeled according to the logbook/notebook descriptions. The site photographs and associated negatives must be docketed into the project's central file.

5.2 Field Notebooks

Key field team personnel may maintain a separate dedicated field notebook to document the pertinent field activities conducted directly under their supervision. For example, on large projects with multiple investigative sites and varying operating conditions, the Health and Safety Officer may elect to maintain a separate field notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a field notebook.

5.3 Sample Forms

A summary of the forms illustrated in this procedure is shown as the listing of Attachments in the Table of Contents for this SOP. Forms may be altered or revised for project-specific needs contingent upon client

approval. Care must be taken to ensure that all essential information can be documented. Guidelines for completing these forms can be found in the related sampling SOP.

5.3.1 Sample Collection, Labeling, Shipment, Request for Analysis, and Field Test Results

5.3.1.1 Sample Log Sheet

Sample Log Sheets are used to record specified types of data while sampling. Attachments B-1 to B-4 are examples of Sample Log Sheets. The data recorded on these sheets are useful in describing the waste source and sample as well as pointing out any problems, difficulties, or irregularities encountered during sampling. A log sheet must be completed for each sample obtained, including field quality control (QC) samples.

5.3.1.2 Sample Label

A typical sample label is illustrated in Attachment B-5. Adhesive labels must be completed and applied to every sample container. Sample labels can usually be obtained from the appropriate Program source electronically generated in-house, or are supplied from the laboratory subcontractor.

5.3.1.3 Chain-of-Custody Record Form

The Chain-of-Custody (COC) Record is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as they are transferred from person to person. This form must be used for any samples collected for chemical or geotechnical analysis whether the analyses are performed on site or off site. One carbonless copy of the completed COC form is retained by the field crew, one copy is sent to the Project Manager, while the original is sent to the laboratory. The original (top, signed copy) of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the first cooler. The COC form should then state how many coolers are included with that shipment. An example of a Chain-of-Custody Record form is provided as Attachment B-6. Once the samples are received at the laboratory, the sample cooler and contents are checked and any problems are noted on the enclosed COC form (any discrepancies between the sample labels and COC form and any other problems that are noted are resolved through communication between the laboratory point-of-contact and the Tetra Tech NUS Project Manager). The COC form is signed and copied. The laboratory will retain the copy while the original becomes part of the samples' corresponding analytical data package.

5.3.1.4 Chain-of-Custody Seal

Attachment B-7 is an example of a custody seal. The Custody seal is an adhesive-backed label. It is part of a chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transport to the laboratory. The COC seals are signed and dated by the samplers and affixed across the opening edges of each cooler containing environmental samples. COC seals may be available from the laboratory; these seals may also be purchased from a supplier.

5.3.1.5 Field Analytical Log Sheets for Geochemical Parameters

Field Analytical Log Sheets (Attachment B-8) are used to record geochemical and/or natural attenuation field test results. Attachments B-8 (3-page form) should be used when applicable.

5.3.2 Hydrogeological and Geotechnical Forms

5.3.2.1 Groundwater Level Measurement Sheet

A groundwater level measurement sheet, shown in Attachment C-1 must be filled out for each round of water level measurements made at a site.

5.3.2.2 Data Sheet for Pumping Test

During the performance of a pumping test (or an in-situ hydraulic conductivity test), a large amount of data must be recorded, often within a short time period. The pumping test data sheet (Attachment C-2) facilitates this task by standardizing the data collection format, and allowing the time interval for collection to be laid out in advance.

5.3.2.3 Packer Test Report Form

A packer test report form shown in Attachment C-3 must be completed for each well upon which a packer test is conducted.

5.3.2.4 Summary Log of Boring

During the progress of each boring, a log of the materials encountered, operation and driving of casing, and location of samples must be kept. The Summary Log of Boring, or Boring Log, (Attachment C-4) is used for this purpose and must be completed for each soil boring performed. In addition, if volatile organics are monitored on cores, samples, cuttings from the borehole, or breathing zone, (using a PID or FID), these results must be entered on the boring log at the appropriate depth. The "Remarks" column can be used to subsequently enter the laboratory sample number, the concentration of key analytical results, or other pertinent information. This feature allows direct comparison of contaminant concentrations with soil characteristics.

5.3.2.5 Monitoring Well Construction Details Form

A Monitoring Well Construction Details Form must be completed for every monitoring well, piezometer, or temporary well point installed. This form contains specific information on length and type of well riser pipe and screen, backfill, filter pack, annular seal and grout characteristics, and surface seal characteristics. This information is important in evaluating the performance of the monitoring well, particularly in areas where water levels show temporal variation, or where there are multiple (immiscible) phases of contaminants. Depending on the type of monitoring well (in overburden or bedrock), different forms are used (see Attachments C-5 through C-9). Similar forms are used for flush-mount well completions.

5.3.2.6 Test Pit Log

When a test pit or trench is constructed for investigative or sampling purposes, a Test Pit Log (Attachment C-10) must be filled out by the responsible field geologist or sampling technician.

5.3.2.7 Miscellaneous Monitoring Well Forms

Monitoring Well Materials Certificate of Conformance (Attachment C-11) should be used as the project directs to document all materials utilized during each monitoring well installation.

The Monitoring Well Development Record (Attachment C-12) should be used as the project directs to document all well development activities.

5.3.3 Equipment Calibration and Maintenance Form

The calibration or standardization of monitoring, measuring or test equipment is necessary to assure the proper operation and response of the equipment, to document the accuracy, precision or sensitivity of the measurement, and determine if correction should be applied to the readings. Some items of equipment require frequent calibration, others infrequent. Some are calibrated by the manufacturer, others by the user.

Each instrument requiring calibration has its own Equipment Calibration Log (Attachment D) which documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. An Equipment Calibration Log must be maintained for each electronic measuring device used in the field; entries must be made for each day the equipment is used.

