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SITE ASSESSMENT FOR UNDERGROUND STORAGE TANK SITE 19 WITH TRANSMITTAL LETTER NAS PENSACOLA FL
4/5/2002
TETRA TECH

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TTNUS/TAL-02-022/4176-4.1

April 5, 2002

Project Number 4176

Commander
Southern Division
Naval Facilities Engineering Command
ATTN: Mr. Byas Glover (ES 24)
Remedial Project Manager
2155 Eagle Drive
North Charleston, South Carolina 29406

Reference: Clean Contract No. N62467-94-D-0888
Contract Task Order No. 0222

**Subject: Site Assessment Plan for Underground Storage Tank Site 19, Building 3241, Naval Air Station Pensacola, Pensacola, Florida**

Dear Mr. Glover:

Tetra Tech NUS, Inc. is pleased to submit page inserts for the Final Site Assessment Plan (SAP) for Underground Storage Tank Site 19, Building 3241, Naval Air Station Pensacola, Pensacola, Florida. Please replace the corresponding pages in the Draft Final Site Assessment Plan with the enclosed pages.

As indicated below, the enclosure has also been forwarded to Mr. Greg Campbell at NAS Pensacola.

If you have any questions, please call me at (850) 385-9899.

Sincerely yours,

Gerald Walker

Gerald Walker, P.G.
Project Manager

GAW/jp

Enclosure

c: Greg Campbell, NAS Pensacola NPWC
Matt Soltis
Debbie Wroblewski (cover letter only)
Mark Perry (unbound)
TTNUS Tallahassee file

Rev. 1
04/05/02

# SITE ASSESSMENT PLAN
# FOR
# UNDERGROUND STORAGE TANK SITE 19
# BUILDING 3241

## 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**
**Foster Plaza 7**
**Pittsburgh, Pennsylvania 15220**

**CONTRACT NUMBER N62467-94-D-0888**
**CONTRACT TASK ORDER 0222**

**APRIL 2002**

**PREPARED UNDER THE SUPERVISION OF:**

Gerald Walker

**GERALD WALKER**
**TASK ORDER MANAGER**
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**TALLAHASSEE, FLORIDA**

**APPROVED FOR SUBMITTAL BY:**

Debra M Wroblewski

**DEBBIE WROBLEWSKI**
**PROGRAM MANAGER**
**TETRA TECH NUS, INC.**
**PITTSBURGH, PENNSYLVANIA**

**PROFESSIONAL CERTIFICATION**

**Site Assessment Plan**
**Underground Storage Tank Site 000019**
**Building 3241**
**Naval Air Station Pensacola, Pensacola, Florida**

This Site Assessment Report was prepared under the direct supervision of the undersigned geologist using geologic and hydrogeologic principles standard to the profession at the time the report was prepared. If conditions are determined to exist that differ from those described, the undersigned geologist should be notified to evaluate the effects of additional information on the assessment described in this report. This report was developed specifically for the referenced site and should not be construed to apply to any other site.

Gerald Walker

Gerald A. Walker, P.G.
Florida License No. PG-0001180

April 5, 2002

Date

Rev. 1
04/05/02

# Site Assessment Plan
for
# Underground Storage Tank Site 19
# Building 3241

## Naval Air Station Pensacola
Pensacola, Florida

**Southern Division**
**Naval Facilities Engineering Command**
**Contract Number N62467-94-D-0888**
**Contract Task Order 0222**

April 2002

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# 1.0 INTRODUCTION

Tetra Tech NUS, Inc. (TTNUS), was contracted by Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) to prepare this Site Assessment Plan (SAP) for the Underground Storage Tank (UST) Site 19 Building 3241 at Naval Air Station (NAS) Pensacola in Pensacola, Florida. The SAP outlines field investigations and sampling activities that will evaluate the horizontal and vertical extent of petroleum contamination in the vicinity of Building 3241 and assess if further action is required to remediate the site. This SAP identifies the site location and develops a rationale for the proposed field investigations to be implemented under this site assessment (SA).

## 1.1 PURPOSE OF THE SAP

The SAP serves as a guide for the site characterization activities to be conducted at the UST Site 19 Building 3241, and documents the procedures for field activities and sample analyses. The SAP specifies sampling protocol and procedures for data collection and sample analysis, sample locations, sample handling and analysis, sampling equipment, and management of investigative-derived wastes (IDW). This plan was prepared in accordance with Chapter 62-770, Florida Administrative Code (F.A.C.), the Florida Department of Environmental Protection (FDEP) Standard Operating Procedures (SOPs) for Field Activities (FDEP, January 1, 2002); and the FDEP, Bureau of Petroleum Storage Systems, Petroleum Cleanup Program SOP for Soil Assessment and Sampling Methods (FDEP, October 1, 2001) and Guidelines for Assessment and Source Removal of Petroleum Contaminated Soil (FDEP, May 1998).

## 1.2 SITE ASSESSMENT PLAN ORGANIZATION

The SAP is organized into six chapters (Chapters 1.0 to 6.0). Chapter 1.0 presents this brief introduction. Chapter 2.0 summarizes the site description, and history. Chapter 3.0 presents the information on proximate potable wells. Chapter 4.0 identifies the investigative methodology for conducting the assessment. Chapter 5.0 addresses the handling of investigative-derived wastes (IDW) resulting from investigation activities. Chapter 6.0 identifies the sampling and analysis schedule of operations for the site assessment activities. Supporting data are provided in the Appendices.

# 2.0 BACKGROUND

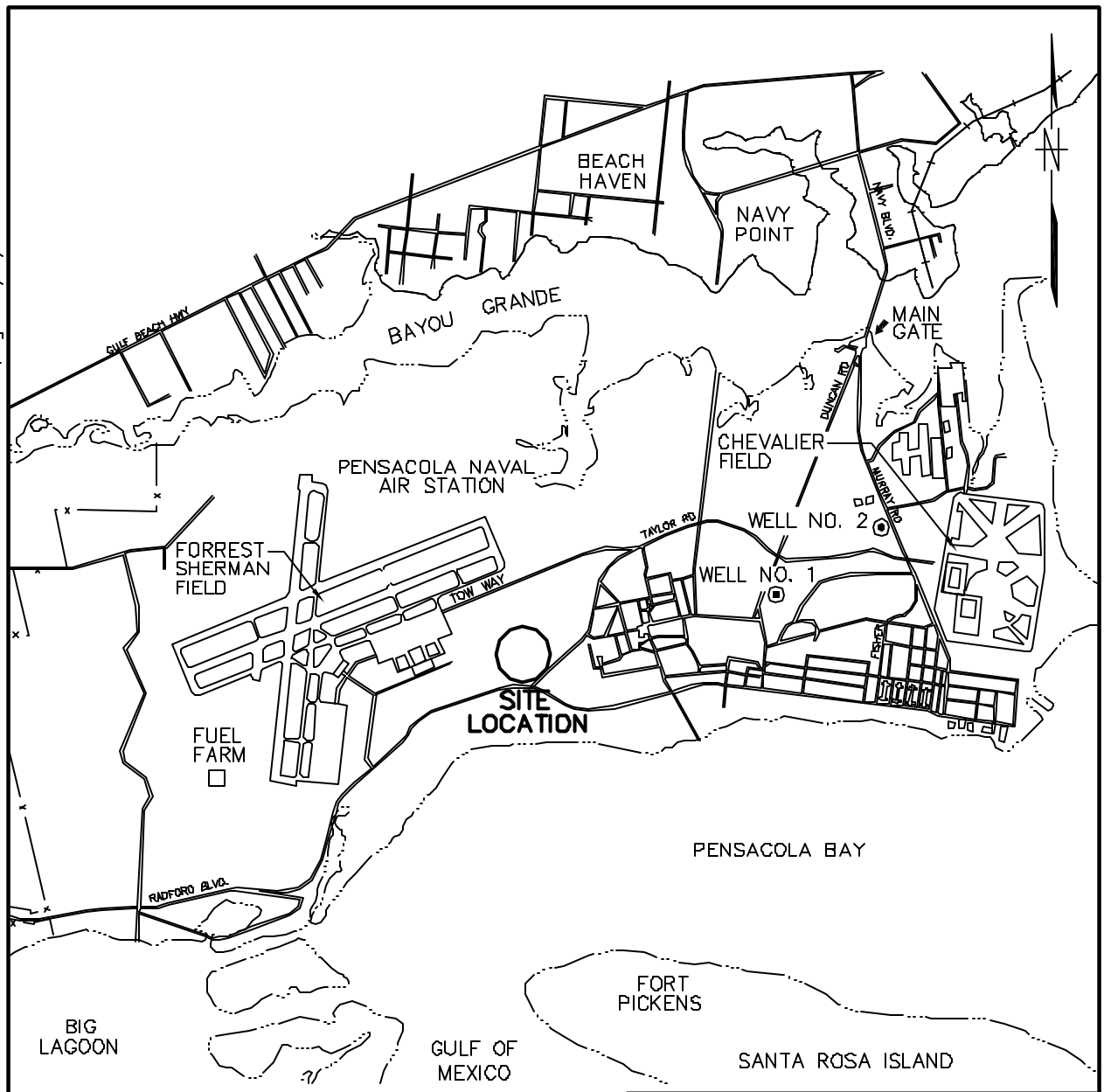
## 2.1 SITE DESCRIPTION

NAS Pensacola is located in Northwest Florida on the western edge of Pensacola Bay, two miles south of Pensacola, Florida, on Navy Boulevard. Building 3241 is located in the western side of the base, north of the Naval Aviation Museum and south of Building 3221 (Figure 2-1). The site is a former UST located on the south side of Building 3241 (Figure 2-2). The site area consists of Building 3241 adjacent to a grassy area and bounded by a parking lot on the east and west, and Building 3221 on the north. The site is covered with asphalt, concrete, and some grass. A single monitoring well is located on-site, south of Building 3241 in the grassy area. Construction details of the monitoring well are unknown.

## 2.2 SITE HISTORY

Building 3241 contains four boilers, which are used for heating Building 3221. Prior to its removal in 1994, the Building former UST was used to store fuel for the boilers. The boilers have been refitted and are currently fueled by natural gas. During the removal and closure of the Building 3241 UST Site 19, soil contamination was discovered (Department of the Navy, 1994). One groundwater sample (likely collected from the excavation pit) and five soil samples were collected. The samples were analyzed for volatile organic compounds (VOCs) by United States Environmental Protection Agency (USEPA) method SW-846 8260 and semi-volatile organic compounds (SVOCs) by USEPA method SW-846 8270A. Benzene was detected above FDEP Groundwater Cleanup Target Levels (GCTLs). Ethylbenzene, toluene, 1,1,2,2-tetrachlorathane, o-xylene, and m,p-xylenes were detected above the FDEP Soil Cleanup Target Levels (SCTLs).

As part of the development of the Plan of Action for this site investigation, a site visit was conducted by TTNUS on November 27, 2001. The site visit consisted of a walk-over to determine if any impedance to field work existed and to obtain measurements of the site and landmarks. All measurements were recorded on a hand-drawn map. This map was used to generate the Site Map (Figure 2-2). The onsite monitoring well was unsecured with no visible identification. No measurements were collected from the monitoring well.

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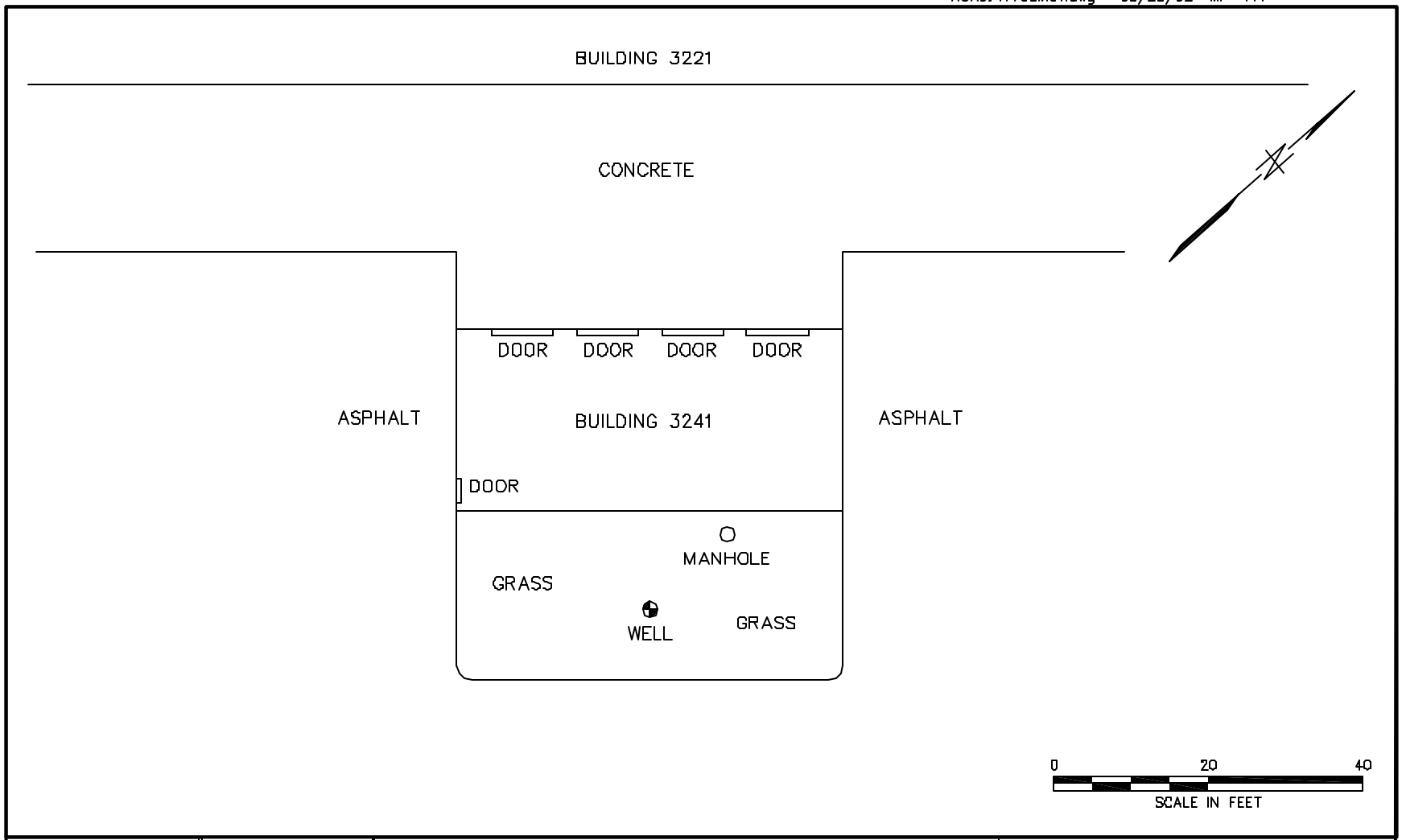


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# 3.0 INVENTORY OF PROXIMATE POTABLE WATER WELLS

Three water wells at NAS Pensacola provide emergency backup potable water supply to the station. These wells have typically been used as fire fighting water supply sources. One of the potable water supply wells (designated well No. 3) has been abandoned. The remaining two potable supply wells located at NAS Pensacola, designated as Well No. 1 and Well No 2, are indicated on Figure 2-1. According to NAS personnel, these wells are not currently used for potable water supplies at NAS Pensacola, but are available as reserve potable water supplies should the need arise. Potable well inventory data are presented in Table 3-1. Both wells at NAS Pensacola are screened in the main producing zone of the sand-and-gravel aquifer at depths ranging from 105 to 160 feet below land surface (bls). The main source of water for the base is a Navy-owned well field located at the Naval Technical Training Center, Corry Station. The water from this well field is pumped from the Sand and Gravel Aquifer.

**Table 3-1**

**Potable Well Inventory Data**

Site Assessment Plan
Sherman Field Fuel Farm
NAS Pensacola, Florida

| Well Identification Number/Local Name | Location | Total Depth (feet bls) | Screened Interval (feet bls) | Diameter Casing/Screen (inches) |
|---|---|---|---|---|
| 302116087170201/No. 1 | Sec. 1,T3S,R30W Duncan and Taylor Roads | 174 | 105-160 | 24/12 |
| 302124087163601/No. 2 | Sec. 1,T3S,R30W Murray and Farrar Roads | 178 | 110-160 | 24/12 |

Note: bls = below land surface.

# 4.0 PROPOSED ASSESSMENT PLAN

## 4.1 SITE ASSESSMENT ACTIVITIES

Prior to initiation of field activities, TTNUS will secure the necessary excavation permits, and acquire utility clearance for soil boring and monitoring well installation at the site. The purpose of the investigation is to identify the vertical and horizontal extent of petroleum hydrocarbon constituents in the soil and groundwater associated with the Building 3241 UST. The SA will require the advancement of soil borings, the collection and screening of soil and groundwater samples, the installation of groundwater monitoring wells, and the collection and laboratory analyses of soil and groundwater samples from site borings and monitoring wells. The SA investigation for Building 3241 will include a start-up meeting to be held at the site. All personnel associated with the investigation will review the scope of work presented in the SAP and in the Health and Safety Plan (HASP). Scheduling, logistics, and special precautions will also be discussed at this time. The following sections provide an overview of the proposed investigative activities.

### 4.1.1 DPT and Mobile Laboratory Soil Investigation

A direct-push technology (DPT) soil-sampling device (e.g. Geoprobe® system) will be used to obtain subsurface soil samples. DPT allows investigators to push a closed soil sampler to depth, open the sampler, and obtain a discrete soil sample that is relatively undisturbed. The mobile laboratory will be used to obtain real-time data defining the vertical and horizontal extent of contamination. Therefore, the number and location of DPT soil samples will be determined iteratively on site. It is anticipated that this investigation will include four days of DPT and mobile laboratory work. The proposed sample locations are presented in Figure 4-1.

To determine the horizontal and vertical extent of the contaminated soil, DPT soil borings will be advanced and soil samples will be screened for petroleum vapors using organic vapor analysis (OVA) in accordance with the FDEP, Bureau of Petroleum Storage Systems, Petroleum Cleanup Program SOP for Soil Assessment and Sampling Methods (Appendix F) and Guidelines for Assessment and Source Removal of Petroleum Contaminated Soil. The soil OVA readings will then be used to target the collection of soil samples for mobile laboratory analysis for Priority Pollutant List (PPL; 40 Code of Federal Regulations (CFR), Chapter I, subchapter D, part 122, Appendix D) VOCs. Approximately eight soil samples, exhibiting the low, medium, and high mobile laboratory readings, will be submitted to a fixed-based laboratory for confirmatory analysis. The samples will be analyzed for kerosene and gasoline parameters

as presented in Chapter 62-770, F.A.C., Table B. Table 3-1 presents the parameters to be analyzed by the fixed-based laboratory.

### 4.1.2 DPT and Mobile Laboratory Groundwater Investigation

Groundwater samples will also be collected at each DPT soil boring location. The groundwater samples will be screened for PPL VOCs by the mobile laboratory to determine the extent of the plume. This information will be used to determine the optimum location, depth of screened interval, and number of permanent monitoring wells. If contaminated groundwater is encountered, additional samples will be collected to complete the vertical and horizontal profiling. Approximately four groundwater samples, exhibiting the highest mobile laboratory results, will be submitted for confirmation by the fixed-based laboratory. The samples will be analyzed for kerosene and gasoline parameters as presented in Chapter 62-770, F.A.C., Table B. Table 4-1 presents the parameters to be analyzed by the fixed-base laboratory.

### 4.1.3 Confirmatory Groundwater Investigation

The installation of permanent monitoring wells will allow for the confirmation and potential continued monitoring of groundwater conditions at and around the Building 3241 Site. Approximately six monitoring wells will be installed at the Building 3241 Site. Monitoring well locations and depths will be determined based on DPT soil and groundwater screening data evaluation. However for planning purposes it is proposed that approximately, four monitoring wells will be installed as shallow wells, screened across the water table at a depth of approximately 20 feet bls, and two monitoring wells will be completed as deep, vertical extent monitoring wells to an approximate depth of 40 feet bls. After the monitoring wells have been installed and developed, groundwater samples will be collected from all monitoring wells. The samples will be analyzed for kerosene and gasoline parameters as presented in Chapter 62-770, F.A.C., Table B. The parameters to be analyzed are summarized in Table 4-2.