5.4 Field Reports

The primary means of recording onsite activities is the site logbook. Other field notebooks may also be maintained. These logbooks and notebooks (and supporting forms) contain detailed information required for data interpretation or documentation, but are not easily useful for tracking and reporting of progress. Furthermore, the field logbook/notebooks remain onsite for extended periods of time and are thus not accessible for timely review by project management.

5.4.1 Daily Activities Report

To provide timely oversight of onsite contractors, Daily Activities Reports are completed and submitted as described below.

5.4.1.1 Description

The Daily Activities Report (DAR) documents the activities and progress for each day's field work. This report must be filled out on a daily basis whenever there are drilling, test pitting, well construction, or other related activities occurring which involve subcontractor personnel. These sheets summarize the work performed and form the basis of payment to subcontractors (Attachment E is an example of a Daily Activities Report).

5.4.1.2 Responsibilities

It is the responsibility of the rig geologist to complete the DAR and obtain the driller's signature acknowledging that the times and quantities of material entered are correct.

5.4.1.3 Submittal and Approval

At the end of the shift, the rig geologist must submit the Daily Activities Report to the Field Operations Leader (FOL) for review and filing. The Daily Activities Report is not a formal report and thus requires no further approval. The DAR reports are retained by the FOL for use in preparing the site logbook and in preparing weekly status reports for submission to the Project Manager.

5.4.2 Weekly Status Reports

To facilitate timely review by project management, photocopies of logbook/notebook entries may be made for internal use.

It should be noted that in addition to the summaries described herein, other summary reports may also be contractually required. Attachment F is an example of a Field Trip Summary Report form.

6.0 ATTACHMENTS

Attachment A	TYPICAL SITE LOGBOOK ENTRY
Attachment B-1	EXAMPLE GROUNDWATER SAMPLE LOG SHEET
Attachment B-2	EXAMPLE SURFACE WATER SAMPLE LOG SHEET
Attachment B-3	EXAMPLE SOIL/SEDIMENT SAMPLE LOG SHEET
Attachment B-4	CONTAINER SAMPLE LOG SHEET FORM
Attachment B-5	SAMPLE LABEL
Attachment B-6	CHAIN-OF-CUSTODY RECORD FORM
Attachment B-7	CHAIN-OF-CUSTODY SEAL
Attachment B-8	FIELD ANALYTICAL LOG SHEET
Attachment C-1	EXAMPLE GROUNDWATER LEVEL MEASUREMENT SHEET
Attachment C-2	EXAMPLE PUMPING TEST DATA SHEET
Attachment C-3	PACKER TEST REPORT FORM
Attachment C-4	EXAMPLE BORING LOG
Attachment C-5	EXAMPLE OVERBURDEN MONITORING WELL SHEET
Attachment C-5A	EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)
Attachment C-6	EXAMPLE CONFINING LAYER MONITORING WELL SHEET
Attachment C-7	EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL
Attachment C-8	EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK
Attachment C-9	EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK (FLUSHMOUNT)
Attachment C-10	EXAMPLE TEST PIT LOG
Attachment C-11	MONITORING WELL MATERIALS CERTIFICATE OF CONFORMANCE
Attachment C-12	MONITORING WELL DEVELOPMENT RECORD
Attachment D	EXAMPLE EQUIPMENT CALIBRATION LOG
Attachment E	EXAMPLE DAILY ACTIVITIES RECORD
Attachment F	FIELD TRIP SUMMARY REPORT

ATTACHMENT A
TYPICAL SITE LOGBOOK ENTRY

START TIME: _____ DATE: _____

SITE LEADER: _____

PERSONNEL:

TtNUS	DRILLER	SITE VISITORS
_____	_____	_____
_____	_____	_____
_____	_____	_____

WEATHER: Clear, 68°F, 2-5 mph wind from SE

ACTIVITIES:

1. Steam jenney and fire hoses were set up.
2. Drilling activities at well ____ resumes. Rig geologist was _____. See Geologist's Notebook, No. 1, page 29-30, for details of drilling activity. Sample No. 123-21-S4 collected; see sample logbook, page 42. Drilling activities completed at 11:50 and a 4-inch stainless steel well installed. See Geologist's Notebook, No. 1, page 31, and well construction details for well _____.
3. Drilling rig No. 2 steam-cleaned at decontamination pit. Then set up at location of well _____.
4. Well _____ drilled. Rig geologist was _____. See Geologist's Notebook, No. 2, page ____ for details of drilling activities. Sample numbers 123-22-S1, 123-22-S2, and 123-22-S3 collected; see sample logbook, pages 43, 44, and 45.
5. Well _____ was developed. Seven 55-gallon drums were filled in the flushing stage. The well was then pumped using the pitcher pump for 1 hour. At the end of the hour, water pumped from well was "sand free."
6. EPA remedial project manger arrives on site at 14:25 hours.
7. Large dump truck arrives at 14:45 and is steam-cleaned. Backhoe and dump truck set up over test pit _____.
8. Test pit _____ dug with cuttings placed in dump truck. Rig geologist was _____. See Geologist's Notebook, No. 1, page 32, for details of test pit activities. Test pit subsequently filled. No samples taken for chemical analysis. Due to shallow groundwater table, filling in of test pit ___ resulted in a very soft and wet area. A mound was developed and the area roped off.
9. Express carrier picked up samples (see Sample Logbook, pages 42 through 45) at 17:50 hours. Site activities terminated at 18:22 hours. All personnel off site, gate locked.

_____

Field Operations Leader

ATTACHMENT B-1

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Domestic Well Data
[] Monitoring Well Data
[] Other Well Type: _____
[] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

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

PURGE DATA:

Date:	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method:								
Monitor Reading (ppm):								
Well Casing Diameter & Material								
Type:								
Total Well Depth (TD):								
Static Water Level (WL):								
One Casing Volume(gal/L):								
Start Purge (hrs):								
End Purge (hrs):								
Total Purge Time (min):								
Total Vol. Purged (gal/L):								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected

OBSERVATIONS / NOTES:

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	

ATTACHMENT B-2

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Stream
[] Spring
[] Pond
[] Lake
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

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

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

ATTACHMENT B-3

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date:	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

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

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

ATTACHMENT B-4

Tetra Tech NUS, Inc.