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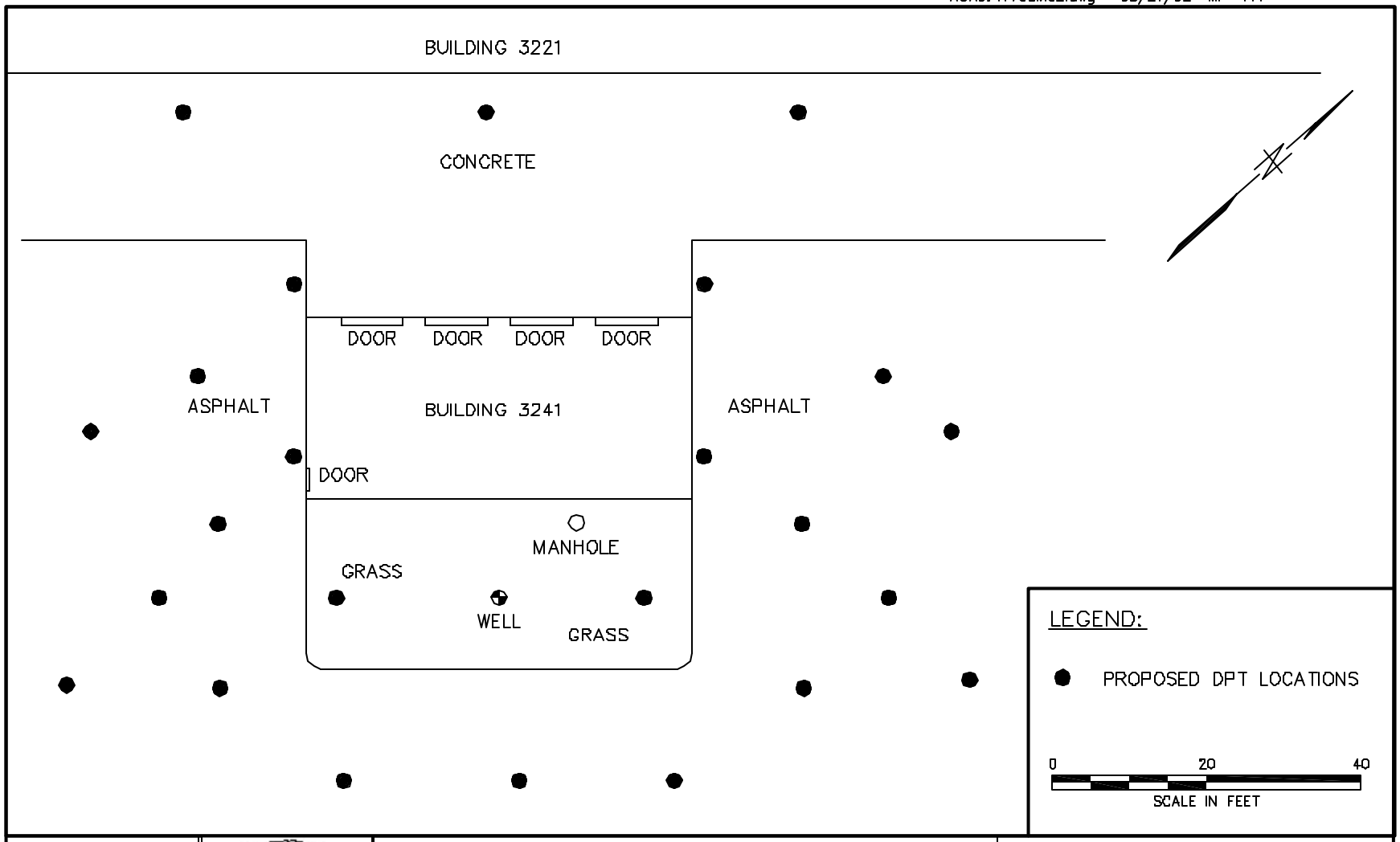


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| DRAWN BY MF DATE 3/21/02 | | PROPOSED SAMPLE LOCATION<br>BUILDING 3241<br>CONTAMINATION ASSESSMENT PLAN<br>NAS PENSACOLA<br>PENSACOLA, FLORIDA | CONTRACT NO. 4176 |
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**TABLE 4-1**
**FIXED-BASE LABORATORY**
**ENVIRONMENTAL SAMPLE SUMMARY**
**UST SITE 19 BUILDING 3241**
**NAS PENSACOLA, FLORIDA**

| Analyte | Proposed Method | Fixed-based Lab Samples | IDW Samples | Duplicate Samples | Rinsate Blanks | Trip Blanks | Total Samples |
|---|---|---|---|---|---|---|---|
| **GROUNDWATER** | | | | | | | |
| PPL /non PPL VOCs (with TICs over 10 µg/L) and BTEXM | EPA SW-846 8260B | 4 | 0 | 1 | 1 | 1 | 7 |
| EDB | EPA 504.1 | 4 | 0 | 1 | 1 | 1 | 7 |
| PAHs | EPA-846 8310C | 4 | 0 | 1 | 1 | 0 | 6 |
| TRPH | FL-PRO | 4 | 0 | 1 | 1 | 0 | 6 |
| Lead | EPA 6010 B | 4 | 0 | 1 | 1 | 0 | 6 |
| **SOIL** | | | | | | | |
| BTEXM | EPA SW-846 8260B | 8 | 0 | 1 | 1 | 2 | 12 |
| TRPH | FL-PRO | 8 | 0 | 1 | 1 | 0 | 10 |
| Lead | EPA 6010 B | 8 | 0 | 1 | 1 | 0 | 10 |

Method referenced reflects FDEP requirements. µg/L = micrograms per liter TICs = tentatively identified compounds
PPL = Priority Pollutant List TRPH =total recoverable petroleum hydrocarbons
BTEXM = Benzene, Toluene, Ethylbenzene, total xylenes, and MTBE

**TABLE 4-2**
**FIXED-BASE LABORATORY**
**ENVIRONMENTAL SAMPLE SUMMARY**
**UST SITE 19 BUILDING 3241**
**NAS PENSACOLA, FLORIDA**

| Analyte | Proposed Method | Fixed-based Lab Samples | IDW Samples | Duplicate Samples | Rinsate Blanks | Trip Blanks | Total Samples |
|---|---|---|---|---|---|---|---|
| **GROUNDWATER** | | | | | | | |
| PPL /non PPL VOCs (with TICs over 10 µg/L) and BTEXM | EPA SW-846 8260B | 6 | 0 | 1 | 1 | 1 | 7 |
| EDB | EPA 504.1 | 6 | | 1 | 1 | 1 | 7 |
| PAHs | EPA-846 8310C | 6 | 0 | 1 | 1 | 0 | 6 |
| TRPH | FL-PRO | 6 | 0 | 1 | 1 | 0 | 6 |
| Total Lead | EPA 6010 B | 6 | 0 | 1 | 1 | 0 | 6 |

Method referenced reflects FDEP requirements. µg/L = micrograms per liter TICs = tentatively identified compounds
PPL = Priority Pollutant List TRPH =total recoverable petroleum hydrocarbons
BTEXM = Benzene, Toluene, Ethylbenzene, total xylenes, and MTBE

### 4.1.4 Investigative Derived Waste

IDW from sampling activities will be containerized and segregated in the following categories:

- Soil cuttings
- Decontamination fluids
- Development water
- Purge water from wells
- Personal Protective Equipment (PPE)

Approximately 6 drums of soil and 4 drums of aqueous IDW will be generated at the site during the investigation. TTNUS will not collect specific IDW samples. Rather, data from analysis of environmental samples will be used for IDW disposal. PPE will be double-bagged and disposed of in an appropriate Base dumpster. Section 5.0, includes a discussion of the IDW management process. A copy of the IDW Management Plan is provided in Appendix A. NAS Pensacola personnel will sign all waste manifests and Bills of Lading.

## 4.2 GENERAL SITE OPERATIONS

### 4.2.1 Field Team Organization

The TTNUS field personnel will consist of staff members who will be assigned temporary duty at NAS Pensacola to conduct the field investigation activities. The organization of the field team is described below.

- The Field Operations Leader (FOL) is responsible for the day-to-day direction of personnel in the field. The FOL will assign tasks to field team personnel, direct the sequence of activities, coordinate with NAS Pensacola personnel, coordinate subcontractors, and review tasks in progress and those completed. The FOL will ensure that project-specific plans are implemented and that activities are in compliance with appropriate guidelines. The FOL will oversee soil boring and monitoring well installation activities and may conduct various environmental sampling activities. Duties may include logging and documentation of drilling and well construction, environmental sample collection and handling, and ensuring that the approved methods are implemented. The FOL may also conduct tests for identifying subsurface conditions and characterizing the groundwater flow regime.

- The Project Health and Safety Officer (PHSO) is responsible for ensuring that proper health and safety procedures are identified and implemented for the project and that project-related health and safety incidents are properly investigated. In the event that only a small number of project staff are required on-site, the duties of the PHSO may be assigned to the FOL or another member of the field team. The PHSO, or designee, will report directly to the TTNUS Corporate Director of Health and Safety.

- Sampling Personnel will be responsible for activities assigned by the FOL and for properly locating, collecting, preserving, packaging, documenting, and shipping environmental samples to the laboratory.

### 4.2.2 Mobilization

TTNUS must perform several internal tasks before field mobilization. These tasks include the following:

- Preparation of technical and subcontractor bid specifications
- Selection and mobilization of subcontractors
- Acquisition and preparation of equipment for transportation to the field

- Acquisition and preparation of expendable supplies for transportation to the field
- Arrangement of transportation and lodging for field personnel

In addition to these internal efforts, external mobilization efforts will be coordinated with the NAS Pensacola Point of Contact (POC). A list of the steps to be taken includes the following:

- Obtain keys to existing locks on wells (other than those installed by TTNUS)
- Select staging areas for equipment and IDW
- Complete security procedures for project and subcontractor personnel to gain access to the NAS
- Ensure supplies of potable water are accessible
- Coordinate with NAS Pensacola personnel to locate buried utilities

Decontamination facilities will be constructed by the drilling subcontractor before the beginning of field activities at a location deemed appropriate by the NAS POC and TTNUS. Site reconnaissance will be performed before initiation of field activities. Some of these activities will be performed with the assistance of NAS Pensacola personnel. These activities include the following:

- Locating and setting up decontamination facilities
- Identifying the potable water source(s), electrical outlets, and other utilities to be used during field activities
- Collecting and shipping, to the laboratory, a field blank of the potable water source to be used for field decontamination activities
- Locating temporary storage for soil cuttings and purge/development water drums, as well as solid wastes generated during field activities (e.g., Tyvek suits, gloves, plastic sheeting)
- Reconnoitering and marking/staking sample locations
- Locating underground and aboveground utilities within the work areas (including water, gas, sanitary sewer lines, drainage lines, telephone cable, and electric lines). Electric lines may be shielded, if necessary
- Erecting any necessary barricades and/or temporary fencing

### 4.2.3 Field Investigation Activities

The planned activities for the CA include the following general categories of field investigation activities:

- Installation of soil borings and collection of subsurface soil and groundwater samples, using direct-push techniques
- Installation of shallow and deep groundwater monitoring wells

- Decontamination of investigation equipment
- Measurement of groundwater potentiometric level
- Collection of groundwater samples
- Tidal survey and aquifer testing
- Field measurement of physical and chemical properties of soil and groundwater samples
- Sample management
- Field QC, documentation, and record keeping
- IDW management
- Location survey

Project-specific SOPs will be given priority, followed by the FDEP Field SOPs and then USEPA Region IV SOPs, when SOPs for the same task differ. Copies of all guidance documents will be located on-site with the TTNUS field crew at NAS Pensacola. If activities arise that are not referenced, then the project-specific SOPs, FDEP Field SOPs, the USEPA Region IV SOPs, or Navy guidance will be followed (in that order).

### 4.2.4 Direct-Push Soil Sampling

A DPT soil-sampling device (e.g., Geoprobe® system) will be used to obtain subsurface soil samples at NAS Pensacola. DPT allows investigators to push a closed sampler to depth, open the sampler, and obtain a discrete soil sample that is relatively undisturbed. For this project, a DPT sampler will be used for collecting subsurface soil samples.

The soil samples may be collected from any discrete depth interval, but will typically be collected from above the water table. The DPT sampler typically has an inside diameter (ID) of 1 to 2 inches and recovers a soil core measuring 2 to 4 feet in length. Liners made of material compatible with the contaminants of interest will be used inside the soil sampler to keep the sample intact after it is extruded from the sampler, and to reduce the likelihood of cross-contamination or false-positive laboratory results.

To collect a sample, the DPT sampler is attached to the leading end of the pushing rods and driven in a closed and sealed position into the subsurface soil, using a hydraulic and/or percussion driver. At the top of the desired sampling interval, the pushing is temporarily stopped and an internal release mechanism in the sampler is triggered, using extension rods inserted down the inside of the push rods. After the release is activated, the sampler is again driven forward, collecting soil in the sample tube as a piston retracts. The probe assembly is then retrieved and the soil sample is retained by sidewall tube friction. Upon retrieval the sample is removed for examination.

After removal from the sampler barrel, the sample is extracted and placed on a fresh, clean surface. If liners are used, the open ends will be covered with clean Teflon™ tape, capped, and sealed with exterior tape. The samples will be labeled, preserved on ice, and transported to the laboratory. All portions of the probe assembly that are inserted into the ground will be decontaminated before use at a new location, using standard decontamination procedures.

### 4.2.5 Soil Organic Vapor Analysis

Soil OVA will be performed according to the method prescribed in FDEP Rule 62-770.200(8) F.A.C. Soil samples will be analyzed for their total hydrocarbon content, using an OVA equipped with a flame ionization detector (FID). A photoionization detector (PID) may be used only after a determination of the instrument's equivalent response to a FID has been made. Charcoal filters will be used to differentiate between methane (a naturally-occurring gas) and petroleum hydrocarbon vapors.

The following steps will be used to prepare soil samples for headspace analysis:

- Each soil sample to be analyzed will be equally split and placed into two clean, 16-ounce glass jars.
- Each sample jar will be filled to approximately one-half its volume, if sufficient sample volume is available.
- Aluminum foil covers will be sealed over the open end of the glass jar, using a threaded metal ring.
- Sample jars will be allowed to equilibrate under a temperature range of 20–30°C for approximately five minutes.
- The headspace will be measured by piercing the aluminum foil with the FID probe and recording the highest sustained reading.
- The FID will be calibrated daily, calibration will be confirmed every 20 samples.
- If FID readings above background levels are detected in the first jar, the second sample jar will be measured, using an in-line charcoal filter to determine the portion of the total reading attributable to methane gas.

### 4.2.6 Direct Push Groundwater Sampling

A DPT groundwater-sampling device (e.g., Geoprobe® system) will be used to obtain groundwater samples at NAS Pensacola. DPT allows investigators to obtain a groundwater sample from discreet depths.

To collect a sample, the DPT slotted-screen will be attached to the leading end of the pushing rods and driven through an existing borehole, using a hydraulic and/or percussion driver. At the depth of the desired sampling point, the pushing will be temporarily stopped, teflon tubing will be inserted through the rod and placed within the DPT screen interval. A peristaltic pump will be attached to the teflon tubing. After the sampling is complete, the sampler is again driven forward, to the depth of the next desired sampling point.

### 4.2.7 Monitoring Well Installation

#### 4.2.7.1 Well Casing and Screen Materials

All monitoring wells will be constructed of new Schedule 40 polyvinyl chloride (PVC) casing and screen manufactured for environmental applications (i.e., no inked markings and shipped clean in individual sealed wraps) and meeting requirements of the American Society for Testing and Materials (ASTM) F 480 and D 1785. This variance from the USEPA Region IV SOPs' requirement for stainless steel casing and screen materials is based on previous investigation results, which identify background groundwater quality (e.g., pH) and dissolved contaminants in groundwater (e.g., petroleum hydrocarbons) are not present at concentrations detrimental to the use of PVC. The use of PVC will make the construction of these wells consistent with that of environmental monitoring wells previously installed at NAS Pensacola. If conditions are encountered in which the use of PVC in monitoring well construction is inappropriate, stainless steel or another suitable material will be selected and presented to the FDEP and Navy personnel for approval before being used.

#### 4.2.7.2 Filter Pack and Screen Design

The USEPA Region IV SOPs (USEPA 1996) require that the filter pack used for monitoring well annular space be selected based on grain-size analysis of the formation interval adjacent to the well screen interval. This guidance will be followed during additional assessment for aquifer zones in which previous investigations have analyzed the formation intervals of interest and for which the grain-size data are available. When this information is not available, monitoring well construction will follow the previous investigation practice of using a 20/30-size gradation filter material coupled with a 0.01-inch factory-slotted well screen. This filter pack size and screen slot size combination has previously been used at NAS Pensacola and groundwater samples of acceptable quality have been obtained.

The 20/30 filter size is compatible with a formation that has a D30 size (i.e., 30 percent finer by weight than the D30 sieve size) in the range of fine sand. If visual inspection of the drill cuttings or split-spoon samples indicates that the D30 size of the formation is significantly coarser than this range (e.g., uniform medium-to-coarse sand and/or gravel), an alternate filter pack and screen slot size combination will be recommended in accordance with the USEPA Region 4 SOPs (USEPA 1996).

#### 4.2.7.3 Shallow Well Installation

Shallow monitoring wells will be installed using hollow stem auger (HAS) techniques. The wells will be completed to depths from 20 feet bls, as determined from the data gathered during the soil boring program. All wells will be constructed of 2-inch ID PVC casing with 10 feet of 0.01-inch PVC slotted screen. The screened section will be backfilled, using a 20/30-size gradation sand pack to a level at a minimum of 2 feet above the slotted screen. Either a bentonite pellet or a fine sand seal at least 2 feet thick will be installed on top of the sand pack. The remainder of the annulus of the borehole will be grouted by pumping a cement/bentonite slurry through a tremie pipe to a point 2 feet bls. The monitoring well screens will be placed so that the screens bracket the water table.

#### 4.2.7.4 Deep Well Installation

The deep monitoring well will be installed using HAS auger techniques and is expected to be completed to an approximate depth of 40 feet bls. Surface casing is not proposed for the deep monitoring well. The monitoring well will be constructed of 2-inch-diameter Schedule 40 PVC, flush-threaded casing, with 5 feet of 0.01-inch factory-slotted, PVC screen. The screened section will be backfilled, using a 20/30-size gradation sand pack to a level at a minimum of 2 feet above the slotted screen, and either bentonite pellets or a fine sand seal at least 2 feet thick will be installed on top of the sand pack. The remainder of the annulus of the borehole will be grouted by pumping a cement/bentonite slurry through a tremie pipe up to a point 2 feet bls. A diagram of the typical shallow and deep monitoring well construction is illustrated in Figure 3-1.

#### 4.2.7.5 Well Surface Completion

Each monitoring well surface completion will be flush mount. The riser pipe will be cut to approximately 3 inches bls, using an inside pipe cutter, and a v-notch will be cut into the north edge of the top of casing for surveying purposes. A protective steel casing will be flush-mount installed around each monitoring well.

The flush-mount covers shall be a minimum 8-inch round security vault, equipped with a sealing gasket to reduce the amount of water infiltration. A 2-foot by 2-foot (saw-cut or saw-scored and jack hammered hole) by 6-inch-thick concrete apron will be constructed around each flush-mounted monitoring well. The flush-mounted casings will be completed 1-inch above existing grade, and the apron tapered to be flush with existing grade at the edges so that water will run off the apron. The protective casing shall be completed with a metal identification tag.

#### 4.2.7.6 General Drilling Requirements

The only drilling fluid used will be potable water. In addition, lubricants used on the rig will not introduce or mask chemicals of concern (COCs) at the site being investigated. All trash, waste, grout, cuttings, and drilling fluids associated with drilling activities will be disposed of by the drilling subcontractor in accordance with the methods previously at NAS Pensacola.

The items listed below will also be part of the SOP for drilling.

- All data related to well construction will be documented on a monitoring well sheet (Appendix B)
- Each well will be constructed by a driller and drilling company certified by the State of Florida
- Well locations will be approved by the NAS POC before installation
- Glue will not be used to join screen or casing
- At any well nest location, the deep well will be installed first to prevent invasion of drilling fluids into the shallower wells.

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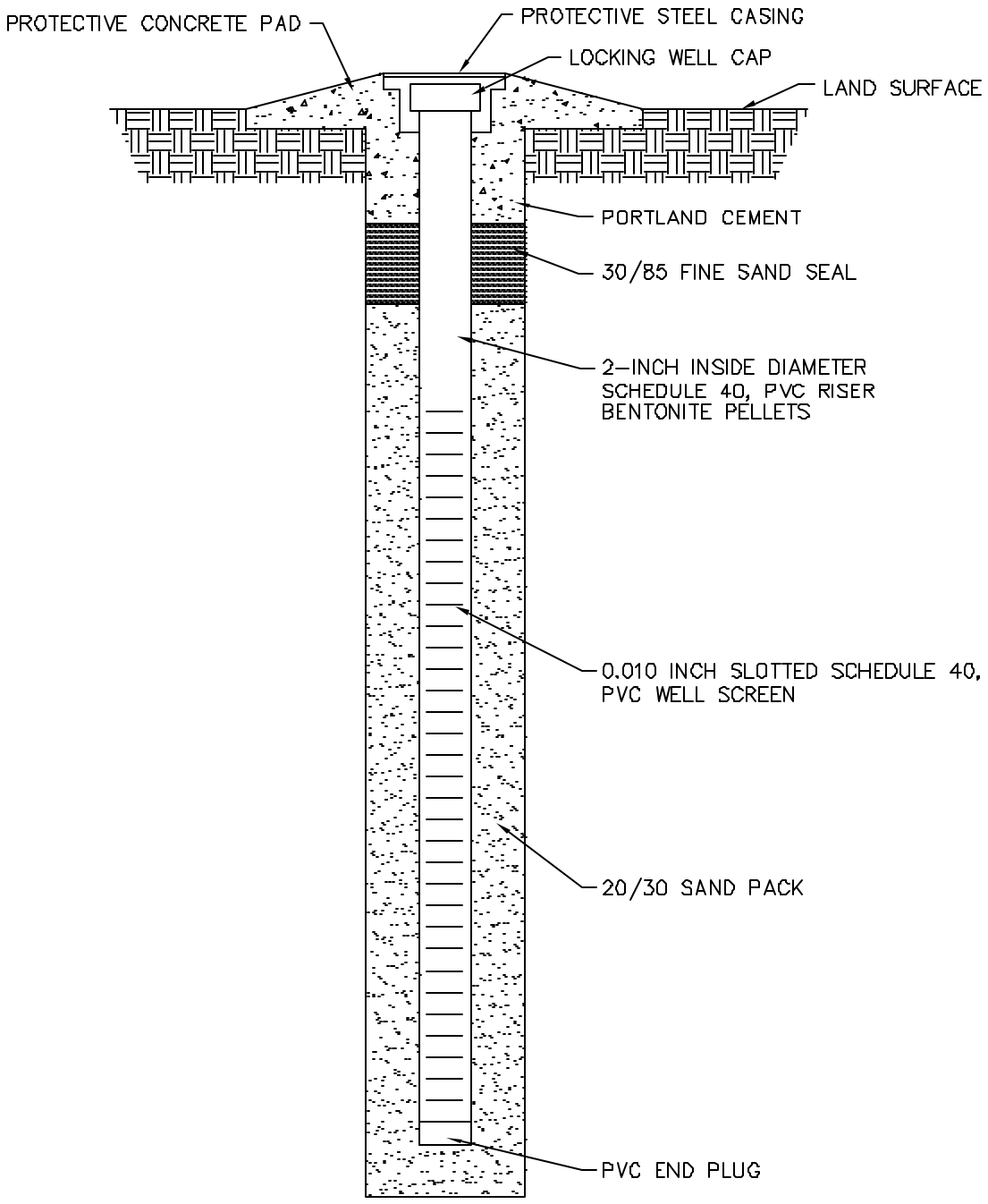



NOTE:

PVC = POLYVINYL CHLORIDE

| | | | |
|---|---|---|---|
| DRAWN BY DATE MF 3/20/02 | | TYPICAL SHALLOW AND INTERMEDIATE MONITORING WELL INSTALLATION DETAIL CONTAMINATION ASSESSMENT NAS PENSACOLA PENSACOLA, FLORIDA | CONTRACT NO. 4176 |
| CHECKED BY DATE | | | APPROVED BY DATE |
| COST/SCHED-AREA | | | APPROVED BY DATE |
| SCALE AS NOTED | | | DRAWING NO. FIGURE 4-2 / REV. 0 |

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98

#### 4.2.7.7 Well Development

Monitoring wells will be developed to remove fine-grained sediments and smearing of drill cuttings from along the borehole wall. The preferred method of development will be surging alternating with pumping. All down hole development equipment will be decontaminated before being placed in the well. Throughout the development procedure, discharge watercolor and volume shall be documented, as well as criteria described below.

Wells will be developed until the following criteria are achieved:

- Stabilization of the following parameters occurs:
  - temperature plus or minus 1° C
  - pH plus or minus 1 unit, and
  - electrical conductivity plus or minus 5 percent of scale and
- Turbidity remains within a 10 nephelometric turbidity unit (NTU) range for two consecutive readings,
- Accumulated sediment is removed from the well

The well development process will begin no sooner than 24 hours after well installation. Detergents, bleaches, soaps, or other such items will not be used to develop monitoring wells. Following development, and after the water levels have been allowed to stabilize for a minimum of 24 hours, the static water level will be measured and recorded. All data related to well development, including alternate development methodologies and their justification, will be written on the well development sheet (Appendix B) or in the field logbook.

### 4.2.8 Decontamination Procedures

The decontamination of major equipment (e.g., drilling rigs, augers) and sampling equipment (e.g. split spoons) will minimize the spread of contamination to clean zones, reduce cross-contamination of samples when equipment is used at more than one sampling location, and minimize exposure to site personnel.

Major equipment will be decontaminated at either the individual site where work is completed or at the NAS Pensacola equipment decontamination area established by previous contractors. Sampling equipment will be decontaminated in tubs or drainage pans to allow rinse water to collect for disposal. Rinsate samples will be collected from the decontaminated sampling equipment by rinsing the clean equipment with analyte-free water. The sampling equipment will then be wrapped in aluminum foil and

stored in a clean area until use. Clean sampling equipment will not be allowed to come into contact with the ground or any potentially contaminated surfaces before use at a sampling location.

Disposable material (e.g., gloves, Tyvek suits) generated during decontamination will be double-bagged and disposed of in an on-base dumpster.

All decontamination procedures will be conducted in accordance with the FDEP Field SOP for Cleaning and Decontamination Procedures (DEP-SOP-001/01, FC 1000).

### 4.2.9 Groundwater Level Measurements

Measurement of the depth to water in monitoring wells will be performed according to the FDEP Field SOP for Groundwater Sampling.

A minimum of one complete round of water level measurements will be obtained from all new and existing monitoring wells. All measurements will be collected within a 48-hour period of consistent weather conditions to minimize atmospheric/precipitation effects on groundwater conditions. Measurements will be collected at least 24 hours after well development using an electronic water level indicator. A permanent reference point on the top of each well casing will be used for determining the depth to water. Water level measurements will be recorded in the field logbook to the nearest 0.01 foot. Static water levels will be measured in each well before any fluid is withdrawn. If floating hydrocarbon is detected in each monitoring well, the thickness of the free product will be measured with an electronic interface probe.

### 4.2.10 Confirmatory Groundwater Sampling

Groundwater samples will be collected from the six, newly installed monitoring wells located on-site. The existing well will be investigated to determine its viability. Before purging, an oil-water interface probe will be used to check for free-product. Groundwater samples will not be collected from monitoring wells that exhibit measurable free-product. The thickness of free-product will be measured and recorded. Prior to obtaining samples, water levels and total well depths will be measured at all on-site wells; the wells will then be purged, using a peristaltic pump and a low-flow quiescent purging technique. The monitoring wells will be purged using techniques in accordance with the FDEP Field SOP for Groundwater Sampling (DEP-SOP-001/01, FS 2200; Appendix E). Field measurements of pH, temperature, specific conductance, and turbidity will be collected and conducted in accordance with the FDEP Field SOP for Groundwater Sampling and the appropriate FDEP Field SOP for field measurement [FT1100 (pH), FT

1200 (specific conductivity), FT1400 (temperature), FT1500 (DO), and FT1600 (turbidity)]. Monitoring well stabilization will be determined in accordance with the FDEP Field SOP for Groundwater Sampling.

Samples will be collected in accordance with the FDEP SOP for Groundwater Sampling. The subcontract laboratory will specify sample bottle types, preservatives, and holding times; however, the criteria will be in accordance with the FDEP SOP for General Aqueous Sampling (DEP-SOP-001/01, FS2200).

### 4.2.11 Aquifer Tests

TTNUS will perform a series of duplicate aquifer slug tests on two selected shallow monitoring wells and one deep monitoring well at the site. Each test will be performed by removing a volume (slug) of water from the well and measuring the recharge as the well re-approaches equlibrium. The Bouwer and Rice methodology for partial penetrating wells in unconfined aquifers will be used to calculate the hydraulic conductivity values for the three monitoring wells as described by Bouwer, 1989, and Bouwer and Rice, 1976. Calculations will be performed using the Aqtesolve$^{tm}$ (Geraghty and Miller, 1989) aquifer characterizations program.

A limited tidal influence survey will also be conducted on the most downgradient-monitoring well to assess whether or not tidal fluctuations are apparent in the study area. Static water levels in the well will be measured several times during one complete tide cycle.

### 4.2.12 Quality Assurance / Quality Control Samples

Quality assurance/quality control (QA/QC) samples will be collected and analyzed according to the FDEP Field SOP for Field Quality Control (DEP-SOP-001/01, FQ 1000). Quality control (QC) samples including equipment blanks, trip blanks, and field duplicates will be collected as outlined in the FDEP SOP for Field QC. Blanks (excluding trip blanks) will be collected at a minimum of 5% of each reported test result/matrix combination.

### 4.2.13 Laboratory Sample Identification

The sample identification system to be used in the field to identify each sample taken during the CA field effort will be in accordance with TTNUS SOP CT-O4, contained in Appendix C. The coding system provides a tracking record to allow retrieval of information about a particular sample and to ensure that each sample is uniquely identified.

Each sample is assigned a series of codes indicating the site (e.g., PEN-MW), sample type, sample location, sample depth, and sample round (i.e., sequential order or date). The sample nomenclature system has been designed to maintain consistency between field, laboratory, and database sample numbers. In addition, the system facilitates cost-effective data evaluation, because data can be easily sorted by matrix and/or depth or by other such parameters.

### 4.2.14 Corrective Actions

Comprehensive QA activities will be conducted by TTNUS to ensure that data obtained from the sampling program, as well as the resultant work products, are technically valid. Any staff member engaged in project work who discovers or suspects a nonconformance is responsible for identifying and segregating (if applicable) the nonconforming item as well as for forwarding a report to the Task Order Manager (TOM) and QA Manager for investigation and corrective action. The QA Manager has the responsibility for assuring the overall adequacy of corrective actions and for summarizing this information in a status report to TTNUS management.

QC data obtained from field duplicates, field blanks, trip blanks, or equipment blanks will be collected and assessed by the QA Manager or the TOM to evaluate the overall quality of the sample collected. Whenever the results of the field QC samples fail to meet acceptance criteria corrective actions will be initiated.

Potential corrective actions will be dependent upon the final use of the data; however, appropriate corrective actions may include the following, as determined by the TOM in conjunction with the QA Manager:

- Evaluation of the suspect QC data by comparison to other QC samples taken at the same site or on the same date or analyzed by the same equipment/technician for similar contamination
- Reanalysis of the QC sample in question (if possible)
- Qualification of the results
- Resampling

Non-TTNUS parties involved in identified nonconformances will be notified initially by telephone, with a follow-up formal correspondence explaining the deficiency. The responsible outside parties will be required to investigate the nonconformance and offer an appropriate corrective action. Notification,

tracking, and ultimate closure of reported nonconformances and the review/approval of submitted corrective actions, will be the responsibility of the TTNUS QA Manager.

### 4.2.15 Field Logbooks and Forms

Field logbooks and standard data collection forms will be completed for field investigation, sample description, and data collection activities daily. These forms include sample log sheets (for soil and groundwater samples), a daily record of drilling activities and equipment calibration logs. Examples of these forms can be found in Appendix B.

Each sampling event leader shall maintain a bound, weatherproof field logbook. The FOL or designee will record all information related to sampling or field activities. This information may include sampling time, weather conditions, unusual events (e.g., well tampering), field measurements, descriptions of photographs, or other such details. A site logbook shall be maintained by the FOL. The requirements of the site logbook are outlined in SOP SA-6.3, attached in Appendix C. This book will contain a summary of each day's activities and will reference the specific field logbooks when applicable.

Each field team member who is supervising a drilling subcontractor must complete a daily record of drilling activity. This form documents the stage, hours, methods, materials, and supplies used during daily drilling activities. The information contained on this form is used for billing verification and progress reports. The driller's signature is required at the end of each working day to verify work accomplished, hours worked, standby time, and material used. An example of this form is provided with SOP SA-6.3 in Appendix C.

At the completion of field activities, the FOL will submit to the TOM all field records, data, field logbooks, site logbooks, chain-of-custody receipts, sample log sheets, drilling logs, daily logs, and other such forms.

### 4.2.16 Manufacturers' Specifications

The FOL shall collect a copy of the available manufacturers' specifications for all supplies and equipment are used in the collection of environmental samples.

This shall apply, but not be limited to, the following:

- Calibration gases
- Sample containers
- Decontamination solvents and detergents

- Laboratory-grade/analyte-free water
- Reagents
- Drilling additives
- Bentonite and cement
- Filter pack materials
- Well casing and screen
- Disposable bailers, filters, and tubing

The manufacturers' specifications will be included in the project files at the end of field mobilization.

### 4.2.17 Surveying

**National Geodetic Vertical Datum Survey Locations**

Horizontal locations shall be referenced to the Florida State Plane Coordinate System, North American Datum of 1983, Florida 1990 Adjustment (NAD 83/90), Florida West zone. Elevations will be referenced to mean sea level, National Geodetic Vertical Datum, 1988 adjustment (NGVD 88).

Existing installation benchmarks will serve as the horizontal and vertical data for the survey. Elevations will be recorded to the nearest hundredth of a foot, whereas horizontal locations will be recorded to the nearest tenth of a foot. The elevations of all monitoring wells will be surveyed at the water level measuring reference point on the top of well casing and on the undisturbed ground surface adjacent to the well pad.

### 4.2.18 Demobilization

Demobilization will occur at the conclusion of all other field activities related to this investigation. In the interest of future investigation, monitoring wells installed at the site will not be abandoned. Well tags will be installed on the new, permanent monitoring wells. The well tags will provide detailed information including total well depth, screened interval, water level measurement (post-development), and date of installation. Verification of proper IDW documentation, the return of all rental equipment, and the securing of the site is also included in demobilization activities.

## 4.3 PREPARATION OF REPORTS

### 4.3.1 Site Assessment Report

A Site Assessment Report (SAR) will be prepared and submitted to SOUTHNAVFACENGCOM, NAS Pensacola, and the FDEP upon completion of the field investigation. The SAR will discuss site background information, hydrogeology, geology, site-specific information, findings, and recommendations for each site. Facility and site location maps will be included in this report. Recommendations will be made as to the need for any follow-up reports.

### 4.3.2 Follow-up Reports

If the investigation results indicate that a No Further Action (NFA) or a Monitoring Only Plan (MOP) is warranted, the SAR recommendations will specify the actions to be completed. These actions may include specific monitoring wells to be sampled, analysis for specific contaminants of concern, sampling frequency, and sampling duration. A separate MOP is generally not required by FDEP and will not be completed.

# 5.0 INVESTIGATIVE DERIVED WASTE

IDW generated during the contamination assessment field activities will be managed in accordance with the procedures described in the *NAS Pensacola Investigation-Derived Waste Management Plan* (EnSafe 1996). This document, which is included as Appendix A of this document, emphasizes management of all IDW in an environmentally responsible manner consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program, Resource Conservation and Recovery Act (RCRA) requirements, and the Base's standard procedures. The objectives of the IDW management plan include:

- Management of IDW in a manner that prevents contamination of uncontaminated areas (by IDW) and is protective of human health and the environment

- Minimization of IDW to reduce disposal costs and the potential for human or ecological exposure to contaminated materials

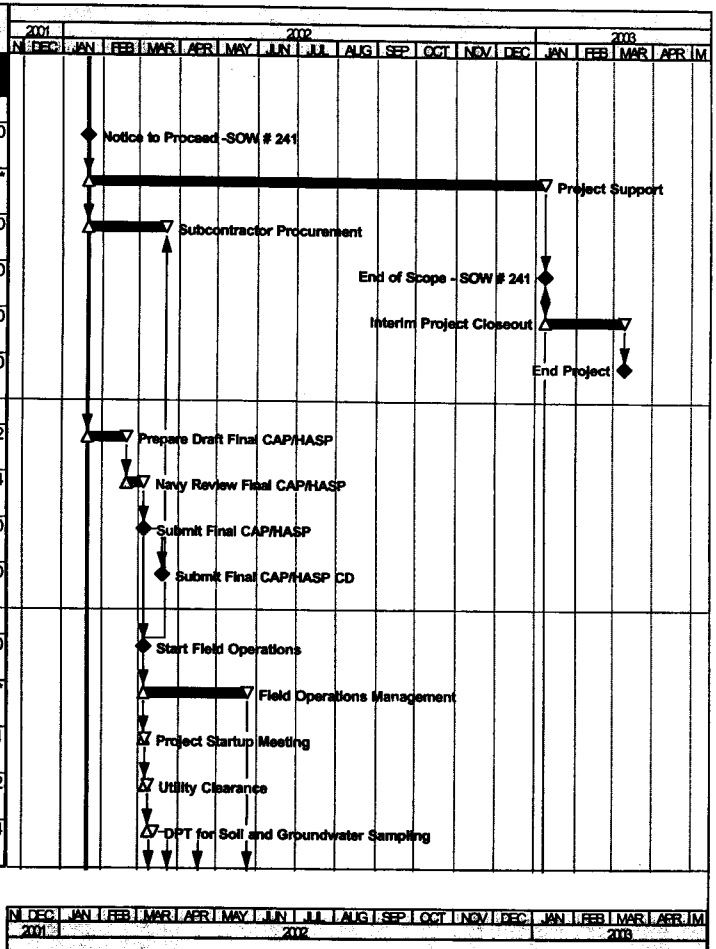
- Compliance with federal and state requirements for the transport and disposal of IDW material

# 6.0 SCHEDULE

Figure 6-1 depicts a Gantt Schedule, indicating the estimated duration and initiation/completion dates of individual tasks for the Contamination Assessment Program at the Building 3241 UST Site, NAS Pensacola, Pensacola, Florida.

# SOW 241 NAS PENSACOLA SAR BLDG 3241

| Activity ID | Activity Description | Cal ID | Early start | Early finish | OD |
|---|---|---|---|---|---|
| **PROJECT MANAGEMENT** | | | | | |
| LR0010100 | Notice to Proceed -SOW # 241 | 1 | 21JAN02* | | 0 |
| LR0010105 | Project Support | 1 | 21JAN02 | 08JAN03 | 351* |
| LR0010110 | Subcontractor Procurement | 1 | 21JAN02 | 21MAR02 | 60 |
| LR0010120 | End of Scope - SOW # 241 | 1 | | 08JAN03 | 0 |
| LR0010253 | Interim Project Closeout | 1 | 09JAN03 | 09MAR03 | 60 |
| LR0010254 | End Project | 1 | | 09MAR03 | 0 |
| **WORK PLANS** | | | | | |
| LR0040110 | Prepare Draft Final CAP/HASP | 2 | 21JAN02 | 19FEB02 | 22 |
| LR0040120 | Navy Review Final CAP/HASP | 1 | 20FEB02 | 05MAR02 | 14 |
| LR0040150 | Submit Final CAP/HASP | 2 | | 05MAR02 | 0 |
| LR0040162 | Submit Final CAP/HASP CD | 2 | | 19MAR02 | 0 |
| **FIELD INVESTIGATION** | | | | | |
| LR0050100 | Start Field Operations | 1 | 06MAR02 | | 0 |
| LR0050105 | Field Operations Management | 1 | 06MAR02 | 24MAY02 | 80* |
| LR0050110 | Project Startup Meeting | 1 | 06MAR02 | 06MAR02 | 1 |
| LR0050115 | Utility Clearance | 1 | 07MAR02 | 08MAR02 | 2 |
| LR0050120 | DPT for Soil and Groundwater Sampling | 1 | 09MAR02 | 12MAR02 | 4 |

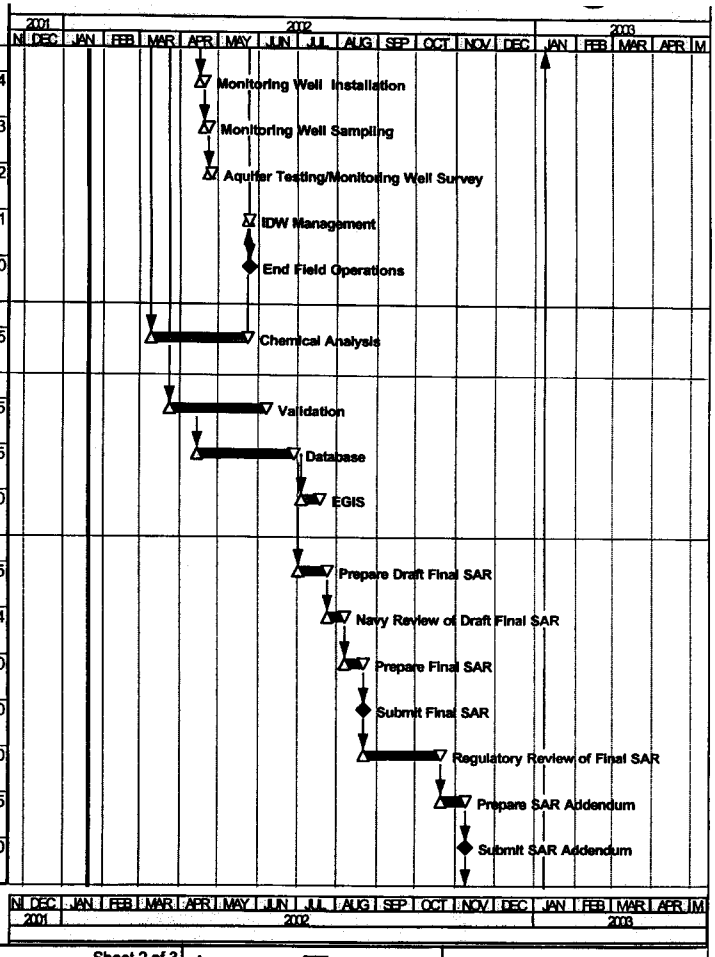



| | | | |
|---|---|---|---|
| Start Date | 21JAN02 | PORX - LR01 | Sheet 1 of 3 |
| Finish Date | 09MAR03 | NAVY CLEAN III | |
| Data Date | 21JAN02 | POA SCHEDULE | |
| Run Date | 09JAN02 15:20 | | |

Early Bar
Progress Bar
Critical Activity

TetraTech NUS

| Activity ID | Activity Description | Cal ID | Early start | Early finish | OD |
|---|---|---|---|---|---|
| **FIELD INVESTIGATION** | | | | | |
| LR050125 | Monitoring Well Installation | 1 | 17APR02 | 20APR02 | 4 |
| LR050130 | Monitoring Well Sampling | 1 | 21APR02 | 23APR02 | 3 |
| LR050140 | Aquifer Testing/Monitoring Well Survey | 1 | 24APR02 | 25APR02 | 2 |
| LR050155 | IDW Management | 1 | 24MAY02 | 24MAY02 | 1 |
| LR050255 | End Field Operations | 1 | | 24MAY02 | 0 |
| **LABORATORY ANALYSES** | | | | | |
| LR050210 | Chemical Analysis | 1 | 10MAR02 | 23MAY02 | 75 |
| **DATA MANAGEMENT** | | | | | |
| LR070120 | Validation | 2 | 25MAR02 | 07JUN02 | 55 |
| LR070130 | Database | 2 | 15APR02 | 28JUN02 | 55 |
| LR070140 | EGIS | 2 | 05JUL02 | 18JUL02 | 10 |
| **UST - ASSESSMENT REPORT** | | | | | |
| LR150305 | Prepare Draft Final SAR | 2 | 03JUL02 | 24JUL02 | 15 |
| LR150310 | Navy Review of Draft Final SAR | 1 | 25JUL02 | 07AUG02 | 14 |
| LR150315 | Prepare Final SAR | 2 | 08AUG02 | 21AUG02 | 10 |
| LR150317 | Submit Final SAR | 2 | | 21AUG02 | 0 |
| LR150330 | Regulatory Review of Final SAR | 1 | 22AUG02 | 20OCT02 | 60 |
| LR150340 | Prepare SAR Addendum | 2 | 21OCT02 | 08NOV02 | 15 |
| LR150350 | Submit SAR Addendum | 2 | | 08NOV02 | 0 |

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| | |
|---|---|
| Start Date | 21JAN02 |
| Finish Date | 09MAR03 |
| Data Date | 21JAN02 |
| Run Date | 09JAN02 15:20 |

PORX - LR01

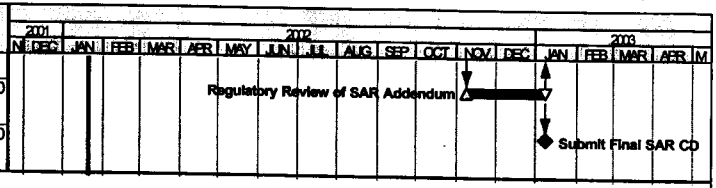
Sheet 2 of 3

**NAVY CLEAN III**
**POA SCHEDULE**

Early Bar
Progress Bar
Critical Activity

TetraTech NUS

| Activity ID | Activity Description | Cal ID | Early start | Early finish | OD |
|---|---|---|---|---|---|
| UST - ASSESSMENT REPORT | | | | | |
| LR0150660 | Regulatory Review of SAR Addendum | 1 | 09NOV02 | 08JAN03 | 60 |
| LR0150400 | Submit Final SAR CD | 1 | | 08JAN03 | 0 |



| | | | |
|---|---|---|---|
| Start Date | 21JAN02 | PORX - LR01 | Sheet 3 of 3 |
| Finish Date | 09MAR03 | NAVY CLEAN III | Early Bar |
| Data Date | 21JAN02 | POA SCHEDULE | Progress Bar |
| Run Date | 09JAN02 15:20 | | Critical Activity |

TetraTech NUS

# 7.0 ACRONYMS

| | |
|---|---|
| ASTM | American Society for Testing and Materials |
| bls | below land surface |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| CLEAN | Comprehensive Long-term Environmental Action, Navy |
| COC | chemicals of concern |
| CTO | Contract Task Order |
| DPT | direct push technology |
| F.A.C. | Florida Administrative Code |
| FDEP | Florida Department of Environmental Protection |
| FID | flame ionization detector |
| FOL | field operations leader |
| GCTLs | Groundwater Cleanup Target Levels |
| GPS | Global Positioning System |
| HASP | Health and Safety Plan |
| HSA | hollow stem auger |
| ID | inside diameter |
| IDW | investigative-derived waste |
| MOP | monitoring only plan |
| NAS | Naval Air Station |
| NFA | no further action |
| NTU | nephelometric turbidity unit |
| OVA | organic vapor analysis |
| PHSO | Project Health and Safety Officer |
| PID | photo ionization detector |
| POC | Point of Contact |
| PPE | personal protective equipment |
| PPL | Priority Pollutant List |
| PVC | polyvinyl chloride |
| QA | quality assurance |
| QA/QC | quality assurance/quality control |
| QC | quality control |
| RCRA | Resource Conservation and Recovery Act |
| SA | Site Assessment |
| SAP | Site Assessment Plan |
| SAR | Site Assessment Report |
| SCTLs | Soil Cleanup Target Levels |
| SOP | Standard Operating Procedure |
| SOUTHDIVNAVFAC-ENGCOM | Southern Division, Naval Facilities Engineering Command |
| SVOCs | semivolatile organic compounds |
| TOM | Task Order Manager |
| TRPH | total recoverable petroleum hydrocarbon |
| TTNUS | Tetra Tech NUS, Inc. |
| USEPA | U.S. Environmental Protection Agency |
| UST | Underground Storage Tank |
| VOC | volatile organic compounds |

# REFERENCES

Bouwer, H., and Rice, R.C., 1976, A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells: Water Resources Research, vol. 12, p. 423-428.