CONTAINER SAMPLE & INSPECTION SHEET

Page____ of ____

Project Site Name: _____
Project Number: _____
Site Identification: _____
Container Number(s): _____
Sample Type: 0 Grab
0 Composite

Sample ID No. _____
Sampled By: _____
C.O.C. No. _____
Concentration: 0 High
0 Medium
0 Low

CONTAINER SOURCE	CONTAINER DESCRIPTION
DRUM: 0 Bung Top 0 Lever Lock 0 Bolted Ring 0 Other _____	**COLOR:** _____ **CONDITION:** _____
TANK: 0 Plastic 0 Metal 0 Other _____	**MARKINGS:** _____ **VOL. OF CONTENTS:** _____
OTHER: _____	**OTHER:** _____

CONTAINER DISPOSITION	CONTENTS DESCRIPTION
SAMPLED: _____ **OPENED BUT NOT SAMPLED:** Reason _____ **NOT OPENED:** Reason _____	**SINGLE PHASED:** _____ **MULTIPHASE :** Layer 1 / Layer 2 / Layer 3 Phase (Sol. or Liq.) _____ _____ _____ Color _____ _____ _____ Viscosity L, M or H L, M or H L, M orH % of Total Volume _____ _____ _____
MONITOR READING:	**SAMPLE and /or INSPECTION DATE & TIME:** _____HRS. **METHOD:**_____
SAMPLER(S) and / or INSPECTOR(S) SIGNATURE:	**ANALYSIS:**

ATTACHMENT B-5

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

ATTACHMENT B-6

TETRA TECH NUS, INC.

CHAIN OF CUSTODY | NUMBER | PAGE ____ OF ____

PROJECT NO: | SITE NAME: | PROJECT MANAGER AND PHONE NUMBER | LABORATORY NAME AND CONTACT:

SAMPLERS (SIGNATURE) | FIELD OPERATIONS LEADER AND PHONE NUMBER | ADDRESS

CARRIER/WAYBILL NUMBER | CITY, STATE

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	CONTAINER TYPE PLASTIC (P) or GLASS (G) / PRESERVATIVE USED / TYPE OF ANALYSIS	COMMENTS

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TINUS-001

ATTACHMENT B-7

CHAIN-OF-CUSTODY SEAL

CUSTODY SEAL	**CUSTODY SEAL**
Date	**Date**
Signature	**Signature**

ATTACHMENT B-8

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page __ of __

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

Sampled By: _____ Duplicate: ☐

Field Analyst: _____ Blank: ☐

Field Form Checked as per QA/QC Checklist (initials): ☐

SAMPLING DATA:

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

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv):_____ Electrode Make & Model:_____

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

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

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier		Concentration
_____	x 0.01	=	mg/L
_____	x 0.02	=	mg/L

CHEMetrics: _____mg/L

Notes:

Alkalinity:

Analysis Time: _____

Equipment: HACH Digital Titrator AL-DT CHEMetrics (Range: _____mg/L) Filtered: ☐

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier		Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	_____ & _____	x 0.1	=	mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	_____ & _____	x 0.4	=	mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	_____ & _____	x 1.0	=	mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	_____ & _____	x 2.0	=	mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5.0	_____ & _____	x 5.0	=	mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	_____ & _____	x 10.0	=	mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

CHEMetrics: _____mg/L

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

Carbon Dioxide:

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

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
_____	x 0.1	=	mg/L
_____	x 0.2	=	mg/L
_____	x 1.0	=	mg/L
_____	x 2.0	=	mg/L

CHEMetrics: _____mg/L

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

ATTACHMENT B-8 (Continued)

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page __ of __

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

Sampled By: _____ Duplicate: ☐

Field Analyst: _____ Blank: ☐

Field Form Checked as per QA/QC Checklist (initials): ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Sulfide (S^{2-}):

Equipment: DR-700 DR-8 __ HS-WR Color Wheel Other: _____ Analysis Time: _____

Program/Module: 610nm 93

Concentration: _____ mg/L Filtered: ☐

Notes:

Sulfate (SO_4^{2-}):

Equipment: DR-700 DR-8 __ Other: _____ Analysis Time: _____

Program/Module: 91

Concentration: _____ mg/L Filtered: ☐

Standard Solution: ☐ Results: _____

Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes:

Nitrite (NO_2^--N): Analysis Time: _____

Equipment: DR-700 DR-8 __ Other: _____ Filtered: ☐

Program/Module: 60

Concentration: _____ mg/L Reagent Blank Correction: ☐

Standard Solution: ☐ Results: ☐

Notes:

Nitrate (NO_3^--N): Analysis Time: _____

Equipment: DR-700 DR-8 __ Other: _____ Filtered: ☐

Program/Module: 55

Concentration: _____ mg/L

Nitrite Interference Treatment: ☐

Standard Solution: ☐ Results: _____ Reagent Blank Correction: ☐

Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes:

ATTACHMENT B-8 (Continued)

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page __ of __

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

Sampled By: _____ Duplicate: ☐

Field Analyst: _____ Blank: ☐

Field Form Checked as per QA/QC Checklist (initials): ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Manganese (Mn^{2+}):

Equipment: DR-700 DR-8 __ HACH MN-5 Other: _____ Analysis Time: _____

Program/Module: 525nm 41

Concentration: _____ mg/L Filtered: ☐

Digestion: ☐

Standard Solution: ☐ Results: _____ Reagent Blank Correction: ☐

Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes: _____

Ferrous Iron (Fe^{2+}):

Equipment: DR-700 DR-8 __ IR-18C Color Wheel Other: _____ Analysis Time: _____

Program/Module: 500nm 33

Concentration: _____ mg/L Filtered: ☐

Notes: _____

Hydrogen Sulfide (H_2S):

Equipment: HS-C Other: _____ Analysis Time: _____

Concentration: _____ mg/L Exceeded 5.0 mg/L range on color chart: ☐

Notes: _____

QA/QC Checklist:

All data fields have been completed as necessary: ☐

Correct measurement units are cited in the SAMPLING DATA block: ☐

Values cited in the SAMPLING DATA block are consistent with the Groundwater Sample Log Sheet: ☐

Mulitplication is correct for each *Multiplier* table: ☐

Final calulated concentration is within the appropriate *Range Used* block: ☐

Alkalinity *Relationship* is determined appropriatly as per manufacturer (HACH) instructions: ☐

QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents: ☐

Nitrite Interference treatment was used for Nitrate test if Nitrite was detected: ☐

Title block on each page of form is initialized by person who performed this QA/QC Checklist: ☐

ATTACHMENT C-1
EXAMPLE GROUNDWATER LEVEL MEASUREMENT SHEET

Tetra Tech NUS, Inc.

GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: _____ **Project No.:** _____
Location: _____ **Personnel:** _____
Weather Conditions: _____ **Measuring Device:** _____
Tidally Influenced: Yes ___ No ___ **Remarks:** _____

Well or Piezometer Number	Date	Time	Elevation of Reference Point (feet)*	Total Well Depth (feet)*	Water Level Indicator Reading (feet)*	Thickness of Free Product (feet)*	Groundwater Elevation (feet)*	Comments

* All measurements to the nearest 0.01 foot

Page ___ of ___

ATTACHMENT C-2
EXAMPLE PUMPING TEST DATA SHEET

Tetra Tech NUS, Inc.

PUMPING TEST DATA SHEET

PROJECT NAME: _____ PUMPING WELL NUMBER: _____
PROJECT NUMBER: _____ MEASURED WELL NUMBER: _____

[ ] PUMPING TEST [ ] STEP DRAW DOWN TEST

DATE(s): MONITORING POINT:
MEASUREMENT METHOD: DEPTH CORRECTION (ft):
TEST NUMBER: PUMP SETTING (Ft. below monitoring point):
STATIC WATER LEVEL (ft): DISTANCE FROM PUMPING WELL (ft):
PERSONNEL:
REMARKS:

MILITARY TIME	ELAPSED TIME SINCE PUMP START OR STOP (Min.)	WATER LEVEL (Ft.)	CORRECTION (Ft.)	DRAW DOWN OR RECOVERY (Ft.)	PUMPING RATE (GPM)	FLOW METER READING (Gals.)	REMARKS

NOTE: All measurements to nearest 0.01 foot measured from top of well riser pipe unless otherwise noted.

ATTACHMENT C-3

ATTACHMENT C-3

PACKER TEST REPORT FORM

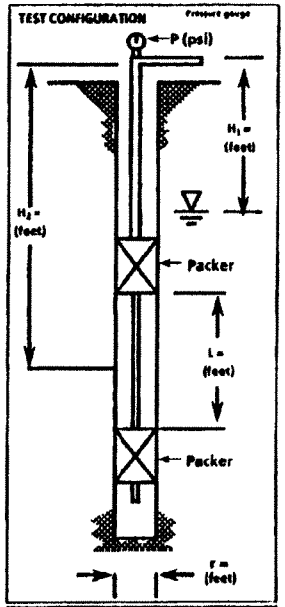
PROJECT: _____ **PROJECT NO.:** _____ **TEST NO:** _____ **PAGE** ____ **OF** ____

BORING NO.: _____ **CASING DEPTH:** _____ **CONTRACTOR:** _____ **STATIC WATER LEVEL** _____

TEST INTERVAL: _____ **BY:** _____ **CHECKED:** _____ **PACKER PRESSURE** _____

Flow Test					Calculated Results							
Pressure, p (psi)	Elapsed Time (min)	Flow Reading	Δ Flow, ΔQ (ft³)	Δ Flow, ΔQ (gal)	Flow Rate Q (gal/min)	H_1* (ft)	Hp(Ft) = 2.31·(psi)	H_2* (ft)	H = Hp + (H1 or H2)	Cp	K (ft/yr) = Cp·Q/H	K (cm/sec) = 9.67 x 10⁻⁷ K (ft/yr)

TEST CONFIGURATION



Length of Test Section in feet, L	Cp — Drilling Bit Size EX (1.5")	AX (1.875")	BX (2.37")	NX (3")
1	31,000	28,500	25,000	21,300
2	19,400	18,100	16,000	15,500
5	9,800	9,300	8,000	8,200
8	6,800	6,400	6,100	5,800
10	5,700	5,400	5,200	4,900
15	4,100	3,900	3,700	3,600
20	3,200	3,100	3,000	2,800

CP = (1/(2 x L)) ln(L/r) (70,315 5)
7.48 Gallons = 1 Ft³
1 psi = 2.31 ft head

* H_1 is used when the test length is below the water table.
H_2 is used when the test length is above the water table.

Remarks: _____

ATTACHMENT C-4

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

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

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

* When rock coring, enter rock brokeness.

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

Remarks: _____

Drilling Area Background (ppm): ____

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

ATTACHMENT C4 (Continued)

LEGEND

SOIL TERMS

UNIFIED SOIL CLASSIFICATION (USCS)

COARSE-GRAINED SOILS

More Than Half of Material is LARGER Than No. 200 Sieve Size

FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)			GROUP SYMBOL	TYPICAL NAMES
GRAVELS (50%(+)>1/4"ø	CLEAN GRAVELS (Low % Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.
	GRAVELS W/FINES (High % Fines)	Non-plastic fines (for identification procedures, see ML)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
		Plastic fines (for identification procedures, see CL)	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.
SANDS 50%(+)<1/4"ø	CLEAN SANDS (Low % Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	SW	Well graded sand, gravelly sands, little or no fines.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	Poorly graded sands, gravelly sands, little or no fines.
	SANDS W/FINES (High % Fines)	Non-plastic fines (for identification procedures, see MCL)	SM	Silty sands, poorly graded sand-silt mixtures.
		Plastic fines (for identification procedures, see CL)	SC	Clayey sands, poorly graded sand-clay mixtures.