Bouwer, H., 1989. The Bouwer and Rice Slug Test - an Update. Groundwater, v. 27, pp. 304-309.

Department of the Navy, 1994, Storage Tank Closure Form for the Underground Storage Tank System at Building 3241, Naval Air Station Pensacola, October

Ensafe/Allen & Hoshall, 1994, Comprehensive Long-Term Environmental Action Draft Investigative- Derived Waste Plan, Naval Air Station, Pensacola, Florida.

Florida Department of Environmental Protection (FDEP), 1999, Florida Administrative Code Proposed Chapter 62-770 Petroleum Contamination Site Cleanup Criteria, January.

FDEP, 1998, Bureau of Petroleum Storage Systems, Petroleum Cleanup Program Guidelines for Assessment and Source Removal of Petroleum Contaminated Soil, May.

FDEP, 2001, Bureau of Petroleum Storage Systems, Petroleum Cleanup Program SOP for Soil Assessment and Samplng Methods, October.

FDEP, 2002, Department of Environmental Protection Standard Operating Procedures for Field Activities, January.

TTNUS 2002. *Health and Safety Plan for Sampling and Analysis at Building 3241, Naval Air Station Pensacola, Pensacola, Florida*, Comprehensive Long-Term Environmental Action, Navy (CLEAN) Contract, Pittsburgh, Pennsylvania.

USEPA (U.S. Environmental Protection Agency), 1996. *Environmental Investigations Standard Operating Procedure Quality Assurance Manual (EISOPQAM),* Environmental Compliance Branch, Region IV, Science and Ecosystems Support Division, Athens, Georgia.

# APPENDIX A

# INVESTIGATIVE-DERIVED WASTE MANAGEMENT PLAN

# COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION DRAFT INVESTIGATION-DERIVED WASTE PLAN NAVAL AIR STATION PENSACOLA, FLORIDA

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**Prepared for:**

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN)
NAVAL SUPPORT ACTIVITY
NAVAL AIR STATION
PENSACOLA, FLORIDA

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**Release of this document requires the prior notification of the Commanding Officer of the Naval Air Station, Pensacola, Florida.**

## List of Abbreviations

The following lists contains many of the acronyms, initials, abbreviations, and units of measure used in this report.

| | |
|---|---|
| AOC | area of contamination |
| ARARs | applicable or relevant and appropriate requirements |
| AWQC | ambient water quality criteria |
| CAA | Clean Air Act |
| CAMU | Corrective Action Management Unit |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| COLIWASA | Composite Liquid Waste Samplers |
| CLEAN | Comprehensive Long-Term Environmental Action Navy |
| cm | centimeters |
| CWA | Clean Water Act |
| DE | Disposable Equipment |
| DOT | Department of Transportation |
| E/A&H | EnSafe/Allen & Hoshall |
| FDEP | Florida Department of Environmental Protection |
| $ft^3$ | Cubic Feet |
| gpm | gallons per minute |
| HSWA | Hazardous and Solid Waste Amendments |
| IDW | Investigation-Derived Waste |
| IR | Installation Restoration |
| IWTP | Industrial Wastewater Treatment Plant |
| JP | Jet Propulsion |
| LDR | Land Disposal Restrictions |
| MCL(s) | Maximum Contaminant Level(s) |
| MCLG | Maximum Contaminant Level Goals |
| ml | milliliter |
| MTRs | Minimum Technological Requirements |
| NAS | Naval Air Station |
| NCP | National Contingency Plan |
| NPL | National Priorities List |
| OD | Outside Diameter |
| PAHs | Polynuclear Aromatic Hydrocarbons |
| PCBs | Polychlorinated Biphenyls |
| POL | Petroleum Oils and Lubricants |
| POTW | Publicly Owned Treatment Works |
| PPE | Personal Protective Equipment |
| ppm | Parts Per Million or milligrams per kilogram |
| PSC | Potential Source of Contamination |

| | |
|---|---|
| QA | Quality Assurance |
| QC | Quality Control |
| RCRA | Resource Conservation and Recovery Act |
| ROD | Record of Decision |
| RT | Regulatory Threshold |
| SDWA | Safe Drinking Water Act |
| SMP | Site Management Plan |
| SOP/QAM | Standard Operating Procedures and Quality Assurance Manual |
| SVOCs | Semivolatile Organic Compounds |
| TBC | To-be-considered |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TRPHs | Total Recoverable Petroleum Hydrocarbons |
| TSCA | Toxic Substances Control Act |
| TSD | Treatment, Storage, or Disposal |
| TU | Temporary Unit |
| USEPA | United States Environmental Protection Agency |
| VOCs | Volatile Organic Compounds |

## 1.0 INTRODUCTION

The following discussion outlines the manner in which investigation-derived waste (IDW) will be managed to comply with all applicable or relevant and appropriate requirements (ARARs). IDW generated during the investigations will likely include soil produced during the advancement of hand auger borings and soil borings and the installation of monitoring wells; groundwater derived from developing and purging of monitoring wells; disposable personal protective equipment and sampling utensils; decontamination fluids generated from the cleaning of personal protective equipment, sampling equipment, and drilling equipment. As the generator of the IDW, the Navy will be responsible for the ultimate treatment, storage, or disposal of all IDW. E/A&H will provide technical assistance to the Navy during the management of all IDW.

## 2.0 IDENTIFICATION OF ARARS

The National Contingency Plan (NCP) requires IDW handled at National Priorities List (NPL) sites, including federal facilities to meet all ARARs to the extent practicable considering the situation's urgency. The NCP is codified at 40 Code of Federal Regulations (CFR) Part 300. Likewise, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 120(a)(4) requires investigation and remediation activities at non-NPL federal facilities to meet the substantive requirements of applicable state laws.

### 2.1 ARARs Defined

*Applicable requirements* are standards or criteria promulgated under federal law that specifically address a hazardous substance, pollutant contaminant, remedial action, location, or other circumstance at a project site (USEPA 1988a). Resource Conservation and Recovery Act (RCRA) requirements are applicable when a waste generated at a CERCLA site meets the definition of a solid hazardous waste.

*Relevant and appropriate requirements* are standards or criteria promulgated under federal or state laws that are suited to a particular site because they address site scenarios sufficiently similar to those on which the regulations are based. Identifying ARARs first dictates determining whether they are both relevant and appropriate. This evaluation compares a number of site-specific factors with those addressed in the statutory or regulatory requirements. Factors considered include the hazardous substances present at the site, physical site features, or the type of remedial action. A given requirement might be relevant, but not appropriate, for the project site. Therefore, such a requirement would not be an ARAR for the site. When a requirement is deemed both relevant and appropriate in a given case, this requirement must be complied with to the same degree as if it were applicable. An example of a relevant and appropriate requirement is the use of maximum contaminant levels (MCLs) as cleanup standards for water. The MCLs are not applicable, because the Navy is not using the contaminated water to supply

drinking water. However, MCLs are relevant and appropriate because the water may be treated for potential use as drinking water in the future.

To-be-considered (TBC) criteria are federal- or state-issued guidance or non-promulgated advisories that are not legally binding and do not have the status of potential ARARs. In many circumstances, TBC criteria will be reviewed along with ARARs in determining an IDW level that sufficiently protects human health or the environment. This review will occur before selecting an IDW management option.

There are several types of ARARs, including chemical-specific, action-specific, and location-specific ARARs. Chemical-specific ARARs are usually health- or risk-based numerical values or methodologies applied to site-specific conditions. These values establish an acceptable concentration of a chemical substance that may be found in or discharged to the ambient environment. MCLs are examples of chemical-specific ARARs. Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken with respect to hazardous substances. An example of an action-specific ARAR is an emissions limit on a chemical constituent for incineration to treat contaminated soil. Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations. Location standards for RCRA facilities are location-specific ARARs when a new waste management unit is created to treat or dispose of waste at a CERCLA site.

Federal environmental laws and regulations that are potential ARARs for IDW at CERCLA sites include RCRA, including the Land Disposal Restrictions (LDR) and Corrective Action Program; the Toxic Substances Control Act (TSCA), the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA), and the Clean Air Act (CAA). State and local environmental laws and regulations also may serve as ARARs. State regulations may have a great impact on how IDW

is managed, since states may promulgate more stringent requirements than the federal requirements for many programs, including the solid and hazardous waste program.

Although CERCLA exempts response actions conducted entirely onsite from permit requirements, the United States Environmental Protection Agency (USEPA) does require that the substantive issues are addressed if the containerized IDW is RCRA hazardous waste (USEPA 1988a). RCRA hazardous IDW containerized and stored onsite should be properly disposed of within a regulatory timeframe. However if the regulatory timeframe cannot be met, storage does not require a permit. Actions that take place offsite are subject to all permitting requirements.

## 2.2 Resource Conservation and Recovery Act

RCRA was passed by Congress in 1976 to meet three goals: (1) to protect human health and the environment, (2) to reduce waste and conserve energy and natural resources, and (3) to reduce or eliminate the generation of hazardous waste as expeditiously as possible. The Hazardous and Solid Waste Amendments (HSWA) of 1984 significantly expanded RCRA's scope by adding new corrective action requirements, LDRs, and minimum technological requirements (MTRs) (USEPA 1988b).

RCRA is the most important federal ARAR for managing IDW, because it specifically regulates solid waste disposal and all aspects of transportation, treatment, storage, and disposal of hazardous waste. RCRA is applicable to management of IDW at CERCLA sites if the IDW is stored or disposed of offsite. If IDW is stored onsite, then the IDW must be managed to comply with RCRA to the extent practical.

RCRA has 10 subtitles addressing specific waste management activities. Two of these subtitles and their implementing regulations may be ARARs for IDW handling: Subtitle C (Hazardous Waste Management) and Subtitle D (Solid Waste Management). The regulations are codified in 40 CFR Parts 260 through 272.

RCRA was developed first and foremost as a prevention-oriented program, with a primary objective to prevent new releases resulting in contaminated sites. Following this objective, stringent standards were developed to ensure human health and the environment were protected from such ongoing waste management. The Subtitle C regulations are specified as uniform, national standards with which all RCRA-regulated facilities must comply. These standards generally are very stringent because they must ensure an adequate level of protection nationally. The standards must prevent or minimize environmental releases over a wide range of hazardous waste types, environmental conditions, operational contingencies, and other factors. The HSWA amendments strengthened the RCRA prevention program by adding the LDRs and MTRs that have become central features of the RCRA prevention program. These features added incentives to generators to minimize the amounts of waste being created by providing technology-based standards for hazardous waste treatment, in the case of LDRs, and land-based disposal units design, in the case of MTRs.

Under RCRA Subtitle C, wastes are hazardous on the basis of their source or method of generation ("listed" wastes) or their chemical constituents or characteristics ("characteristic" wastes). The hazardous waste identification rules are codified in 40 CFR Part 261. For example, 1,1,1-trichloroethane is a listed waste when it is a spent solvent. Based on the "contained-in" interpretation, soil, groundwater, and other investigation wastes containing this listed waste also would be considered hazardous (USEPA 1986). Characteristic hazardous wastes include those wastes with one or more characteristics of ignitability, corrosivity, reactivity, and toxicity. Determining whether a waste is hazardous may be based on knowledge of the IDW and associated suspected or known contamination, rather than by direct testing (USEPA 1991). The IDW generator may choose to characterize the waste as hazardous or non-hazardous based on the site history and environmental data for the surrounding area, without actually collecting a sample of the waste and testing it for hazardous waste parameters.

### 2.2.1 Land Disposal Restrictions

With respect to managing IDW, the LDR program is one of the most significant provisions of RCRA. The LDR program, defined in RCRA Section 3004 and codified in 40 CFR Part 268, establishes technology-based standards that must be met before placing hazardous waste into land disposal units, which include landfills, surface impoundments, waste piles, and other land-based units. Hazardous waste generators must notify receiving hazardous waste facilities that a waste is restricted from land disposal. Certification is required for all restricted wastes that meet LDR treatment standards when the waste is land disposed.

For the purpose of managing IDW, land disposal occurs when any of the following activities take place:

- Wastes from different areas of contamination (AOC) are consolidated and disposed of in one AOC.

- Wastes are moved outside an AOC for storage or treatment and are returned to the same or a different AOC.

- Wastes are excavated from an AOC, removed to a separate unit such as a tank, surface impoundment or incinerator that is within the AOC, and then are redeposited into the AOC (USEPA 1991).

The concept of an AOC can be used to determine whether LDRs apply to a given situation; however, this concept applies only to contaminated soil or sediment from the site. Contaminated personal protective equipment (PPE), disposable equipment (DE), extracted ground water, or decontamination fluids that may be generated by investigation activities at the site are not exempted from LDRs if disposed of within an AOC. USEPA has not yet issued a regulatory definition of the term "AOC," but the preamble to the NCP (55 FR 8760) states "USEPA

generally equates the CERCLA area of contamination with a single RCRA land-based unit, usually a landfill." It is further noted that "under RCRA the term 'landfill' could include a non-discrete land area on or in which there is generally dispersed contamination."

LDRs limit the constituent concentrations of wastes that may be disposed in land units (such as landfills and surface impoundments). An important consideration in evaluating the applicability or relevance and appropriateness of LDRs is whether land disposal of hazardous IDW will occur as a result of the proposed storage or disposal method. Based on the delineation of an AOC, LDRs are not ARARs when uncontained hazardous IDW (soil or sediment) is handled as follows:

- Capped in place
- Treated in situ
- Processed within the AOC to improve structural stability
- Left in place, moved, or stored within a single AOC unit

LDRs prohibit storing restricted hazardous waste beyond specified time limits, unless the purpose is to accumulate sufficient quantities to promote proper disposal, treatment, or recovery. However, under CERCLA there is no time limit for storing IDW in the AOC until a final disposal option is selected in the record of decision (ROD).

All LDRs must be followed to the extent practical if hazardous IDW cannot be held within the delineated AOC. For example, if leaving hazardous IDW within the AOC would significantly increase risk to human health and the environment through the potential of fire, explosion, toxicity, or other hazard, then the IDW should be managed at an offsite RCRA Subtitle C hazardous waste treatment, storage, or disposal (TSD) facility.

### 2.2.2 Corrective Action Program

In addition to the prevention-oriented provisions of RCRA, the HSWA corrective action program created a very different mandate: cleaning up releases from solid waste management units at more than 4,000 RCRA TSD facilities. While implementing these requirements and through its experience with the Superfund program, USEPA found that Subtitle C requirements, when applied to remediation wastes, could be a disincentive to more protective remedies. These requirements also provided very limited flexibility in choosing the most practical remedy at a specific site. In response to this, USEPA created two types of waste management units, the Corrective Action Management Unit (CAMU) and the Temporary Unit (TU), as a mechanism for providing more regulatory flexibility at remediation sites conducted under the auspices of RCRA while maintaining a standard of environmental protection.

**CAMUs**

CAMUs are land-based units that can be used to manage wastes during site remediation. CAMUs provide two primary advantages:

- Placing remediation wastes into or within a CAMU does not constitute land disposal of hazardous wastes, so that LDR standards are not triggered.

- Consolidating or placing remediation wastes into or within a CAMU does not constitute creating a unit subject to MTRs.

Although CAMUs are permitted by the USEPA, they must comply with state and local regulations. Currently, there are no permitted CAMUs.

**TUs**

TUs are for short-term operation of tanks and container storage units used to treat or store remediation wastes for investigations conducted under RCRA. These units may only be used

for remediation wastes, and they must be located at the facility where the remediation is occurring. TUs do not include incinerator, non-tank thermal treatment devices, or units regulated under 40 CFR Part 264 Subpart X (miscellaneous units). The corrective action regulations for temporary units allow an alternative design, operating, or closure standard to be applied rather than the standards that normally apply to permitted facilities. Wastes can be stored in a TU for up to one year, with extensions available on a case-by-case basis.

## 2.3 Toxic Substances Control Act

Congress passed TSCA in 1976 to establish requirements and authorities for identifying and controlling toxic chemical hazards to human health and the environment. While the majority of regulations promulgated under TSCA address chemical manufacturing, the law also covers managing and disposing wastes containing polychlorinated biphenyls (PCBs) in 40 CFR Part 761 and asbestos in 40 CFR Part 763. These regulations potentially affect IDW management in at least two ways:

- Non-hazardous IDW under RCRA that contains PCBs at concentrations greater than specified limits must be managed at facilities permitted under TSCA. Incineration is the most common option for wastes containing 50 parts per million (ppm) PCBs or greater.

- Non-hazardous IDW with PCB concentrations less than 50 ppm are generally not regulated under TSCA, although some states regulate these wastes as hazardous.

## 2.4 Clean Water Act

The CWA, developed in 1977, provides site-specific pollutant discharge limitations and performance standards for specific industries to protect surface water quality. During an investigation, the most likely situation where the CWA will be applicable involves indirectly discharging IDW water to a Navy owned treatment works (NOTW), publicly owned treatment works (POTW), or a wastewater treatment plant for treatment (USEPA 1991). A less likely

situation may involve direct discharge, either onsite or offsite, to surface water. The CWA also regulates criteria for selecting POTWs and sets ambient water quality criteria (AWQC) to protect human health and aquatic life. Regulations under the CWA are codified in 40 CFR Parts 121 through 136.

## 2.5 Safe Drinking Water Act

The SDWA which was enacted in 1974 and most recently amended in 1986, mandates the USEPA establish regulations to protect human health from contaminants in drinking water. Regulations for the SDWA are codified in 40 CFR Parts 141 through 149. The legislation authorizes national drinking water standards and a joint federal-state system for assuring compliance with those standards.

USEPA has developed two sets of drinking water standards, referred to as primary and secondary standards, to protect human health and to ensure the aesthetic quality of drinking water, respectively (USEPA 1988b). Primary standards consist of contaminant-specific standards, known as maximum contaminant levels (MCLs). These are set as close as feasible to MCL goals (MCLGs), which are purely health-based. Secondary drinking water standards are guidelines regulating the aesthetic quality of water supplies, such as clarity and odor, and are not enforceable at the federal level. At a minimum, states must enforce the federal MCLs. In some cases, states establish and enforce secondary standards equal to or more stringent than USEPA's.

Under Section 1424(e) of SDWA, an aquifer identified as the sole or principal source of drinking water for any area may be designated as a "sole source aquifer". No commitment of federal financial assistance may be made for any project that may contaminate a sole source aquifer so as to create a significant public health hazard. No IDW disposal actions should occur that could affect a sole source aquifer without considering MCLs and the ARARs.

## 3.0 GENERATION OF INVESTIGATION-DERIVED WASTE

Activities that may generate IDW during operations at installation restoration (IR) sites include preliminary site investigations, removal actions, and remedial investigations. IDW may include drilling muds, soil cuttings, purged groundwater, decontamination fluids, DE, and PPE.

### 3.1 Sources of IDW

Table 3-1 summarizes all sites to be investigated and lists the known or suspected contaminants for each site.

**Table 3-1**
**Summary of Investigation-Derived Waste Sources**

| Source (Site) | Site Name | Known or Suspected Contaminants |
|---|---|---|
| 1 | Sanitary Landfill | Metals, TRPHs, VOCs, PAHs, phenols |
| 2 | Waterfront Sediments | Metals, TRPHs, VOCs, PAHs |
| 3 | Crash Crew Training Area | Metals, TRPHs, VOCs, PAHs, phenols |
| 4 | Army Rubble Disposal Area | Unknown |
| 5 | Borrow Pit | Unknown |
| 6 | Fort Redoubt Rubble Disposal Area | Unknown |
| 7 | Firefighting School | POLs |
| 8 | Rifle Range Disposal | Solid waste, paper |
| 9 | Navy Yard Disposal Area | Metals, TRPHs, PAHs |
| 10 | Commodore's Pond | Metals, TRPHs, PAHs, phenols |
| 11 | North Chevalier Disposal Area | Metals, TRPHs, VOCs, PAHs, phenols |
| 12 | Scrap Bins | Metals, TRPHs, PAHs, phenols, PCBs |
| 13 | Magazine Point Rubble Disposal Area | TRPHs, VOCs, PAHs, phenols |
| 14 | Dredge Spoil Fill Area | Metals, TRPHs, VOCs, PAHs, phenols |
| 15 | Pesticide Rinsate Disposal Area | Metals, TRPHs, VOCs, PAHs, pesticides |
| 16 | Brush Disposal Area | Metals |
| 17 | Transformer Storage Yard | Metals, TRPHs, PAHs, VOCs, PCBs |
| 18 | PCB Spill Area | Metals, TRPHs, PAHs, VOCs, PCBs |
| 22 | Refueler Repair Shop | Aviation Gas, JP with lead |

**Table 3-1 (Continued)**
**Summary of Investigation-Derived Waste Sources**

| Source (Site) | Site Name | Known or Suspected Contaminants |
|---|---|---|
| 24 | DDT Mixing Area | DDT with diesel fuel |
| 25 | Radium Spill Site | Radioactive Waste |
| 26 | Supply Department Outside Storage | Industrial Waste, Oils |
| 27 | Radium Dial Shop | Radium, phosphors |
| 28 | Transformer Accident | Transformer Oil |
| 29 | Soil South of Building 3460 | Metals, TRPHs, PAHs, VOCs |
| 30 and formerly PSC 31 | Buildings 649 and 755, Building 648 | Metals, TRPHs, VOCs, PAHs, phenols |
| 32, 33, 35 | Industrial Wastewater Treatment Plant | Metals, VOCs, SVOCs |
| 34 | Solvent North of Building 3557 | Metals, TRPHs, PAHs, phenols |
| 36 | Industrial Waste Sewer | Metals, TRPHs, PAHs, phenols |
| 38 | Building 71 | Metals, VOCs, PCBs |
| 39 | Oak Grove Campground | Debris, POL, broken clay, coal, cleaning solutions |
| 40 | Bayou Grande | Unknown |
| 41 | NAS Pensacola Wetlands | Unknown |
| 42 | Pensacola Bay | Unknown |

**Key:**

| | | |
|---|---|---|
| PSC | = | Potential Source of Contamination |
| TRPHs | = | Total Recoverable Petroleum Hydrocarbons |
| VOCs | = | Volatile Organic Compounds |
| PAHs | = | Polynuclear Aromatic Hydrocarbons |
| PCBs | = | Polychlorinated Biphenyls |
| SVOCs | = | Semivolatile Organic Compounds |
| POL | = | Petroleum, Oils and Lubricants |
| JP | = | Jet Propulsion |

*Source:* U.S. Navy 1993

Field activities performed during the site investigations that may generate IDW typically include some or all of the following:

| Activity | Waste Type |
|---|---|
| Monitoring Well Installation | Soil cuttings, decontamination fluids, drilling mud, PPE, DE |
| Monitoring Well Development | Development water, silt, decontamination fluids, PE, DE |
| Groundwater Sampling | Purge water, decontamination fluids, PPE, DE |
| Soil Boring | Soil cuttings, drilling mud, decontamination fluids, PPE, DE |
| Soil Excavation/Trenching | Soil cuttings, decontamination fluids, PPE, DE |
| Soil Sampling | Soil cuttings, decontamination fluids, PPE, DE |
| Sediment Sampling | Sediment, decontamination fluids, PPE, DE |
| Surface Water Sampling | Decontamination fluids, PPE, DE |
| Aquifer Testing | Development water, decontamination fluids, PPE, DE |
| Radiation Monitoring | PPE, DE |

The wastes described above may be regulated as hazardous for the purposes of storage, treatment, or disposal. Section 4 describes how this determination will be made and how IDW will be characterized. Once the IDW is characterized, a decision may be made on properly managing the waste. In addition to the waste types listed above, general refuse may be created during field activities, including packaging materials, broken or cut-off well screen, and casing. Typically, this refuse is managed as non-hazardous material and disposed of accordingly.