FINE-GRAINED SOILS

More Than Half of Material is SMALLER Than No. 200 Sieve Size

FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)	Identification Procedures on Fraction Smaller than No. 40 Sieve Size: DAY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to Shaking)	TOUGHNESS (Consistency Near Plastic Limit)	GROUP SYMBOL	TYPICAL NAMES
SILTS AND CLAYS Liquid Limit <50	None to Slight	Quick to Slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity.
	Medium to High	None to Very Slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
	Slight to Medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity.
SILTS AND CLAYS Liquid Limit >50	Slight to Medium	Slow to None	Slight to Medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
	High to Very High	None	High	CH	Inorganic clays of high plasticity, fat clays.
	Medium to High	None to Very Slow	Slight to Medium	OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS	Readily identified by color, odor, spongy feel and frequently by fibrous texture.			Pt	Peat and other organic soils

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

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

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

ROCK TERMS

ROCK HARDNESS (FROM CORE SAMPLES)		
Descriptive Terms	Screwdriver or Knife Effects	Hammer Effects
Soft	Easily Gouged	Crushes when pressed with hammer
Medium Soft	Can be Gouged	Breaks (one blow); crumbly edges
Medium Hard	Can be scratched	Breaks (one blow); sharp edges
Hard	Cannot be scratched	Breaks conchoidally (several blows); sharp edges

ROCK BROKENESS		
Descriptive Terms	Abbreviation	Spacing
Very Broken	(V. Br.)	0-2"
Broken	(Br.)	2"-1'
Blocky	(Bl.)	1'-3"
Massive	(M.)	3'-10'

LEGEND:

SOIL SAMPLES - TYPES

5-2" Split-Barrel Sample

ST-3" O.D. Undisturbed Sample
O - Other Samples, Specify in Remarks

ROCK SAMPLES - TYPES

X-NX (Conventional) Core (~2-1/8" O.D.)

Q-NQ (Wireline) Core (~1-7/8" O.D.)
Z - Other Core Sizes, Specify in Remarks

WATER LEVELS

12/18
▽ 12.6' Initial Level w/Date & Depth

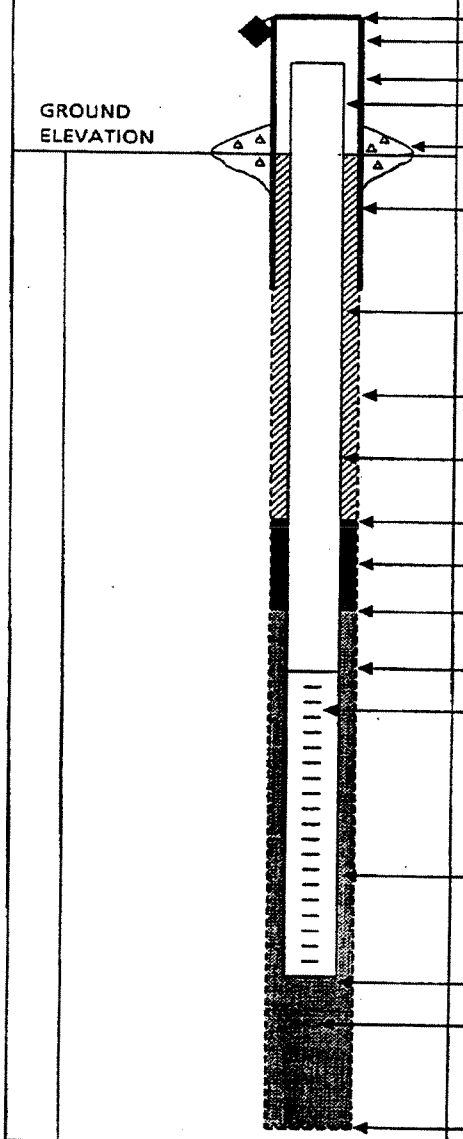
12/18

ATTACHMENT C-5
EXAMPLE OVERBURDEN MONITORING WELL SHEET

BORING NO.: _____

OVERBURDEN
MONITORING WELL SHEET

PROJECT _____ LOCATION _____ DRILLER _____
PROJECT NO. _____ BORING _____ DRILLING METHOD _____
ELEVATION _____ DATE _____ DEVELOPMENT METHOD _____
FIELD GEOLOGIST _____