## 3.2 IDW Volume Estimates

Various field activities conducted in an investigation may create IDW. Estimated typical volumes of IDW generated from field activities are shown below.

- **Screening:** Screening studies typically include soil-gas, soil-probe, geophysical surveys, and water level measurements. These activities may generate several 55-gallon drums of decontamination fluid, PPE, DE and groundwater during the course of the initial studies.

- **Drilling:** Drilling an 8-inch-outside-diameter (OD) soil boring will generate a minimum of 0.35 cubic feet ($ft^3$) or 2.6 gallons of soil cuttings per linear foot of borehole. A 25-foot soil boring therefore would generate approximately 9.0 $ft^3$, or 65 gallons, of soil cuttings (approximately 1.25 55-gallon drums). Table 3-2 shows the relationship between the diameter of the borehole and the potential volume of soil cuttings generated. Larger diameter soil borings will generate proportionately larger quantities of soil. Additional quantities of soil should be expected due to its expansion following removal from the borehole (known as bulking) and slough created during drilling, especially if poorly consolidated materials are encountered. The bulking is estimated to increase soil cutting volume by 30 percent. Soil cuttings from drilling typically will be placed into 55-gallon containers.

**Table 3-2**
**Volume of Soil Cuttings Generated for Typical Diameter Boreholes**

| Hole Diameter (inches) | Undisturbed Volume of Soil per Linear Foot of Hole | | Volume of Loose Soil per Lineal Foot of Hole | |
|---|---|---|---|---|
| | Gallons | $Ft^3$ | Gallons | $Ft^3$ |
| 6.0 | 1.5 | 0.20 | 2.0 | 0.26 |
| 8.0 | 2.6 | 0.35 | 3.4 | 0.46 |
| 10.0 | 4.0 | 0.54 | 5.2 | 0.70 |
| 12.0 | 5.8 | 0.78 | 7.5 | 1.01 |

**NOTES:**
1 $ft^3$ = 7.5 gallons (approximately)
1 Gallon = 0.134 $ft^3$ (approximately)

- **Well Development or Purging and Groundwater Sampling:** The volume of groundwater from monitoring well development and groundwater sampling depends on a number of variables, including the turbidity of the groundwater, well diameter, length of screened interval, diameter of the saturated filter pack, and porosity of the material used as filter packing.

  Complete well development requires removing of well drilling relics to establish proper flow conditions and until field parameters have stabilized. Table 3-3 shows the estimated water volumes for various well screen diameters and borehole diameters, assuming a 30 percent porosity within the filter pack.

**Table 3-3**
**Volume of Water Generated for a Typical Well Casing and Borehole Combination**

| Well Casing/Boring Diameter (inches) | Volume of Water Generated per Lineal Foot of Hole (gallons) |
|---|---|
| 2/8 | 0.9 |
| 4/10 | 1.2 |
| 4/12 | 2.2 |

For example, a 4-inch well with a 10-inch borehole would contain approximately 1.2 gallons of fluid per foot of saturated zone. If no additional construction water was used and only three volumes of water were pumped for the development of 15 feet of saturated material, the well would produce approximately 54 gallons of fluid.

For hollow-stem drilling, additional water typically is used for flowing sand conditions. For normal well construction, minimal additional water would be used. Additional water would be generated during later purging and sampling and would be specific to the conditions for the well. The water generated during these activities typically will be placed in 55-gallon containers or in portable storage tanks.

- **Aquifer testing**: Aquifer tests which may be conducted at the Naval Air Station Pensacola may generate large quantities of groundwater, depending on the hydraulic properties of individual screened formations. A well installed in a formation with a high transmissivity will sustain a higher pumping rate and generate greater quantities of water. A typical test would be 1.5 to 2 times the expected withdrawal rate for the recovery system. It is anticipated withdrawal rates for NAS Pensacola will range from approximately 10 gallons per minute to 250 gallons per minute. With large volumes such as this, it will be necessary to use 20,000-gallon portable tanks to store water these tests generate. This water may undergo treatment at the onsite IWTP or be transported to an offsite facility. Slug tests typically will generate a small-to-moderate volume of decontamination fluid. In some instances, it may be possible to store fluids from several different aquifer tests in one container.

- **Trenching and Subsurface Exploration**: For trenching or other large-volume excavations, it will be necessary to store the wastes in large covered roll-off bins or on an appropriate liner material and to cover it. If possible, and when appropriate and

approved by the regulatory agencies, the best option may be to return the materials to the excavation.

- **PPE, DE, and Decontamination Fluid:** The volume of IDW generated as PPE, DE, and decontamination fluids during each field activity depends on a number of site-specific factors and therefore will vary in quantity. Site-specific factors include the USEPA health and safety work level (Level D, Level C, or Level B), number and type of field activities per site, and total number of sites being investigated. PPE waste volumes typically will account for one-half of a 55-gallon container per day for a crew of four. Decontamination fluid will vary from a few gallons per day for decontaminating monitoring instruments to several hundred gallons per day for large equipment such as drilling rigs.

## 4.0 CHARACTERIZING INVESTIGATION-DERIVED WASTE

Identifying and characterizing IDW should begin in the planning stages of field activities. First, it must be determined if the IDW contains CERCLA hazardous substances, and whether these hazardous substances constitute either RCRA hazardous wastes or contaminants regulated under other statues. The origin of the waste must be determined as well as the chemical contaminants and their concentrations. Typically, sampling data obtained from site characterization or investigation activities provide an initial determination of whether a waste is hazardous. If necessary, IDW is sampled and submitted for TCLP analysis to provide additional information and to determine specific hazardous waste characteristics. Environmental samples relevant to IDW are soil samples (for soil cuttings and excavated soil) and groundwater samples (for purge water and development water).

The Navy as *"Generator"* of the waste retains all responsibility for characterizing the containerized waste as hazardous or non-hazardous according to 40 Code of Federal Regulations (CFR) 260. The Navy characterizes its waste in accordance with NAS Pensacola Instruction 5090.1B *Hazardous Waste Management Program* (NAS Pensacola 1994).

### 4.1 RCRA Hazardous Wastes and CERCLA Hazardous Substances

Some CERCLA hazardous substances are RCRA hazardous waste. PCBs also are considered CERCLA hazardous substances. Identification of RCRA hazardous waste and PCB-contaminated IDW is essential for making storage and disposal decisions. The presence of RCRA hazardous wastes invoke special considerations. The RCRA program recognizes two general classes of waste at the federal level: hazardous and non-hazardous. Solid wastes are defined by RCRA to be hazardous either by being a listed waste, determined by the wastes's origin or by its contaminant concentrations.

## 4.2 RCRA Listed Hazardous Waste

The E/A&H site manager is responsible for identifying any potential listed hazardous wastes that may be present at the site. The site manager establishes the site's history and use, and determines whether activities there generate, or have generated, listed hazardous wastes. Examples of activities that may generate listed wastes include use of solvents, rinsing and management of pesticide containers, electroplating, dry cleaning, and wood treatment. USEPA provides guidance in the level of effort required to establish whether listed waste activities are involved at investigation sites. USEPA states that "at many CERCLA sites no information exists on the source of the wastes nor are references available citing the date of disposal. The U.S. Navy should use available site information, manifests, storage records, and vouchers in an effort to ascertain the source of these contaminants. When this documentation is not available, the U.S. Navy may assume that the wastes are not listed RCRA hazardous wastes, unless further analysis or information becomes available which allows the lead agency to determine that the wastes are listed RCRA hazardous wastes" (USEPA 1990).

Once it has been determined that a listed waste is involved at a field activity site, the environmental analytical data should be reviewed to determine if the IDW contains any hazardous constituent found in the RCRA listed waste. USEPA's "contained-in" policy states that media such as soil and groundwater containing a listed hazardous waste must be managed as such until they no longer contain that waste. There is no established policy on how to determine when the media no longer contains the listed hazardous waste. Usually this determination is made on a case-by-case basis. Two aspects should be considered for managing IDW: whether the waste also may be hazardous for characteristics (as described in Section 4.3) and whether the cost of additional analytical work will offset the cost of managing the waste as a listed hazardous waste. In addition to identifying potential listed criteria, IDW also should be evaluated for characteristic hazardous waste criteria, as described in Section 4.3.

## 4.3 RCRA Characteristic Hazardous Waste

Characteristic hazardous wastes are based on general criteria. In order for a waste to be considered a characteristic hazardous waste, it must exhibit one or more of the following properties, as defined in 40 CFR §261.21 through §262.24:

- Ignitability
- Corrosivity
- Reactivity
- Toxicity
  - — Heavy Metals
  - — Volatile Organic Compounds
  - — Semivolatile Organic Compounds
  - — Pesticides and Herbicides

IDW does not usually exhibit the characteristics of ignitability, corrosivity, or reactivity due to the waste's nature and matrix. Typically, IDW waste consists of low concentrations of contaminants in soil and water. The quantities of these contaminants typically are insufficient to cause the soil or water to exhibit any of the characteristics of ignitability, corrosivity, or reactivity.

The characteristic for toxicity is based on the waste's leaching characteristics. The Toxicity Characteristic Leaching Procedure (TCLP) simulates the effect of hazardous constituents leaching from a waste; USEPA bases regulatory limits to protect human health and the environment on the TCLP test. Reviewing environmental data to initially screen the IDW helps eliminate some or all of the toxicity characteristics. USEPA provides that if a total analysis demonstrates the individual constituents are not present in the waste, or they are present but at such low concentrations that the appropriate regulatory levels could not possibly be exceeded, the TCLP need not be run (40 CFR Part 261, Appendix II). IDW to be left onsite should not containerized or tested.

## 4.4 CERCLA Hazardous Substances

If the IDW does not contain RCRA "hazardous waste", it should be determined if the IDW contains other CERCLA hazardous substances. CERCLA hazardous substances include, in addition to RCRA hazardous wastes, substances, elements, compounds, solutions, or mixtures designated as hazardous under CERCLA or under the authority of another ARAR including TSCA, CWA, CAA, and SDWA. CERCLA hazardous substances are listed in 40 CFR Part 302.4, Table 302.4.

## 5.0 SAMPLING AND ANALYSIS

Sampling and analyzing IDW will be conducted when corresponding environmental sample data are not available or when details are needed about the waste. Sampling of soil or sediment IDW may occur as the waste is generated (i.e., as the boring is advanced) or may be collected from the containerized waste. All samples collected for waste analysis should be representative of the waste being sampled. Therefore, the samples should be composited. If the soil or sediment IDW is to be disposed of offsite, samples for TCLP analysis may be collected during advancement of the soil boring or from the containerized waste. If the IDW is to be disposed of within the AOC, sampling is not required. Guidelines for collecting representative samples are contained in Chapter 9 of *Test Methods for Evaluating Solid Waste* (USEPA 1986). Sampling methods are detailed in Appendix A.

### 5.1 Completing a Waste Profile

IDW is characterized through knowledge of the waste, review of environmental data correlating to the waste, or sampling and analyzing the waste itself. This characterization leads to a waste profile summarizing all the information available on the IDW. The waste profile is required for shipping any IDW to offsite facilities. It should be completed for all wastes generated in investigation activities as an accurate record of the waste identification, source, and characteristics. The profile also can describe wastes that are generated consistently and have similar or identical characteristics. For example, if a site investigation is conducted over many months and soil cuttings are generated consistently over that period, one waste profile may be completed to describe all the soil cuttings, even though they may be shipped offsite at different times throughout the investigation. Once that profile is approved, it may be used for subsequent shipments of the same waste without completing and approving a new profile. Appendix B includes the waste profile form.

Completing all 11 sections of the profile ensures all necessary information is obtained to properly manage the waste. Each blank on the profile form should be filled in, even if the appropriate response is "not applicable" or a zero value. The sections cover these subjects:

- Generator Information
- Waste Description
- Transportation Information
- Physical Properties
- Toxicity Characteristics
- Total Metals
- Other Solvent Constituents
- Chemical Composition
- Additional Information and Comments
- Technical Review
- Generator Certification

In most cases, environmental data gathered during the site investigation will be used to characterize the associated IDW. This process allows the IDW to be characterized more quickly and minimizes the sampling and analysis of IDW by providing an initial review of potential hazardous waste categories that may apply.

Once the waste profile has been completed, it will be signed by the Navy installation environmental coordinator. The waste profile then will be used for obtaining approval for treatment or disposal at offsite TSD facilities and for evaluating possible onsite treatment and disposal options.

## 5.2 Management of Disposable PPE and Equipment

Disposable PPE and DE will be managed according to the type of activity and concentration of contamination encountered with the equipment. In general, most PPE and DE will be managed as non-hazardous solid waste, particularly if little contact occurs with the sampling media and low concentrations of contaminants are involved. The IDW should be placed in plastic bags and transferred to an onsite industrial dumpster, whose contents is routinely disposed of in an municipal landfill. A second option is to transport the IDW to a suitable offsite municipal solid waste landfill.

Contaminated PPE and DE used in collection of samples from known highly contaminated areas will be placed in 55-gallon drums, accurately labeled as discussed in Section 5.6 and stored at a container storage area. PPE and DE will be stored until adequate characterization is complete for the site or for the containerized PPE and DE. The environmental sampling results from the sites where the IDW was generated will be reviewed when available. PPE and DE that is contaminated with listed hazardous waste will be managed as hazardous waste, and will be characterized in a manner consistent with the media being sampled.

## 5.3 Management of Empty Drums

Empty drums may be generated in rare cases, such as when IDW is consolidated onsite to minimize the number of containers shipped to offsite waste management facilities. Empty drums also may be generated when IDW is removed from containers for onsite treatment or disposal. Federal regulations require empty containers that held hazardous waste to be emptied to the maximum extent practicable before further management. In addition, if the container was used for an acutely hazardous waste, it must be decontaminated via triple rinsing before further management (40 CFR 261.7[3]).

Federal regulations exempt empty containers from regulation as hazardous waste. However, in order to retain the exemption, the empty container must be managed in one of the following ways:

- Dispose of it at an approved solid waste management facility, if 5-gallon capacity or less.
- Reclaim its scrap value onsite or ship the container to a reclaimer for its scrap value.
- Recondition or remanufacture the container onsite for subsequent reuse, or ship it to reconditioner or remanufacturer.
- Ship the container to a supplier or another intermediate collection location for accumulation before managing the container.

## 6.0 STORAGE

Specific IDW storage requirements depend on a number of factors, including the auspices under which the investigation is being conducted, location of the storage area, the length of storage, the type of storage unit, the type of waste, and the regulatory status of the storage unit. Storage of non-hazardous waste and designated waste in drums and portable tanks is not regulated by USEPA.

Storage of hazardous waste is regulated on the federal and state levels, with four options discussed further:

- Accumulation within the AOC
- Storage in a TU
- Accumulation for up to 90 days from the date of generation
- Storage in a unit that meets permitted facility standards

Selection of an applicable option may be dependent on:

- State laws and interpretations
- Applicable statutes under which the investigation is being conducted
- Site-specific issues

The location of IDW storage may be within the AOC or at another location of the installation. It is important to carefully consider the location chosen for IDW storage, since it may affect the applicability of some RCRA requirements such as LDRs and MTRs. IDW is generally stored in a manner meeting the requirements for hazardous waste storage until environmental data or other information prove otherwise. Typically, IDW is accumulated within the AOC or at a centralized storage area that complies with RCRA requirements for storing both solid and hazardous IDW.

## 6.1 Accumulation within the AOC

Accumulation of IDW within the AOC is appropriate for investigations conducted under CERCLA. In addition, if IDW is merely being moved within the AOC, land disposal is not considered to have occurred, therefore LDRs are not triggered. An evaluation of the IDW handling technique must be conducted to determine if the technique constitutes land disposal. Activities which constitute land disposal are detailed in Section 2.2.1 Land Disposal Restrictions. If IDW cannot be deposited within the AOC, IDW handling and disposal must comply with all LDRs to the extent practical.

## 6.2 Storage in a Temporary Unit

TUs are appropriate for investigations conducted under RCRA. Storing waste in a TU provides the greatest flexibility for design and operation of the storage unit. A temporary storage unit may be established for containers or tanks and may be placed either within or outside an AOC. A TU's major advantage is that IDW may be stored for up to one year, and waste may be removed from the TU and placed back into the AOC for treatment or disposal without triggering LDRs or MTRs. TUs must be administratively created with regulatory agency input. Design of a TU must consider:

- Length of time the unit will operate
- Type of unit
- Volumes of wastes to be managed
- Physical and chemical characteristics of the wastes to be managed there
- Potential for releases
- Hydrogeological and other relevant environmental conditions at the facility that may influence the migration of any potential releases
- Potential for exposure of humans and environmental receptors if releases were to occur

Specific design and operating requirements for accumulation storage areas and permitted storage units may be used as guidelines in developing temporary storage units. It is important to determine whether the TU will reside within an AOC, and the specific AOC should be identified in site-specific plans for the TU.

## 6.3 Accumulation of Containers for Less Than 90 Days

Generators may accumulate RCRA hazardous waste in container storage areas or storage tanks for up to 90 days before shipment to an offsite management facility. These storage areas and tanks are commonly called accumulation storage units. This storage option is somewhat flexible in terms of design due to the limited storage time involved. However, 90 days is not always sufficient to adequately characterize the waste before shipment offsite. This storage option is inappropriate for long-term storage of IDW.

Accumulation container storage areas must meet specific design and operational requirements outlined in 40 CFR §262.34(a) and R.61-79.262 Subpart C, which include the following:

- Containers must be in good condition and compatible with the waste placed inside them.
- Containers must be kept closed, except when waste is being added or removed from them, and they must be managed in such a way as to prevent rupture or leakage.
- Containers must be marked as hazardous waste and with the accumulation start date, composition and physical state of the waste, hazardous properties of the waste, and the name and address of the generator.
- Inspection of the accumulation storage unit must be conducted and recorded at least weekly.
- Personnel handling the containers must receive initial and annual training on operating and maintaining the accumulation storage unit.
- A contingency plan must be developed and emergency equipment provided for the accumulation storage unit.

- The accumulation storage unit must be closed to meet the RCRA closure performance standard.

In addition to these requirements. E/A&H recommends providing the following measures when possible:

- If the accumulation storage unit is not within the AOC, the unit should be constructed with a concrete or asphalt base, depending on the type and quantity of waste stored, and should have berms around the perimeter. Existing concrete and asphalt pads often are appropriate for storage.
- The accumulation storage unit should be covered, or adequate capacity should be provided to handle runon and precipitation.
- Liquids from runon, precipitation, or spills should be collected promptly from the accumulation storage unit and managed appropriately.

Accumulation storage units do not require administrative action to create; the generator simply must establish the storage area and maintain adequate documentation demonstrating compliance with the operating requirements.

### 6.4 Storage of Containers to Meet Permitted Facility Standards

The last storage option for IDW is to use an existing permitted storage facility or create a storage area meeting all the design specifications and operating requirements applicable to permitted facilities. The requirements for permitted facilities were developed to allow longer storage of a variety of wastes generated at industrial facilities, and these requirements are the most stringent under RCRA. Unless using an existing permitted storage facility, this option provides the least amount of flexibility because the requirements are extensive and very specific. However, this option also provides the greatest amount of storage time, with no pre-established limits on time a waste may be stored. While CERCLA allows onsite storage units of this type

to be exempt from permitting standards, the substantive requirements still must be met. These requirements for container storage areas are summarized below:

- General Standards
  - Waste analysis plan for characterizing each hazardous waste stored at the facility
  - Facility security
  - Location standards for flood zones and seismically sensitive areas
  - Annual personnel training
- Emergency Preparedness
  - Develop a contingency plan for emergencies
  - Provide adequate communication and alarm systems for emergencies
  - Personnel training in emergency response
  - Procedures for managing ignitable, reactive, and incompatible wastes
- Design
  - Impermeable containment base free of cracks and gaps
  - Containment adequate for 10 percent of total waste capacity or largest container, whichever is greater
  - Additional containment adequate to contain a 25-year, 24-hour storm event, or a method to prevent runon and runoff of storm water and precipitation
- Operation
  - Weekly inspections
  - Removing accumulated liquids in the containment system within 24 hours
  - Separating incompatible wastes
- Closure
  - Develop closure plan subject to agency approval
  - Oversight by independent registered professional engineer
  - Certify to regulators the adequacy of closure

## 6.5 Inspections and Storage Inventory Log

All storage areas (TU, 90-day accumulation, and units meeting permitted facility standards) should be inspected at least weekly. A standard inspection form is included in Appendix C which shows the items to be inspected, discrepancies noted, and corrective actions taken. Container storage inspections should cover the following areas:

- Condition of containers
- Adequacy and completeness of labels
- Evidence of leaks and spills
- Adequate aisle space
- Loading and unloading areas
- Emergency equipment

In addition to completing weekly inspections, an inventory of containers should be maintained that reflects the following information:

- Number of containers currently in storage
- Date each container was generated
- Dates, manifest numbers, and destination facilities for IDW shipped to offsite management facilities
- Dates and disposition information for IDW disposed of onsite

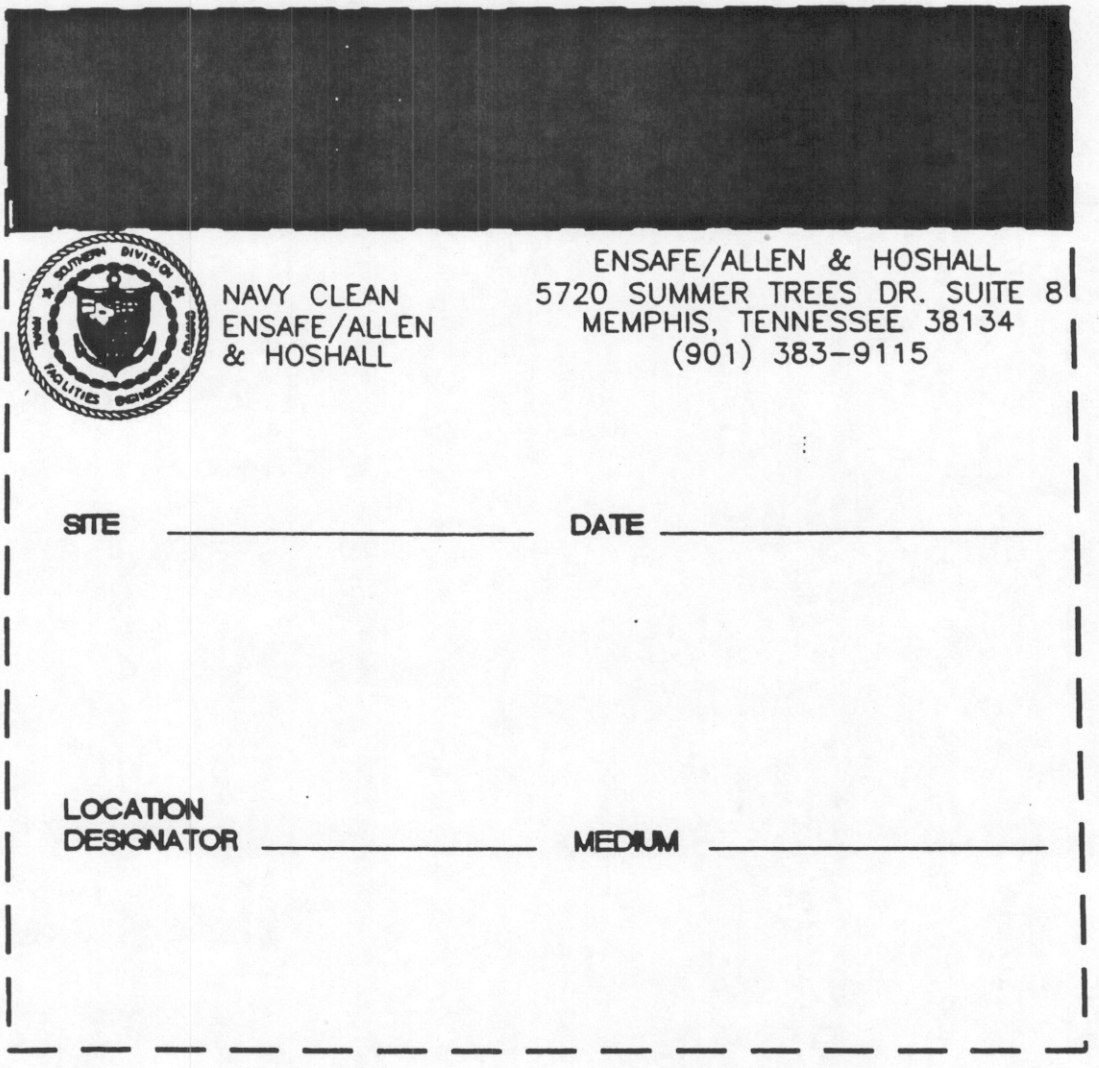
Inventory information for small quantities of IDW may be maintained in the field logbook for the site. An inventory log may be used to track larger quantities of IDW from multiple sites. An inventory form is included as Appendix D. Inventory information should be updated at least weekly, and the inventory should be physically checked against the containers in storage at the time of inspection.

## 6.6 Container Labeling

Identifying marks and labels will be required on each waste container. The generating personnel must clearly mark each container with contrasting lettering. All empty drums will be marked as empty to avoid question of their contents. E/A&H has instituted the use of CERCLA IDW labels as shown in Figure 6-1. These labels will provide the base personnel with all the pertinent information they need to complete the inspection records state and federal regulations require. The labels will show the site location, date media was introduced in the drum, location designator, and type of media. Each location designator will be composed of five to six characters, the first two will represent the site identification number at NAS Pensacola (for example "30", represents site 30). The third character represents the waste origin (for example "S" for soil boring, "G" for monitoring well). If the monitoring well is temporary, the fourth digit will be used for the temporary designation of "R." The fourth digit may also designate the depth of the permanent monitoring well (i.e., "S" for shallow, "I" for intermediate, "D" for deep). The fourth and fifth characters may represent the matrix serial identification number, which is a unique location number assigned to the origin. For example a drum of purge water collected from Site 30, shallow monitoring well number 12 would have the location designator 30GS12. These labels will be filled out by the E/A&H personnel on the specific site and attached to the full and sealed drums. Drum labels will be placed on the side of the drum, not on the lid, to reduce weathering and to prevent the possibility of interchanging labels if lids are reused. If labels are not available, the following action will be accepted: The drums containing waste will be marked with a contrasting paint pen or grease pencil as CERCLA IDW, identifying the site location, date media was introduced in the drum, location designator, and type of media to allow the appropriate analysis to be traced to the correct drum of waste. All old markings on recycled drums shall be painted over with black spray paint to avoid confusion with the new labels or markings.

All labeling information for each drum will be entered into the field logbook. After the drum's contents are characterized, as described in Section 4, the labels will be updated to reflect the

Figure 6-1 Drum Label



appropriate classification of wastes and the logbook will be updated. Drums containing hazardous IDW will be labeled using a paint pen or grease pencil "HAZARDOUS WASTE - Florida Law Prohibits Improper Storage or Disposal" in accordance with 40 CFR Part 172 and the applicable state regulations. Drums containing non-hazardous IDW will be labeled using a paint pen or grease pencil "NON HAZARDOUS WASTE".

## 6.7 Use of Portable Storage Tanks

Portable storage tanks often are used to accumulate and store liquid IDW such as groundwater or storm water runoff. USEPA regulates these portable tanks as containers for storage onsite. Storage tanks should be labeled in the same manner as for containers. However, the portable tanks must comply with federal Department of Transportation (DOT) specification and labeling if they will be used to transport liquids to offsite facilities.

## 6.8 Repackaging and Overpacking Containers

Repackaging or overpacking containers may become necessary if they become damaged or weathered and no longer are suitable for use. Repackaging involves transferring the waste from the damaged drum into a new container, whereas overpacking involves placing the damaged drum into a larger container. When repackaging or overpacking occurs, the new container must be labeled identically, and a note should be made in the field logbook or storage inventory log of the change in packaging or drum size.

## 7.0 TREATMENT AND/OR DISPOSAL OF IDW

The Navy as *"Generator"* of the waste retains all responsibility for disposal of the containerized waste. The Navy disposes of its hazardous waste in accordance with NAS Pensacola Instruction 5090.1B *Hazardous Waste Management Program* (NAS Pensacola 1994).

Once the IDW has been characterized, treatment and disposal options that appropriately manage the waste may be considered. The options available at a particular installation depend on:

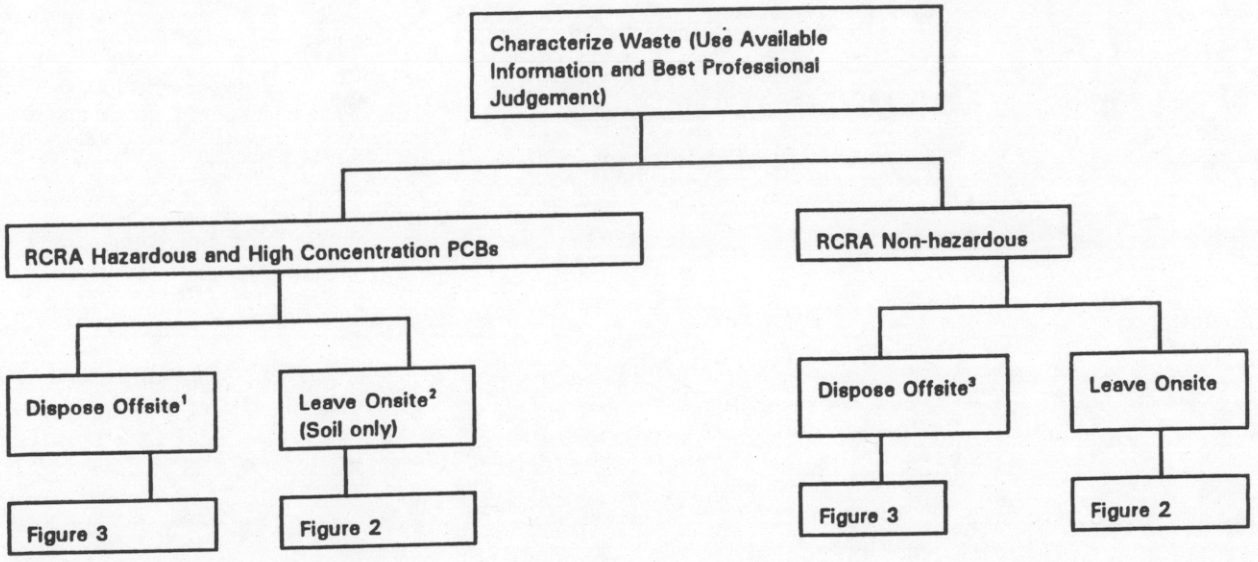
- Availability of onsite management facilities, such as industrial wastewater treatment plants, NOTWs, bioremediation facilities, and other treatment technologies that may have been developed for other cleanup sites.

- Availability of a POTW with the capability to treat wastewater from the installation.

- Site conditions and regulatory approval for disposal of non-hazardous soil back onto the site where generated.

A decision tree for selecting the best approach for IDW management is provided in Figure 7-1, 7-2, and 7-3. If the IDW is to remain onsite, then the onsite branch, Figure 7-2, shows the steps and choices for the different types of IDW. If the IDW is to leave the site, the offsite branch, Figure 7-3, shows the steps and choices for the different types of IDW. The waste management options addressed in this section include managing aqueous wastes at installation wastewater treatment plants, NOTWs, and at POTWs. Solid IDW may be disposed of at an offsite facilities or returned to the site from which it was generated. In addition, IDW may be used onsite in pilot-scale treatability studies.

## Figure 7-1
## IDW Management Decision Tree




**Source:** Modified from USEPA 1991

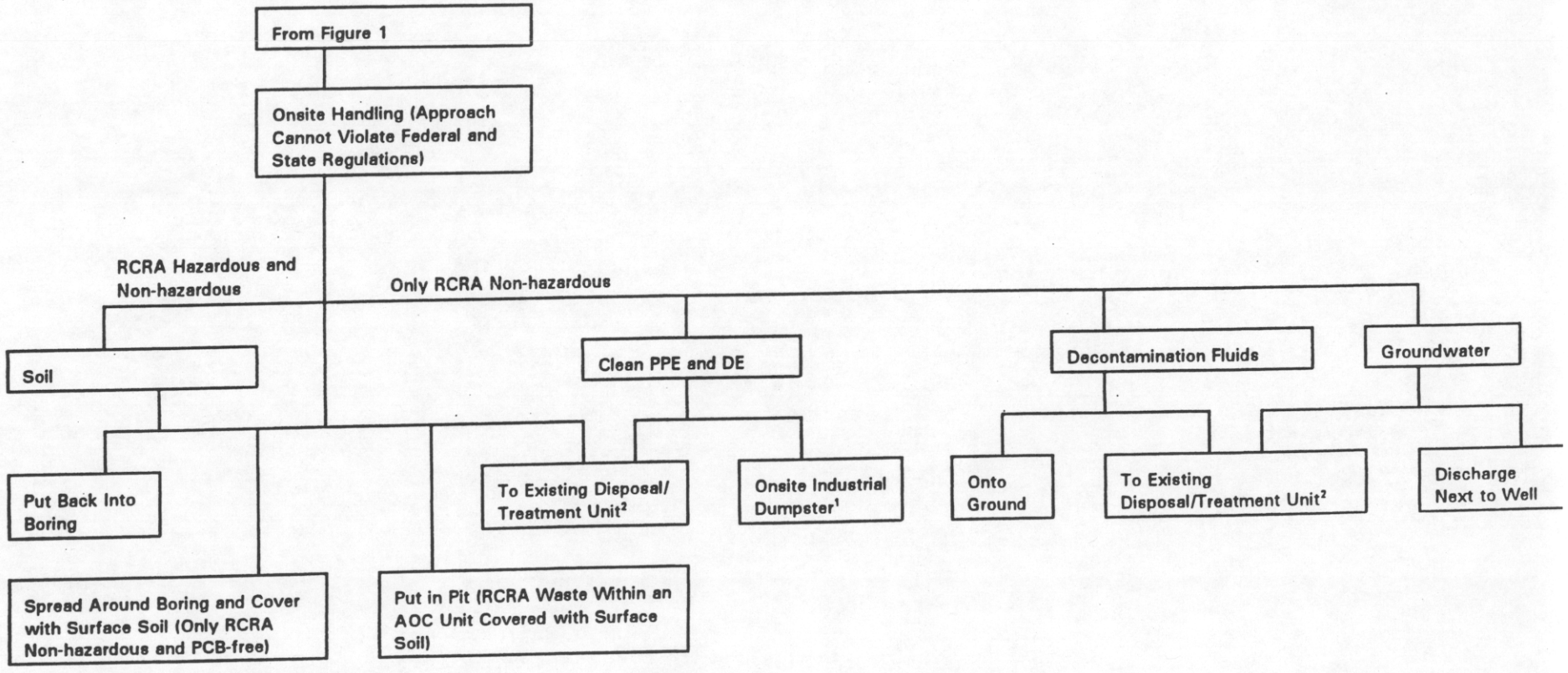
**Notes:**

1 Soil cuttings, groundwater, and decontamination fluids creating increased hazards should be disposed of offsite.

2 If not prohibited by other legally enforceable requirements such as state ARARs

3 Justified only when a RCRA non-hazardous waste is a state hazardous waste and state requires waste removal, or if leaving the waste onsite would significantly affect human health and the environment

## Figure 7-2
## Onsite Handling of IDW



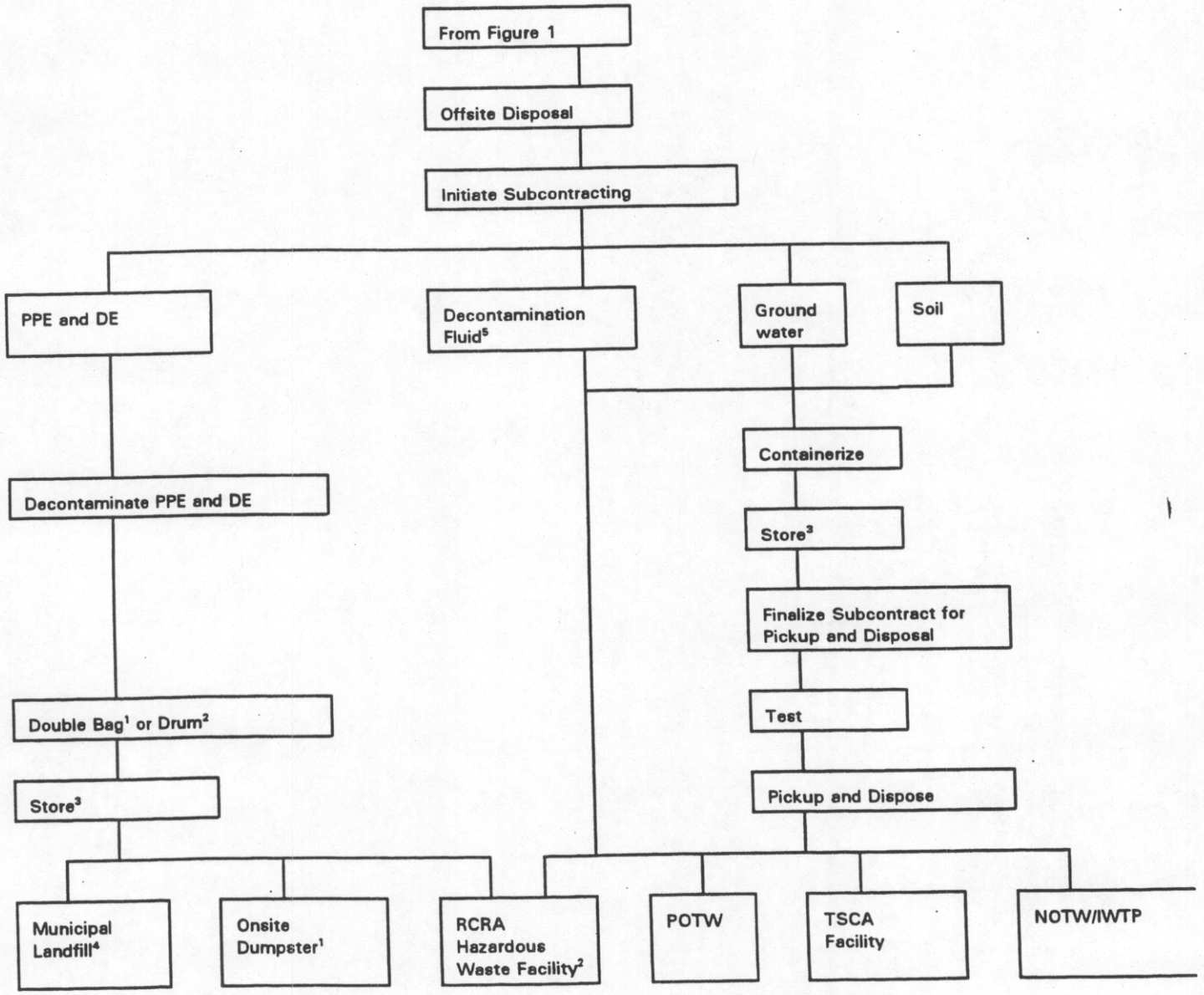

**Source:** Modified from USEPA 1991

**Notes:**

1 Clean PPE and DE may also go to the nearest landfill

2 If the receiving unit meets the offsite policy acceptability criteria

## Figure 7-3
## Offsite Handling of IDW




**Source:** Modified from USEPA 1991

**Notes:**

1 Only RCRA non-hazardous waste
2 Only RCRA hazardous waste generated in quantities greater than 100 kg/month when sent offsite
3 In accordance with accumulation requirements for RCRA hazardous wastes
4 Only if the conditionally exempt small quantity generator exception applies
5 If the conditionally exempt small quantity generator exception applies, offsite disposal of decontamination fluids may not require subcontracting

## 7.1 Offsite Handling

Offsite handling of IDW would involve using a subcontractor to haul and dispose of the IDW at an offsite facility which complies with the applicable regulations for the type of waste. Generally, this approach allows for the most technologically advanced disposal option. However, there are several disadvantages to offsite handling which include:

- increased costs
- loss of control over the fate of the IDW while retaining liability
- potential for spills during transportation
- finding a suitable disposal facility
- reluctance of states to accept waste generated out-of-state

### 7.1.1 Management of Aqueous Liquids at Installation Treatment Plants

Aqueous liquids such as well purge water, well development water, and decontamination liquids often can be treated at available installation wastewater treatment plants. Based on the completed waste profile, the IDW can be evaluated to determine if it meets the acceptance criteria under the wastewater treatment plant's discharge permit. This evaluation usually consists of comparing the waste contaminants to the chemical constituents the plant is permitted to manage. Accepting and discharging the IDW to the wastewater treatment plant typically is coordinated with the installation environmental coordinator and plant personnel. If the waste is restricted under the LDR program, a special notification must be completed and submitted to the wastewater treatment plant when the waste is transferred (40 CFR §268.7[1[[6]). A certificate of disposal or their receipt should be obtained from the wastewater treatment plant after the IDW has been accepted, and this document should be filed with the waste profile, along with a copy of the LDR notification.

In addition to IWTPs, NOTWs are permitted to accept wastewater for treatment. However, NOTWs may be subject to different regulations. If this option is selected for use, notification and coordination with Base environmental personnel will be required.

### 7.1.2 Management of Aqueous Liquids at POTWs

Many POTWs are permitted to accept wastewater for treatment under special discharge permits issued for occasional or one-time discharges. These permits may often be obtained with the data used to complete the waste profile. The process of obtaining a special discharge permit is more formal than obtaining approval; however, the turnaround time for approval is typically just two to four weeks. If the waste is restricted under the LDR program, a special notification must be completed and submitted to the POTW when the waste is shipped or transferred (40 CFR §268.7[a][6]). A certificate of disposal or other receipt should be obtained from the POTW after IDW has been accepted, and this document should be filed with the waste profile, along with copies of the LDR notification.

### 7.1.3 Use of Investigation-Derived Waste in Pilot-Scale Treatability Studies

IDW may often be used beneficially onsite in pilot-scale treatability studies. At the federal level, samples undergoing treatability studies at laboratories and testing facilities are exempt from hazardous waste regulation, as long as USEPA and the Florida Department of Environmental Protection (FDEP) are notified and certain record-keeping and management standards are met (40 CFR 261.4[e] and [f]).

Before conducting a treatment study, any IDW intended for such use should be stored in accordance with applicable regulation, in properly labeled and marked containers.

## 7.2 Onsite IDW Handling and Management Options

Onsite handling of IDW is a cost effective approach to handling IDW. If IDW is RCRA non-hazardous soil or water, it may be left onsite unless a state ARAR or community concerns, require offsite disposal. IDW to be left onsite should not be containerized or tested. The onsite handling options for RCRA non-hazardous IDW are listed below.

- Soil
  - — Spread around the well
  - — Return to boring
  - — Put the IDW into a pit within the AOC
  - — Dispose at the site's TDU

- Groundwater
  - — Pour onto ground next to well
  - — Dispose at the site's TDU

- Decontamination Fluids
  - — Pour onto ground
  - — Dispose at the site's TDU

- Decontaminated PPE and DE
  - — Double bag and dispose at the site, or in an municipal landfill
  - — Dispose at the site's TDU

If the IDW is RCRA hazardous soil that poses no immediate danger to human health and the environment, it may remain onsite within the delineated AOC. Proximity to residents and workers must be considered before using this disposal option. Onsite disposal of RCRA hazardous soil involves:

- Delineating the AOC
- Determining pit locations close to the borings within the AOC
- Covering hazardous IDW in the pits with the surficial soil

## 8.0 IDW MANAGEMENT ORGANIZATION

The Navy will have ultimate authority and responsibility for managing and disposing of the IDW E/A&H generates on its behalf. Interim status for hazardous waste container storage facilities on the military base has been granted under RCRA statues and regulations. This allows all wastes to be managed in accordance with subtitles C and D of RCRA and with the state solid waste regulations. The Navy, E/A&H, and subcontractor personnel will implement the IDW management plan. E/A&H and its subcontractor personnel will be responsible for properly containerizing and labeling the waste and collecting samples for laboratory analysis. The Navy will be responsible for managing the waste inventory at waste accumulation areas, laboratory analysis, characterizing the waste as hazardous or non-hazardous (after analytical information is returned from the laboratory), loading of waste for offsite transfer, and for the transporting the waste to a properly permitted waste management facility.

### 8.1 E/A&H Site Manager

The E/A&H site manager will be responsible for properly containerizing IDW including:

- Notifying the site IDW coordinator of any new waste.
- Properly labeling the containers per Section 6 of this plan when accumulation is initiated.
- Establishing IDW accumulation area(s) at each site.

### 8.2 E/A&H IDW Coordinator

The E/A&H IDW coordinator will be responsible for assisting the Navy in managing IDW accumulation areas and accumulation areas associated with the investigation, however the Navy will retain ultimate responsibility for the waste management system. His responsibilities include:

- Supervising daily waste management at all generating points.
- Ensuring hazardous waste containers are properly labeled and stored in an appropriate manner and incompatible waste are segregated.
- Maintaining drum inventory logs or forms.
- Ensuring overall compliance with this plan.