ELEVATION OF TOP OF SURFACE CASING : _____
ELEVATION OF TOP OF RISER PIPE: _____

STICK - UP TOP OF SURFACE CASING: _____
STICK - UP RISER PIPE : _____

TYPE OF SURFACE SEAL: _____

I.D. OF SURFACE CASING: _____
TYPE OF SURFACE CASING: _____

RISER PIPE I.D. _____
TYPE OF RISER PIPE: _____

BOREHOLE DIAMETER: _____

TYPE OF BACKFILL: _____

ELEVATION / DEPTH TOP OF SEAL: _____ / _____

TYPE OF SEAL: _____

DEPTH TOP OF SAND PACK: _____

ELEVATION / DEPTH TOP OF SCREEN: _____ / _____

TYPE OF SCREEN: _____

SLOT SIZE x LENGTH: _____

I.D. OF SCREEN: _____

TYPE OF SAND PACK: _____

ELEVATION / DEPTH BOTTOM OF SCREEN: _____ / _____

ELEVATION / DEPTH BOTTOM OF SAND PACK: _____ / _____
TYPE OF BACKFILL BELOW OBSERVATION WELL: _____

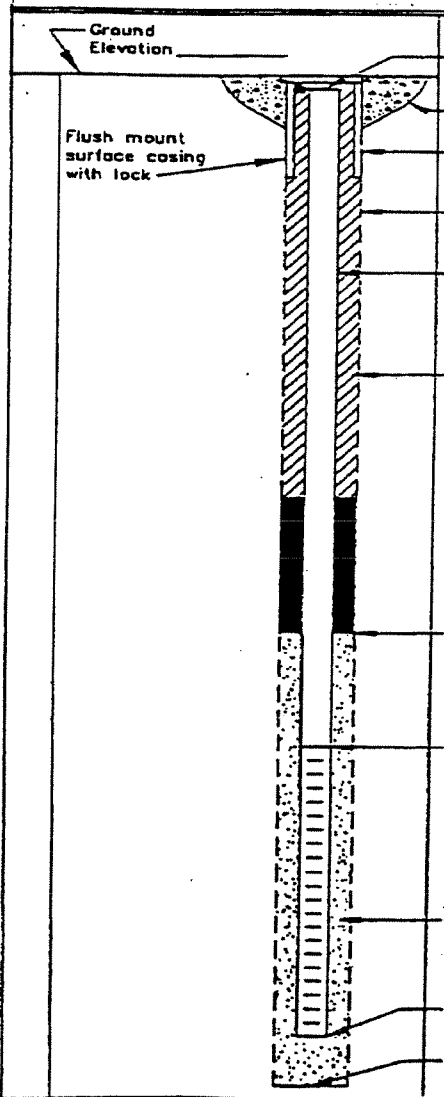
ELEVATION / DEPTH OF HOLE: _____ / _____

ATTACHMENT C-5A
EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)

BORING NO.: _____

MONITORING WELL SHEET

PROJECT _____ LOCATION _____ DRILLER _____
PROJECT NO. _____ BORING _____ DRILLING METHOD _____
ELEVATION _____ DATE _____ DEVELOPMENT METHOD _____
FIELD GEOLOGIST _____



ELEVATION TOP OF RISER: _____

TYPE OF SURFACE SEAL: _____

TYPE OF PROTECTIVE CASING: _____

I.D. OF PROTECTIVE CASING: _____

DIAMETER OF HOLE: _____

TYPE OF RISER PIPE: _____

RISER PIPE I.D.: _____

TYPE OF BACKFILL/SEAL: _____

DEPTH/ELEVATION TOP OF SAND: _____ / _____

DEPTH/ELEVATION TOP OF SCREEN: _____ / _____

TYPE OF SCREEN: _____

SLOT SIZE x LENGTH: _____

TYPE OF SAND PACK: _____

DIAMETER OF HOLE IN BEDROCK: _____

DEPTH/ELEVATION BOTTOM OF SCREEN: _____ / _____

DEPTH/ELEVATION BOTTOM OF SAND: _____ / _____

DEPTH/ELEVATION BOTTOM OF HOLE: _____ / _____

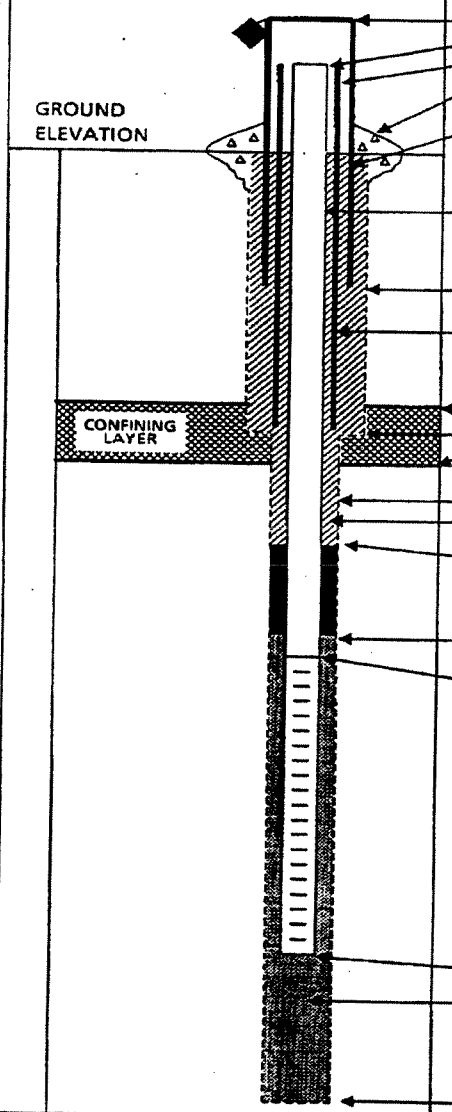
BACKFILL MATERIAL BELOW SAND: _____

ATTACHMENT C-6
EXAMPLE CONFINING LAYER MONITORING WELL SHEET

BORING NO.: _____

CONFINING LAYER
MONITORING WELL SHEET

PROJECT _____ LOCATION _____ DRILLER _____
PROJECT NO. _____ BORING _____ DRILLING METHOD _____
ELEVATION _____ DATE _____ DEVELOPMENT METHOD _____
FIELD GEOLOGIST _____



ELEVATION OF TOP OF SURFACE CASING : _____
ELEVATION OF TOP OF RISER PIPE: _____
ELEVATION TOP OF PERM. CASING: _____
TYPE OF SURFACE SEAL: _____

I.D. OF SURFACE CASING: _____
TYPE OF SURFACE CASING: _____

RISER PIPE I.D. _____
TYPE OF RISER PIPE: _____

BOREHOLE DIAMETER: _____

PERM. CASING I.D. _____
TYPE OF CASING & BACKFILL: _____

ELEVATION / DEPTH TOP CONFINING LAYER: _____
ELEVATION / DEPTH BOTTOM OF CASING: _____
ELEVATION / DEPTH BOT. CONFINING LAYER: _____