## 8.3 Navy Environmental Coordinator (IDW Manager)

The Navy manages the hazardous waste in accordance with NAS Pensacola Instruction 5090.1B *Hazardous Waste Management Program* (NAS Pensacola 1994). The Navy environmental coordinator (IDW manager) will be responsible for the entire IDW management system. He will be responsible for informing E/A&H IDW Coordinator of any changes in procedures or policy concerning the handling, storage, and disposal of IDW.

## 9.0 REFERENCES

Naval Air Station Pensacola. (1994). *NASP Instruction 5090.1B Hazardous Waste Management Program.* Naval Air Station Pensacola: Pensacola, Florida.

U.S. Environmental Protection Agency (1986). Test Methods for Evaluating Solid Waste, Third Edition SW-846. Prepared by the Office of Solid Waste and Emergency Response.

U.S. Environmental Protection Agency (1988a). *Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA, Interim Final.* Prepared by the Office of Emergency and Remedial Response.

U.S. Environmental Protection Agency (1988b). *CERCLA Compliance with Other Laws Manual, Draft Guidance.* Prepared by the Office of Emergency and Remedial Response.

U.S. Environmental Protection Agency. (1990). *National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule.* USEPA/540/1-89/002. December 1989. Federal Register V55:46 pg 8666-8865, March 8, 1990.

U.S. Environmental Protection Agency (1991). *Management of Investigation-Derived Wastes During Site Inspections.* Prepared by the Office of Emergency and Remedial Response, Publication 9345.3-02FS.

U.S. Navy. (1993). *1994 Site Management Plan (SMP) of the Installation Restoration Program for the Naval Air Station Pensacola*, Pensacola, Florida.

# Appendix A
# Sampling and Analysis Procedures

## 1.0 IDW SAMPLING METHODS

The basic objective of the IDW sampling program is to produce a set of samples representative of the IDW media under investigation and suitable for subsequent analysis. This attachment describes the methods and materials to be used for sampling IDW generated at Navy installations. Under many circumstances, the sampling and testing performed for the investigation will be sufficient to classify the IDW and no additional sampling will be necessary. When additional sampling is required to characterize the waste, it is important that quality control (QC) sampling is performed to assess the accuracy and precision of the sampling program. QC sampling methods should be the same as those stated in the approved work plan.

Sampling accuracy is usually achieved by using a random sampling technique. Sampling precision is achieved by collecting the appropriate number of samples and by maximizing the physical size of the samples.

A simple random sampling strategy will be employed for most solid waste cases where it is determined additional samples are required to characterize the IDW. The rationale for using this type of sampling method is that typically little or no information is known about the distribution of the chemical contaminants within the waste. For most solid IDW, distinct strata within the containers are not identified and various in composition or stratification may have occurred at unknown and random depths.

Simple random sampling is a type of probability sampling relying on mathematical and statistical theories. In simple random sampling all locations or portions of the IDW have an equal chance of being sampled. For simple random sampling, the appropriate number of samples to be collected is estimated by finding the regulatory threshold (RT) for the contaminants of concern and by estimating the sample mean (x) and variance (s).

Simple random sampling may be used for liquid IDW thought to be homogeneous. Stratified random sampling may be used for liquid IDW sampling where the contaminants of concern are thought to stratify due to their density relative to the other liquids. Stratified random sampling

is different from simple random sampling in that the Xs are calculated for each stratum in the population and then integrated into the overall estimates of those statistics. Systematic random sampling may also be used for instances where there are recognized trends or cycles associated with the contaminants in the IDW. Cases where systematic random sampling may be used include drums with floating or sinking products.

It is also likely that if the waste is to be disposed of to a treatment, storage, or disposal unit (TSDF), the TSDF's operators will want to perform their own waste characterization. Therefore, it is important to contact the potential TSDF before performing sampling and laboratory analysis of the IDW to avoid duplication of efforts and costs. Potential TSDFs for the IDW should be contacted following environmental sampling. Their requirements regarding acceptable laboratory analyses change as do the wastes that they are accepting and the rates that they charge. Transportation requirements and costs should be determined before shipping.

The sampling method selected for each of the IDW media will, in part, depend on the potential contaminants of concern as shown by site history or analytical results of the field sampling program. The generation of additional decontamination fluids through IDW sampling should be minimized and should be a factor considered in the final choice of sampling technique. Care should be exercised to avoid using sampling devices plated with chrome or other materials that might contaminate the sample.

The description of sampling methods for containerized media is divided into three sections that address (1) soil and sludge, (2) containerized liquid, and (3) containerized PPE. If required, wipe sampling will be used to analyze the surface of drums, DE, and PPE.

### 1.1 Soil and Sludge Sampling

Available options for sampling devices suitable for soil and sludge (or sediment) sampling include scoops, thin-walled tube samplers, hand augers, and core samplers. The use of a scoop and a 100 centimeters (cm) long sampling trier is the recommended method for sampling containerized soil and sludge. However, site-specific conditions may necessitate a variety of

sampling options, and therefore all of these sampling methods will be discussed. The presence of rocks, debris, or other sampling-specific considerations may complicate sampling and preclude the use of or require modification to some of these sampling devices.

When sampling a previously sealed vessel, the presence of a bottom sludge should be checked. This is easily accomplished by measuring the depth to apparent bottom and then comparing it to the known interior depth. Methods for sampling a bottom sludge are described in the following sections. Sludge developing in 55-gallon drums can also be collected by employing glass tubes used for the liquid portion of the sample.

### 1.1.1 Shovel, Spades, and Scoops

Collection of soil and sludge samples can be accomplished with tools such as spades, shovels, and scoops. The recommended and most direct method of collecting surface samples for subsequent analysis is with the use of a spade and scoop. This method is limited somewhat to sampling at the near surface. Samples from depths greater than 50 cm may become very labor-intensive. Samples collected for volatile organic compound (VOC) analysis will be placed directly into the analytical bottle. Samples collected for other analyses will be composited in a stainless steel bowl and then placed into the analytical bottles.

### 1.1.2 Thin-Walled Tube Sampler and Hand Corers

The thin-walled tube sampler is, as its name implies, a metal tube generally 2.5 to 7.5 cm in diameter and 30 to 60 cm long. The tube is forced into the soil or sludge and then extracted. Friction will usually hold the sample material in the tube during extraction. A variety of interchangeable cutting tips facilitates penetration with reduced sample disturbance. Thin-walled tube samplers are available in various types and construction materials and are suitable for moist, dry, sandy, or heavy-duty applications.

Sampling soil or sludge can also be accomplished with a hand corer. This device is essentially the same type of thin-walled tube sampler described above. It is modified by the addition of a handle to facilitate driving the corer and a check valve on top to prevent washout during retrieval

through an overlying water layer. Hand auguring devices can be used in conjunction with a thin-walled tube sampler. In this manner, a thin-walled tube sampler can be used to sample both from the surface or to the bottom of a 55-gallon drum. However, the presence of rocks or the collapse of the auger hole generally prohibits sampling at depth.

## 1.2 Aqueous Liquid Sampling

Beakers, glass tubes, bailers, and extended bottle samplers and composite liquid waste samplers (COLIWASA) are potential devices used to sample containerized liquid media. Site-specific conditions may necessitate a variety of sampling options, and therefore all of these methods will be discussed. Samples from drums can also be readily collected by merely submerging a sample bottle.

### 1.2.1 Beakers

The use of a sampling device such as a beaker, either disposable or constructed or glass, Teflon, or stainless steel, is the recommended method for sampling containerized liquids. The device typically has a capacity of at least 500 milliliters (ml) to provide an adequate sample volume for analysis and to minimize the number of times the liquid will be distributed, thus reducing agitation of any sediment layer. Large sample volumes required for some analyses will require submerging the beaker several times to obtain the appropriate volume. A stainless steel beaker with pour spout and handle works well. It is easily cleaned and considerably less expensive than Teflon.

### 1.2.2 Bailers

Liquid samples from open containers, such as 55-gallon drums, may be collected. Bailers may also be used to collect liquid samples from containers such as drums or tanks. The major disadvantages to using bailers are splash hazards, and the need for decontamination of reusable bailers, and the generation of waste when using disposable bailers.

### 1.2.4 Composite Liquid Waste Samplers

The composite liquid waste samplers (COLIWASA) is designed to permit representative sampling of the complete water column from drums or other containerized liquid media. This type of sampler is used when contaminants of different densities such as oil and water are potentially present in the containerized liquid. It consists of a 152-cm long by 4-cm ID section of tubing with a neoprene stopper at one end. The stopper is attached to a rod running the length of the tube and terminating with a locking mechanism at the other end. Manipulation of the locking mechanism opens and closes the sampler by raising and lowering the neoprene stopper. The major drawbacks associated with using the COLIWASA include the difficulty of decontamination and cost. The sampler is difficult to decontaminate in the field and high in cost relative to alternative procedures such as glass tubes. The COLIWASA should only be used when multiphase wastes are suspected.

## 1.3 Wipe Sampling

Wipe samples are used to assess surface pesticide/PCB contamination and are applicable for the analysis of drums containing used PPE and DE. The terms "wipe sample," "swipe sample," and "smear sample" have all been used synonymously. For purposes of this section, the sample will be termed "wipe sample". Wipe samples will adhere to requirements for soil sample preservation and holding times. Wipe samples will be collected in accordance with the following procedures.

*Before Sampling:*

1. Don personal protective equipment as required in the site-specific HASP.
2. Mark the 10-cm sample site with a decontaminated template or a ruler.
3. Write a detailed description of the area to be sampled including a sketch of the sampling area in the field logbook.
4. Prepare all sampling equipment for the sampling event.

*During Sampling:*

5. Remove the cap from the sampling vial.

6. Remove the hexane- or deionized water-soaked gauze or swab from the sampling vial with stainless steel forceps or tongs.
7. Immediately begin wiping the sampling area twice, from left to right and then from top to bottom.
8. Return the gauze or swab to the sample vial. If using a gauze, fold the gauze so the side used in sampling is not exposed.
9. Cap the sample vial.

*After Sampling:*

10. Label the vial and record the sampling details on the sampling forms. Complete the chain-of-custody forms in accordance with Section 12 of the CSAP.

QA/QC samples will be collected at the frequency presented in Section 15 of the CSAP. In addition, a hexane- or deionized water-soaked gauze will be submitted as a QA sample.

# Appendix B

## Waste Profile Forms and Instruction

PROFILE NUMBER_____
Completed by_____
Date_____
Reviewed by_____

# INVESTIGATION-DERIVED WASTE PROFILE

Complete one form for each waste stream generated at each site. See instructions attached for detailed information about this form.

## GENERATOR INFORMATION

Facility Name _____
Site Name _____
Address _____
_____
City _____ State ___ Zip _____

USEPA ID Number_____
Technical Contact _____
Phone _____
Fax _____
CTO Number_____

## WASTE DESCRIPTION

Waste Description_____
Source Code/Process _____
Waste Form Code/Category of Waste _____
Special Handling Instructions _____
Is this waste regulated by USEPA or FDEP? _____ Waste codes _____ CLIN_____

| | | | | |
|---|---|---|---|---|
| LDR Subcategory | _____ | _____ | _____ | _____ |
| Numerical Standard per §268.41? | _____ | _____ | _____ | _____ |
| Numerical Standard per §268.43? | _____ | _____ | _____ | _____ |
| Technology-Based Standard §268.42? | _____ | _____ | _____ | _____ |

## TRANSPORTATION INFORMATION

DOT Proper Shipping Name_____
DOT Hazard Class_____ UN/NA_____ RQ_____
Packaging Description _____

## PHYSICAL PROPERTIES

Color _____
Odor _____

Liquid Layering _____
Physical State _____

Viscosity _____
Yard-Pound Factor _____ % YD = LB

| | Avg. | Min. | Max. |
|---|---|---|---|
| pH | ____ | ____ | ____ |
| Specific Gravity | ____ | ____ | ____ |
| Flash point | ____ | ____ | ____ |
| (Method): | ____ | ____ | ____ |
| BTU/lb | ____ | ____ | ____ |

%Halogens_____
% Liquid _____
% Sludge _____
% Solid _____
%Water_____

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Acid Reactive | Y | N | Biological | Y | N | Corrosive | Y | N |
| Dioxin | Y | N | Explosive | Y | N | Flammable | Y | N |
| Oxidizer | Y | N | Pesticide | Y | N | Herbicide | Y | N |
| Poison | Y | N | Pumpable | Y | N | Pyrophoric | Y | N |
| Radioactive | Y | N | RCRA Reactive | Y | N | Shock Sensitive | Y | N |
| Wastewater | Y | N | Water Reactive | Y | N | Other _____ | | |

## TOXICITY CHARACTERISTICS

| USEPA Waste Code | Contaminant | Level (mg/L) | Federal Regulated Level |
|---|---|---|---|
| | Aldrin | _____ | |
| | Antimony | _____ | |
| D004 | Arsenic | _____ | 5.0 |
| | Asbestos | _____ | |
| D005 | Barium | _____ | 100.0 |
| D018 | Benzene | _____ | 0.5 |
| | Beryllium | _____ | |
| D006 | Cadmium | _____ | 1.0 |
| D019 | Carbon Tetrachloride | _____ | 0.5 |
| D020 | Chlordane | _____ | 0.03 |
| D021 | Chlorobenzene | _____ | 100.0 |
| D022 | Chloroform | _____ | 6.0 |
| D007 | Chromium (Total) | _____ | |
| | Chromium (Trivalent | _____ | |
| | Chromium (Hexavalent) | _____ | |
| | Cobalt | _____ | |
| | Copper | _____ | |
| D023 | o-Cresol | _____ | 200.0 |
| D024 | m-Cresol | _____ | 200.0 |
| D025 | p-Cresol | _____ | 200.0 |
| D016 | 2,4-D | _____ | 10.0 |
| | DDT, DDE, DDD | _____ | |
| D027 | 1,4-Dichlorobenzene | _____ | 7.5 |
| D028 | 1,2-Dichloroethane | _____ | 0.5 |
| D029 | 1,1-Dichloroethylene | _____ | 0.7 |
| | Dieldrin | _____ | |
| D030 | 2,4-Dinitrotoluene | _____ | 0.13 |
| | Dioxin (2,3,7,8, - TCDD) | _____ | |
| D012 | Endrin | _____ | 0.02 |
| | Fluoride salts | _____ | |
| D031 | Heptachlor (& its epoxide) | _____ | 0.008 |
| D032 | Hexachlorobenzene | _____ | 0.13 |
| D033 | Hexaclorobutadiene | _____ | 0.5 |
| D034 | Hexachloroethane | _____ | 3.0 |
| | Ketone | _____ | |
| D008 | Lead | _____ | 5.0 |
| | Lead components, organic | _____ | |
| D013 | Lindane | _____ | 0.4 |
| D009 | Mercury | _____ | 0.2 |
| D014 | Methoxychlor | _____ | 10.0 |
| D035 | Methyl ethyl ketone | _____ | 200.0 |
| | Mirex | _____ | |
| | Molybdenum | _____ | |
| | Nickel | _____ | |
| D036 | Nitrobenzene | _____ | 2.0 |
| D037 | Pentachlorophenol | _____ | 100.0 |
| D038 | Pyridine | _____ | 5.0 |
| D010 | Selenium | _____ | 1.0 |
| D011 | Silver | _____ | 5.0 |
| D039 | Tetrachloroethylene | _____ | 0.7 |
| | Thallium | _____ | |
| D015 | Toxaphene | _____ | 0.5 |
| D017 | 2,4,5-TP (Silvex) | _____ | 1.0 |
| D040 | Trichloroethylene | _____ | 0.5 |
| D041 | 2,4,5-Trichlorophenol | _____ | 100.0 |
| D042 | 2,4,6-Trichlorophenol | _____ | 2.0 |
| | Vanadium | _____ | |
| D043 | Vinyl chloride | _____ | 0.2 |
| | Zinc | _____ | |
| | PCB | _____ | |

## TOTAL METALS

| Metals (ppm) | Avg. | Min. | Max. | Metals (ppm) | Avg. | Min. | Max. |
|---|---|---|---|---|---|---|---|
| Aluminum | — | — | — | Iron | — | — | — |
| Antimony | — | — | — | Lead | — | — | — |
| Arsenic | — | — | — | Mercury | — | — | — |
| Barium | — | — | — | Molybdenum | — | — | — |
| Beryllium | — | — | — | Nickel | — | — | — |
| Cadmium | — | — | — | Selenium | — | — | — |
| Chromium VI | — | — | — | Silver | — | — | — |
| Chromium III | — | — | — | Thallium | — | — | — |
| Cobalt | — | — | — | Vanadium | — | — | — |
| Fluoride | — | — | — | Zinc | — | — | — |

## CHEMICAL COMPOSITION

| Chemical Name | Avg. | Min. | Max. | Circle one: |
|---|---|---|---|---|
| _____ | — | — | — | % PPM PPB |
| _____ | — | — | — | % PPM PPB |
| _____ | — | — | — | % PPM PPB |
| _____ | — | — | — | % PPM PPB |
| _____ | — | — | — | % PPM PPB |
| _____ | — | — | — | % PPM PPB |
| _____ | — | — | — | % PPM PPB |
| Water | — | — | — | % PPM PPB |

## ADDITIONAL INFORMATION AND COMMENTS

Attached documentation: _____

## GENERATOR CERTIFICATION

I hereby certify, as an authorized representative of the generator named on Page w of this Waste Profile, that the information provided in this and all attached documents is true and correct; reveals any and all known or suspected hazards involving the handling, transportation, treatment, storage and disposal of this waste; and no willful misrepresentations or omissions have been made. I further certify and warrant that this identification is the result either of an analysis of a representative sample obtained and analyzed in accordance with the sampling and testing procedures specified by the U.S. Environmental Protection Agency or by applying knowledge of the process generating the specific waste being offered.

Generator's Signature _____ Title _____ Date _____

## Instructions for Completing the Investigation-Derived Waste Profile

1. ***General Information***. The mailing address of the generator and the site where the waste will be picked up should be indicated. The USEPA Identification Number for the site must be provided, unless the generator is a conditionally-exempt small quantity generator.

2. ***Waste Description***. This Section contains some general information about the waste, including how it was generated.

   USEPA hazardous waste codes are also included in this section. Waste codes are selected according to whether the waste contains any listed hazardous waste or whether the waste itself exhibits a characteristic of hazardous waste. There is a hierarchy for assigning waste codes which can be reviewed in detail in 40 CFR Part 261 of the federal hazardous waste regulation. Here's a simple explanation:

   a. If the remediation site is associated with a specific industrial process, first look under the K-code listing in 40 CFR §261.32 to determine if any of the generating processes match the activities previously conducted at the site. If so, the waste gets the K-code and go on to step "d" to assign characteristic codes. If the process is not described in the K-code list, go to step "b". There are very few specific industrial processes that would result in such IDW at Navy facilities.

   b. If the remediation site is associated with a non-specific industrial process that was not listed under the K-codes, look under the F-code listings in 40 CFR §261.31 to determine if any of the generating processes match the activity and contaminants at the site. If so, the waste gets the appropriate F-code, and then continue to step "d" to assign characteristic codes. If the process is not described in the F-code list, go to step "d". Some common F-code activities include use of solvents, wood treatment activities, and electroplating operations.

   c. If the remediation site is associated with the release of a commercial product, off-specification species or out-of-date product, look under the P-code and U-code listings in 40 CFR §261.33 for a match to the contaminants found at the site. P-code sates are acutely toxic, and U-code waste are listed for chronic toxicity, reactivity, or ignitability. A common activity which results in this type of waste is a pesticide storage area where containers were rinsed or where releases occurred. Don't forget to check the lists for common synonyms of the chemical. The CAS number may also be used to review the list of waste codes. If the waste does not match any of the chemicals in this list, go to step "J".

   d. If the waste doesn't fall into any of the categories listed above, you must consider the characteristic waste categories listed in 40 CFR Part 261. Subpart C. There are four categories of characteristics, known as D-code wastes: ignitable, corrosive, reactive and toxic. A waste may exhibit one or more of these characteristics. The only way to determine whether a waste is regulated as a characteristic waste is to take a sample and analyze it for the characteristic, or to use other analytical data to determine if it exhibits one or more characteristics. If the waste does not fall into any of the categories listed in steps "a" through "c" and does not exhibit a hazardous characteristic, it is not regulated as hazardous waste, although it may be regulated as designated waste.

      Characteristic waste codes regulated under federal regulations are assigned according to the type of characteristic exhibited.

3. ***Transportation Information***. This section is for completing the proper U.S. Department of Transportation shipping name, hazard class and UN/NA number. In addition, the reportable quantity (RQ) for the waste is shown here. DOT information is available in 40 CFR Part 172, and RQ information is available in 40 CFR Part 302.

4. ***Physical Properties***. Important physical characteristics are described in this section of the profile, including many of the characteristics to be used for verifying the waste identification when the waste is picked up by E/A&H's waste management contractor.

5. ***Toxicity Characteristics***. This section of the profile contains a comprehensive listing of chemical constituents that are regulated by USEPA. Their corresponding D-codes are shown in the list, as is the regulated level for each chemical. This section of the form should be completed even if the waste is listed as a K-code, F-code, P-code or

U-code. It is usually based on an analytical report for the waste. If a sample will be collected for toxicity characteristic analysis, the constituents selected for analysis should be based on a review of available corresponding environmental data, known activities at the site, and possible management methods for the waste.

6. ***Total Metals.*** Information on total metals is usually required for waste streams requiring certain types of treatment. For example, an inorganic sludge that exhibits a toxicity characteristic for cadmium and lead (D006 and D008) may be chemically stabilized to meet LDR treatment standards before it is landfilled. Usually this type of treatment consists of "fixing" the waste in a concrete-like material. In order to ensure that the required USEPA treatment standards will be met, the treatment company needs information on the total quantity of cadmium and lead in the waste so that it can develop the proper "recipe" for the waste and stabilizer.

7. ***Chemical Composition.*** All the components of the waste are listed, along with a range of their concentration. It is important that the average concentrations add up to 100%, so that all the components are represented. A composition listing for a typical solvent/water waste stream is on the following page.

| Chemical Name | Avg. | Min. | Max. | Conc. |
|---|---|---|---|---|
| Xylenol | 3 | 2 | 4 | % |
| Ethyl Acetate | 5 | 4 | 6 | % |
| Methanol | 1 | 1 | 2 | % |
| Ethanol | 1 | 1 | 2 | % |
| Hexone (Methyl Isobutyl Ketone) | 1 | 1 | 2 | % |
| Aliphatic Naphtha (carrier) | 69 | 50 | 70 | % |
| Water | 20 | 10 | 55 | % |
| **Total Composition** | 100 | N/A | N/A | % |

8. ***Additional Information and Comments.*** This section is for explaining any special conditions or handling required for the waste. In addition, this section should list the supporting documentation attached to the profile to support the waste characterization.

9. ***Generator Certification.*** The generator certification should be signed by the environmental coordinator for the Navy installation where the waste is generated.