BOREHOLE DIA. BELOW CASING: _____
TYPE OF BACKFILL: _____

ELEVATION / DEPTH TOP OF SEAL: _____
TYPE OF SEAL: _____

DEPTH TOP OF SAND PACK: _____

ELEVATION/DEPTH TOP OF SCREEN: _____
TYPE OF SCREEN: _____

TYPE OF SAND PACK: _____

ELEVATION / DEPTH BOTTOM OF SCREEN: _____

ELEVATION / DEPTH BOTTOM OF SAND PACK: _____
TYPE OF BACKFILL BELOW OBSERVATION WELL: _____

ELEVATION / DEPTH OF HOLE: _____

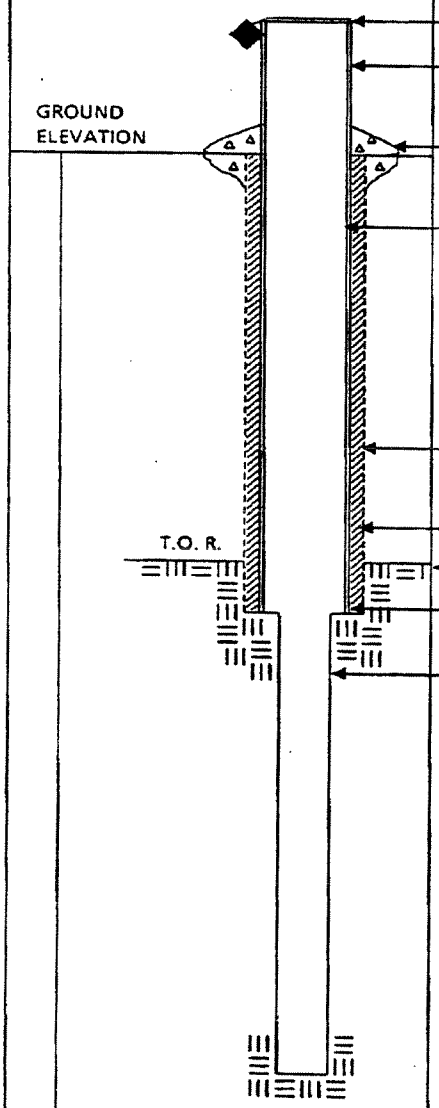
ATTACHMENT C-7
EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL

BORING NO.: _____

BEDROCK MONITORING WELL SHEET
OPEN HOLE WELL

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

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____



ELEVATION OF TOP OF CASING: _____

STICK UP OF CASING ABOVE GROUND SURFACE: _____

TYPE OF SURFACE SEAL: _____

I.D. OF CASING: _____
TYPE OF CASING: _____

TEMP. / PERM.: _____

DIAMETER OF HOLE: _____

TYPE OF CASING SEAL: _____

DEPTH TO TOP OF ROCK: _____

DEPTH TO BOTTOM CASING: _____

DIAMETER OF HOLE IN BEDROCK: _____

DESCRIBE IF CORE / REAMED WITH BIT:

_____

DESCRIBE JOINTS IN BEDROCK AND DEPTH:

_____

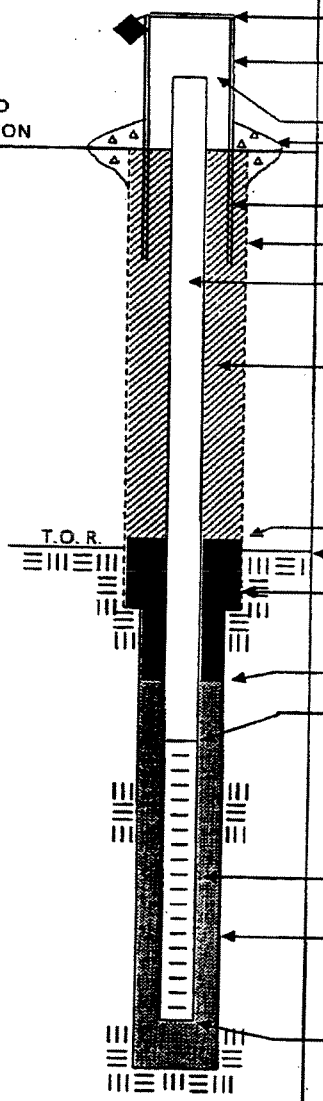
ELEVATION / DEPTH OF HOLE: _____ / _____

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

BORING NO.: _____

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT _____ LOCATION _____ DRILLER _____
PROJECT NO. _____ BORING _____ DRILLING METHOD _____
ELEVATION _____ DATE _____ DEVELOPMENT METHOD _____
FIELD GEOLOGIST _____



ELEVATION OF TOP OF SURFACE CASING: _____

STICK UP OF CASING ABOVE GROUND SURFACE: _____

ELEVATION TOP OF RISER: _____

TYPE OF SURFACE SEAL: _____

I.D. OF SURFACE CASING: _____

DIAMETER OF HOLE: _____

RISER PIPE I.D.: _____

TYPE OF RISER PIPE: _____

TYPE OF BACKFILL: _____

ELEVATION / DEPTH TOP OF SEAL: ____/____

ELEVATION / DEPTH TOP OF BEDROCK: ____/____

TYPE OF SEAL: _____

ELEVATION / DEPTH TOP OF SAND: ____/____

ELEVATION / DEPTH TOP OF SCREEN: ____/____

TYPE OF SCREEN: _____

SLOT SIZE x LENGTH: _____

I.D. SCREEN: _____

TYPE OF SAND PACK: _____

DIAMETER OF HOLE IN BEDROCK:

CORE / REAM: _____

ELEVATION / DEPTH BOTTOM SCREEN: ____/____

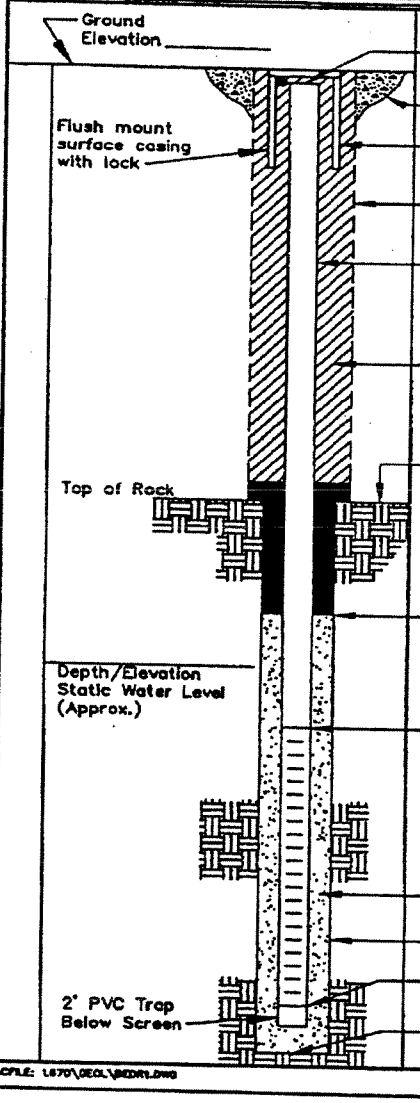
ELEVATION / DEPTH BOTTOM OF HOLE: ____/____

ATTACHMENT C-9
EXAMPLE BEDROCK MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK (FLUSHMOUNT)

BORING NO.: _____

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT: _____ LOCATION: _____ DRILLER: _____
PROJECT NO.: _____ BORING: _____ DRILLING METHOD: _____
ELEVATION: _____ DATE: _____ DEVELOPMENT METHOD: _____
FIELD GEOLOGIST: _____



ELEVATION TOP OF RISER: _____
TYPE OF SURFACE SEAL: _____
TYPE OF PROTECTIVE CASING: _____
I.D. OF PROTECTIVE CASING: _____
DIAMETER OF HOLE: _____
TYPE OF RISER PIPE: _____
RISER PIPE I.D.: _____
TYPE OF BACKFILL/SEAL: _____
_____
DEPTH/ELEVATION TOP OF BEDROCK: _____ / _____
DEPTH/ELEVATION TOP OF SAND: _____ / _____
DEPTH/ELEVATION TOP OF SCREEN: _____ / _____
TYPE OF SCREEN: _____
SLOT SIZE x LENGTH: _____
TYPE OF SAND PACK: _____
DIAMETER OF HOLE IN BEDROCK: _____
DEPTH/ELEVATION BOTTOM OF SCREEN: _____ / _____
DEPTH/ELEVATION BOTTOM OF SAND: _____ / _____
DEPTH/ELEVATION BOTTOM OF HOLE: _____ / _____
BACKFILL MATERIAL BELOW SAND: _____

ACFILE: L670\GEOL\BEDR1.DWG

ATTACHMENT C-10
EXAMPLE TEST PIT LOG

TEST PIT LOG

Tetra Tech NUS, Inc.

PROJECT: _____ TEST PIT NO.:
PROJECT NO _____ DATE: _____
LOCATION: _____
FIELD GEOLOGIST: _____

DEPTH (ft.)	LITHOLOGY CHANGE (Depth/ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS

Test Pit Cross Section and / or Plan View

REMARKS _____

PHOTO LOG _____ TEST PIT _____

PAGE ____ OF ____

ATTACHMENT C-11
EXAMPLE CERTIFICATE OF CONFORMANCE

MONITORING WELL MATERIALS
CERTIFICATE OF CONFORMANCE

Well Designation: _____ Site Geologist: _____

Site Name: _____ Drilling Company: _____

Date Installed: _____ Driller: _____

Project Name: _____ Project Number: _____

Material	Brand/Description	Source/Supplier	Sample Collected ?
Well Casing			
Well Screen			
End Cap			
Drilling Fluid			
Drilling Fluid Additives			
Backfill Material			
Annular Filter Pack			
Bentonite Seal			
Annular Grout			
Surface Cement			
Protective Casing			
Paint			
Rod Lubricant			
Compressor Oil			

To the best of my knowledge, I certify that the above described materials were used during installation of this monitoring well.

Signature of Site Geologist: _____

ATTACHMENT C-12
EXAMPLE MONITORING WELL DEVELOPMENT RECORD

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Page ___ of _____

Site: _____ Depth to Bottom (ft.): _____ Project Name: _____
Well: _____ Static Water Level Before (ft.): _____ Project Number: _____
Date Installed: _____ Static Water Level After (ft.): _____ Site Geologist: _____
Date Developed: _____ Screen Length (ft.): _____ Drilling Co.: _____
Dev. Method: _____ Specific Capacity: _____
Pump Type: _____ Casing ID (in.): _____

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units _____)	Turbidity (NTU)	Remarks (odor, color, etc.)

ATTACHMENT D
EXAMPLE EQUIPMENT CALIBRATION LOG

Tetra Tech NUS, Inc.

EQUIPMENT CALIBRATION LOG

PROJECT NAME : ____________________ INSTRUMENT NAME/MODEL: ____________________

SITE NAME: ____________________ MANUFACTURER: ____________________

PROJECT No.: ____________________ SERIAL NUMBER: ____________________

Date of Calibration	Instrument I.D. Number	Person Performing Calibration	Instrument Settings		Instrument Readings		Calibration Standard (Lot No.)	Remarks and Comments
			Pre-calibration	Post-calibration	Pre-calibration	Post-calibration		

ATTACHMENT E

Tetra Tech NUS, Inc.

DAILY ACTIVITIES RECORD

PROJECT NAME: _____ **PROJECT NUMBER:** _____

CLIENT: _____ **LOCATION:** _____

DATE: _____ **ARRIVAL TIME:** _____

Tt NUS PERSONNEL: _____ **DEPARTURE TIME:** _____

CONTRACTOR: _____ **DRILLER:** _____

ITEM	QUANTITY ESTIMATE	QUANTITY TODAY	PREVIOUS TOTAL QUANTITY	CUMULATIVE QUANTITY TO DATE

COMMENTS: _____

APPROVED BY:

_____ _____

Tt NUS REPRESENTATIVE DRILLER

DATE: _____

ATTACHMENT F
FIELD TRIP SUMMARY REPORT
PAGE 1 OF 2

SUNDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

_____

_____

_____

MONDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

_____

_____

_____

TUESDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

_____

_____

_____

WEDNESDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

_____

_____

_____

ATTACHMENT F
PAGE 2 OF 2
FIELD TRIP SUMMARY REPORT

THURSDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

_____

_____

_____

FRIDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

_____

_____

_____

SATURDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

_____

_____

_____