**Appendix C**
**Sample Storage Area Inspection Form**

## ACCUMULATION STORAGE UNIT
## GENERAL INSPECTION - WEEKLY

**INSPECTED BY:** _____ _____ __/__/__ _____
Inspector' name (print) Signature Date Time

**REVIEWED BY:** _____ _____ __/__/__ _____
Manager's name (print) Signature Date Time

| EQUIPMENT/AREA | SAT | UNSAT | COMMENTS |
|---|---|---|---|
| **FACILITY PROPER** | | | |
| **Evacuation Routes** | | | |
| Access (Unobstructed) . . . . . | | | |
| Emergency exits unlocked at start of day . . . . . | | | |
| **Pavement/curbing** | | | |
| No evidence of leakage, spillage, or accumulated liquid . | | | |
| **Access Road** | | | |
| Access (Unobstructed) . . . . . | | | |
| Condition (No holes, depressions, or debris) . . . . . | | | |
| **SECURITY DEVICES** | | | |
| **Fences** | | | |
| Condition (No damage or corrosion). . . . . | | | |
| **Gates** | | | |
| Condition (No damage or corrosion) . . . . . | | | |
| Operation (Swing or slide freely) . . . . . | | | |
| Access (Unobstructed) . . . . . | | | |
| **Padlocks** | | | |
| Present at each gate . . . . . | | | |
| Operation . . . . . | | | |
| **Warning Signs** | | | |
| Presence (Maximum 75 feet apart) . . . . . | | | |
| Legibility (From a minimum 25 feet apart) . . . . . | | | |
| **SAFETY AND EMERGENCY EQUIPMENT** | | | |
| **Emergency Shower/Eye Wash Stations** | | | |
| Adequate supply of eyewash solution . . . . . | | | |
| Handle operation . . . . . | | | |
| Water Pressure, volume, and flow . . . . . | | | |
| Identification signs (Present, legible, and in satisfactory condition) . . . . . | | | |
| Access (Unobstructed) . . . . . | | | |

# Appendix D
# Drum Inventory Form

# EnSafe/Allen & Hoshall

## Investigation Derived Waste: Drum Inventory

| Project Name: | | | Project Number: | | |
|---|---|---|---|---|---|
| Client: | | | Site No.: | | |
| Survey Date: | | | Surveyor: | | |
| | Boring/Well No. | Contents | Date Generated | # Drums | Comments |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |
| 13 | | | | | |
| 14 | | | | | |
| 15 | | | | | |
| 16 | | | | | |
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| 19 | | | | | |
| 20 | | | | | |

# APPENDIX B

# FORMS

Tetra Tech NUS, Inc.

# BORING LOG



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

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

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 |
|---|---|---|---|---|
| | | | | |
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COMMENTS: _____

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_____

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APPROVED BY:

_____ _____

Tt NUS REPRESENTATIVE SUBCONTRACTOR REPRESENTATIVE

DATE: _____

Tetra Tech NUS, Inc.

# EQUIPMENT CALIBRATION LOG

PROJECT NAME : ______________________

SITE NAME: ______________________

PROJECT No.: ______________________

INSTRUMENT NAME/MODEL: ______________________

MANUFACTURER: ______________________

SERIAL NUMBER: ______________________

| Date of Calibration | Instrument I.D. Number | Person Performing Calibration | Instrument Settings | | Instrument Readings | | Calibration Standard (Lot No.) | Remarks and Comments |
|---|---|---|---|---|---|---|---|---|
| | | | Pre-calibration | Post-calibration | Pre-calibration | Post-calibration | | |
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# Tetra Tech NUS, Inc.

**PROJECT:** _____ **LOCATION:** _____

**JOB & CTO #:** _____ / _____ **DEPART:** _____

**TOM:** _____ **RETURN:** _____

## FIELD CHECKLIST

### TRAVEL

**American Express**

___ Airline reservations
___ Hotel reservations/BQOs
___ Car rental
___ Itinerary

### DRILLING/DPT/SURVEY

**Subcontractor**

___ POC phone #/address
___ Drill Specification RFP
___ Contact (time & place to meet)
___ Confirm Subcontract w/ S. Scaff
___ Health and Safety info. for all personnel on site
___ Copy of Drillers liscense
___
___

**Utilities (2 weeks lead time?)**

___ Contact Site POC (Date:_____)
___ Contact "Call Before You Dig"
___ Utility Clearance Form

**Forms**

___ Boring logs
___ Well construction forms
___ Daily activity forms
___ IDW inventory/manifest
___ IDW drum labels
___ Chemical Inventory
___ MSDS sheets

### EQUIPMENT

___ Fillout Equipment Requisition Form
___ Order equipment from TtNUS warehouse (Tom Patton)
___ Order rental/misc. equip
___ Equipment calibration forms
___ Span/cal. gas and regulator

### SAMPLING

**Forms**

___ Sample log sheets
___ COC records
___ COC seals
___ Sample labels (from Lee Leck)

**Laboratory**

___ POC address/phone#
___ Order bottles/hold times
___ Shipping address
___ Bottle & preservation requirements from lab
___

### MISCELLANEOUS

___ Site POC name/phone #

**Schedule**

___ Plan field operations w/TOM

**Documents**

___ Logbook(s)
___ Work plan
___ Field Sampling plan (1 per field tech.)
___ Health & Safety plan
___ Maps

**Authorization**

___ Gov't rate letter
___ H&S/OSHA 40-hour certifcate
___ 8-Hour Refresher Training Certificate
___ Medical Clearance Letter
___ Supervisory Training Certificate
___ Health & Safety Clearance Letter
___ Full-size OSHA Poster
___

### HYDRO

**Forms**

___ Slug test/pumping test forms
___ Groundwater elevation sheets
___ Graph paper
___ Hermit/slug/transducer/data cable
___ Existing well const & water level data

### SHIPPING

**Forms**

___ FedEx Airbills
___ FedEx location
___ FedEx Gov. Acct# (1771-8058-0)
___ FedEx Package Windows
___ Lab Shipping Labels
___ Warehouse Shipping Labels
___ Blank Labels

**Supplies**

___ Tape
___ Lg. garbage bags

### OTHER

___ Personnell information to POC
___ Mobilization schedule to POC
___ Steel-toed boot & hard hat
___
___
___
___
___
___
___
___

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 |
|---|---|---|---|---|---|---|---|---|
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* All measurements to the nearest 0.01 foot

Tetra Tech NUS, Inc.

# GROUNDWATER SAMPLE LOG SHEET



Project Site Name: _____
Project No.: _____

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

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

**SAMPLING DATA:**

| Date: / Time: | Color Visual | pH Standard | S.C. mS/cm | Temp. °C | Turbidity NTU | DO mg/l | TBD | TBD |
|---|---|---|---|---|---|---|---|---|
| Method: | | | | | | | | |

**PURGE DATA:**

| Date: | Volume | pH | S.C. | Temp. (C) | Turbidity | DO | TBD | TBD |
|---|---|---|---|---|---|---|---|---|
| Method: | | | | | | | | |
| Monitor Reading (ppm): | | See Low Flow Purge Data Sheet | | | | | | |
| 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 |
|---|---|---|---|
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**OBSERVATIONS / NOTES:**

See Field Analytical Log Sheets for Geochemical Parameters (i.e. natural attenuation).

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

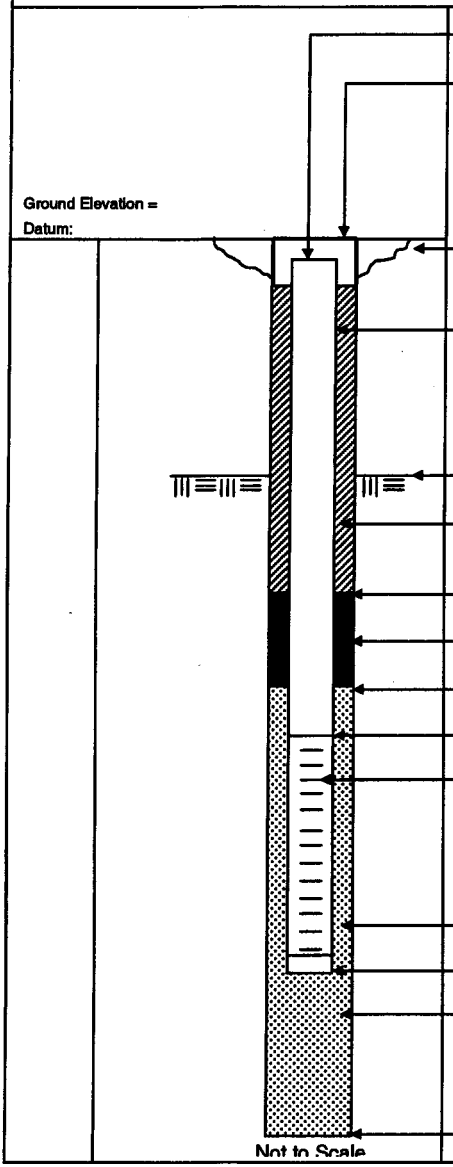
TBD: To Be Determinec

Tetra Tech NUS, Inc.

WELL No.: _____

## MONITORING WELL SHEET

| | | | | | |
|---|---|---|---|---|---|
| PROJECT: | _____ | DRILLING Co.: | _____ | BORING No.: | _____ |
| PROJECT No.: | _____ | DRILLER: | _____ | DATE COMPLETED: | _____ |
| SITE: | _____ | DRILLING METHOD: | _____ | NORTHING: | _____ |
| GEOLOGIST: | _____ | DEV. METHOD: | _____ | EASTING: | _____ |




Elevation / Depth of Top of Riser: _____ /

Elevation / Height of Top of Surface Casing: _____ /

I.D. of Surface Casing: _____

Type of Surface Casing: _____

Type of Surface Seal: _____

_____

I.D. of Riser: _____

Type of Riser: _____

Borehole Diameter: _____

Elevation / Depth Top of Rock: _____ /

Type of Backfill: _____

_____

Elevation / Depth of Seal: _____ /

Type of Seal: _____

Elevation / Depth of Top of Filter Pack: _____ /

Elevation / Depth of Top of Screen: _____ /

Type of Screen: _____

Slot Size x Length: _____

I.D. of Screen: _____

Type of Filter Pack: _____

Elevation / Depth of Bottom of Screen: _____ /

Elevation / Depth of Bottom of Filter Pack: _____ /

Type of Backfill Below Well:

_____

Elevation / Total Depth of Borehole: _____ /

Tetra Tech NUS, Inc.

# MONITORING WELL DEVELOPMENT RECORD



Well: _____ Depth to Bottom (ft.): _____ Responsible Personnel: _____
Site: _____ Static Water Level Before (ft.): _____ Drilling Co.: _____
Date Installed: _____ Static Water Level After (ft.): _____ Project Name: _____
Date Developed: _____ Screen Length (ft.): _____ Project Number: _____
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 |
|---|---|---|---|---|---|---|---|---|
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Tetra Tech NUS, Inc.

# SOIL & SEDIMENT SAMPLE LOG SHEET



Project Site Name: _____
Project No.: _____

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

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

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

**GRAB SAMPLE DATA:**

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

**COMPOSITE SAMPLE DATA:**

| Date: | Time | Depth | Color | Description (Sand, Silt, Clay, Moisture, etc.) |
|---|---|---|---|---|
| | | | | |
| Method: | | | | |
| | | | | |
| Monitor Readings (Range in ppm): | | | | |
| | | | | |
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**SAMPLE COLLECTION INFORMATION:**

| Analysis | Container Requirements | Collected | Other |
|---|---|---|---|
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**OBSERVATIONS / NOTES:**

**MAP:**

**Circle if Applicable:**

| MS/MSD | Duplicate ID No.: |
|---|---|

**Signature(s):**

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.) | CORREC-TION (Ft.) | DRAW DOWN OR RECOVERY (Ft.) | FLOW METER READING (Gals.) | PUMPING RATE (GPM) | REMARKS |
|---|---|---|---|---|---|---|---|
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# APPENDIX C

# TTNUS STANDARD OPERATING PROCEDURES

| TETRA TECH NUS, INC. | STANDARD OPERATING PROCEDURES | Number CT-04 | Page 1 of 6 |
|---|---|---|---|
| | | Effective Date 03/01/96 | Revision 0 |
| | | Applicability Tetra Tech NUS, Inc. | |
| | | Prepared Risk Assessment Department | |
| Subject SAMPLE NOMENCLATURE | | Approved D. Senovich | |

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| 5.3 | EXAMPLE SAMPLE FIELD DESIGNATIONS | 4 |

## 1.0 PURPOSE

The purpose of this document is to specify a consistent sample nomenclature system that will facilitate subsequent data management in a cost-effective manner. The sample nomenclature system has been devised such that the following objectives can be attained:

- Sorting of data by matrix.
- Sorting of data by depth.
- Maintenance of consistency (field, laboratory, and data base sample numbers).
- Accommodation of all project-specific requirements on a global basis.
- Accommodation of laboratory sample number length constraints (10 characters).

## 2.0 SCOPE

The methods described in this procedure shall be used consistently for all projects requiring electronic data handling managed by personnel located in the Northeast Region of Brown & Root Environmental (Pittsburgh, Wayne, Holt, and Wilmington) and for any large contracts managed by the Northeast Region (e.g., NORTHDIV CLEAN, SOUTHDIV CLEAN, ARCS I, ARCS III, etc.). Smaller projects (as determined by Project Manager) are outside the scope of this SOP.

## 3.0 GLOSSARY

None.

## 4.0 RESPONSIBILITIES

**Program Manager** - It shall be the responsibility of the Program Manager (or designee) to inform contract-specific Project Managers of the existence and requirements of this Standard Operating Procedure.

**Project Manager** - It shall be the responsibility of the Project Manager to determine the applicability of this Standard Operating Procedure based on: (1) program-specific requirements, and (2) project size and objectives. It shall be the responsibility of the Project Manager (or designee) to ensure that the sample nomenclature is thoroughly specified in the relevant project planning document (e.g., sampling and analysis plan) and is consistent with this Standard Operating Procedure if relevant. It shall be the responsibility of the project manager to ensure that the Field Operations Leader is familiar with the sample nomenclature system.

**Field Operations Leader** - It shall be the responsibility of the Field Operations Leader to ensure that all field technicians or sampling personnel are thoroughly familiar with this Standard Operating Procedure and the project-specific sample nomenclature system. It shall be the responsibility of the Field Operations Leader to ensure that the sample nomenclature system is used during all project-specific sampling efforts.

## 5.0 PROCEDURES

### 5.1 Introduction

The sample numbering system consists of 12 distinct alpha-numeric characters, only 10 of which will be provided to the laboratory on the sample labels and chain-of-custody forms. The sample number provided to the lab shall be as follows where "A" indicates "alpha," "N" indicates "numeric," and "E" indicates "either"):

$$\overline{E}\ \overline{E}\ \overline{E}\ \overline{A}\ \overline{A}\ \overline{E}\ \overline{E}\ \overline{E}\ \overline{N}\ \overline{N}$$

Once the analytical results are received from the laboratory the sample number will be revised by a subroutine such that the sample number is more user friendly (i.e., dashes will be inserted). The sample number will then appear as follows:

$$\overline{E}\ \overline{E}\ \overline{E}\ -\ \overline{A}\ \overline{A}\ -\ \overline{E}\ \overline{E}\ \overline{E}\ -\ \overline{N}\ \overline{N}$$

If multiple sampling events occur (or are planned) for a given matrix, a subroutine within the database will be used to append two additional characters such that the sample number will appear as follows:

$$\overline{E}\ \overline{E}\ \overline{E}\ -\ \overline{A}\ \overline{A}\ -\ \overline{E}\ \overline{E}\ \overline{E}\ -\ \overline{N}\ \overline{N}\ -\ \overline{N}\ \overline{N}$$

Site Type Location Depth Round

### 5.2 Sample Number Field Requirements

The various fields in the sample number will include the following:

- Site Identifier
- Sample Type
- Sample Location
- Sample Depth Indicator
- Sampling Round

The site identifier must be a three-character field (numeric characters, alpha characters, or a mixture of alpha and numeric characters may be used). A site number is necessary since many facilities/sites have multiple individual sites, SWMUs, operable units, etc.

The sample type must be a two-character alpha field. Suggested codes are provided in Section 5.3 of this SOP.

The sample location must be a three-character field (alpha, numeric, or a mixture).

The depth field must be provided for all samples, regardless if it is strictly applicable (as discussed in Section 5.3).

The sampling round is optional, but, if provided, must be two numeric characters.

## 5.3 Example Sample Field Designations

Examples of each of the fields are as follows:

Site Number - Examples of site numbers/designations are as follows:

A01 - Area of Concern Number 1
125 - Solid Waste Management Unit Number 125
000 - Base or Facility Wide Sample (e.g., upgradient well)
BBG - Base Background

The examples cited are only suggestions. Each Project Manager (or designee) must designate appropriate (and consistent) site designations for their individual project.

Sample Type - Examples of sample types are as follows:

AS - Air Sample
BS - Biota Sample (See Note)
CP - Composite Sample
CS - Chip Sample
DS - Drum Sample
DU - Dust Sample
FP - Free Product
ID - Investigation Derived Waste Sample
LT - Leachate Sample
MW - Monitoring Well
OF - Outfall Sample
RW - Residential Well Sample
SB - Soil Boring Sample
SD - Sediment Sample
SC - Scrape Sample
SG - Soil Gas Sample
SP - Seep Sample
SS - Surface Soil Sample
SU - Subsurface Soil Sample
SW - Surface Water Sample
TP - Test Pit Sample
TW - Temporary Well Sample
WC - Well Construction Material Sample
WI - Wipe Sample
WP - Well Point Sample
WS - Waste/Sludge Sample

Note: The biota sample designation may be contingent upon the type of biota sampled (e.g., BL - Lobster; BF - Finfish; BC - Clam; BO - Oyster). Numerous other examples can be cited but will be site-specific.

This field will also be used to designate field Quality Control Samples, as follows:

TB - Trip Blank
FB - Field Blank
RB - Rinsate Blank (Equipment Blank)
BB - Bottle Blank
AB - Ambient Condition Blank

Field quality control samples should be numbered sequentially (e.g., RB-001; FB-010, etc.).

Filtered/unfiltered surface water or groundwater samples shall be handled in an separate manner, as subsequently discussed.

Location - Examples of the location field are as follows:

A01 - Grid node A1
001 - Monitoring Well 1

It is important that consistency be maintained with respect to the use of the characters "0" and O. Data base subroutines will not sort correctly if a mixture are used (e.g, AO1 and A02).

Depth - Formerly, depth specifications were indicated with a four digit field (e.g., 0002 - 0 to 2 feet). While this is effective for depth sorting, it is difficult to include this level of detail in a 10-character lab number (FormMaster limitations). In addition, this approach will not accommodate non-integer depths (e.g., 2.5 feet to 4.5 feet).

Based on such potential problems, the following approach shall be used: Sample depths will simply represent the horizon from which the sample was obtained: For example, if ten split-spoon samples are collected from a boring, they will be numbered 01 through 10. The sample log sheet will be used to record the specific depth of the sample, and this information will be entered in a separator field in the data base.

Similar nomenclature will be used for depth-specific surface water and sediment samples, etc. If no depth information is required (e.g., groundwater samples), the field must still be filled (e.g., ø, ø).

This field will also be used for the designation of filtered and unfiltered samples. An unfiltered groundwater sample shall be designated as U0, if and only if, a corresponding filtered sample is collected. Such as sample shall be designated as F0.

Sampling Round - The sampling round field is straightforward. It can range from 01 to 99.

## 5.4 Example Sample Numbers

Examples of complete sample numbers (field/data base versus laboratory) are as follows:

| Field/Data Base ID | Lab ID | Description |
|---|---|---|
| 101-SB-A01-01 | 101SBA0101 | The first sample (e.g., 0 to 2 feet) from soil boring A01 (grid) at Site 101. |
| 101-SB-A01-02 | 101SBA0102 | The second sample from boring A01 (could be the next depth interval or a duplicate of 101-SB-A01-01). |
| 125-MW-001-01-01 | 125MW00101 | A groundwater sample from monitoring well MW001 (first sampling round) |
| 125-MW-001-02-01 | 125MW00102 | A duplicate groundwater sample from monitoring well MW001 (first sampling round) |
| 130-MW-003-U1-01 | 130MW003U1 | An unfiltered groundwater sample from monitoring well MW003 (first sampling round) |
| 130-MW-003-F1-01 | 130MW003F1 | A filtered groundwater sample from monitoring well MW003 (first sampling round) |
| 137-RB-001-00-01 | 137RB00100 | The first rinsate blank collected at site 137. |
| 137-TB-004-00-02 | 137TB00400 | The fourth trip blank collected during the second sampling event at Site 137. |
| 155-SW-003-01-01 | 155SW00301 | A surface water sample collected from the surface of a pond at Site 155. |
| 155-SW-003-02-01 | 155SW00302 | A surface water sample collected from the bottom of the water column in a pond at Site 155. |

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

**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 |
|---|---|---|---|
| | | | |
| | | | |
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**OBSERVATIONS / NOTES**

Circle if Applicable

MS/MSD | Duplicate ID No.:

Signature(s):

## ATTACHMENT B-2

Tetra Tech NUS, Inc. **SURFACE WATER SAMPLE LOG SHEET**

Page___ of___

Project Site Name: _____
Project No.: _____

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

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

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

**SAMPLING DATA**

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

**SAMPLE COLLECTION INFORMATION**

| Analysis | Preservative | Container Requirements | Collected |
|---|---|---|---|
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**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.: _____

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

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

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 |
|---|---|---|---|
| | | | |
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**OBSERVATIONS/NOTES:**

**MAP:**

**Circle if Applicable:**

MS/MSD

Duplicate ID No.:

**Signature(s):**

ATTACHMENT B-4

## CONTAINER SAMPLE & INSPECTION SHEET

Tetra Tech NUS, Inc.

Page____ of ____

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

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

### CONTAINER SOURCE

DRUM:
0 Bung Top
0 Lever Lock
0 Bolted Ring
0 Other _____

TANK:
0 Plastic
0 Metal
0 Other _____

OTHER: _____

### CONTAINER DESCRIPTION

COLOR: _____

CONDITION: _____

MARKINGS: _____

VOL OF CONTENTS: _____

OTHER: _____

### CONTAINER DISPOSITION

SAMPLED: _____

OPENED BUT NOT SAMPLED:
Reason _____
_____

NOT OPENED:
Reason _____
_____

### CONTENTS DESCRIPTION

SINGLE PHASED: _____
_____

MULTIPHASE :

| | Layer 1 | Layer 2 | Layer 3 |
|---|---|---|---|
| Phase (Sol. or Liq.) | _____ | _____ | _____ |
| Color | _____ | _____ | _____ |
| Viscosity | L, M or H | L, M or H | L, M orH |
| % of Total Volume | _____ | _____ | _____ |

### MONITOR READING

### SAMPLE and/or INSPECTION DATE / TIME

_____HRS.

METHOD: _____

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

### ANALYSIS

ATTACHMENT B-5

| | | |
|---|---|---|
| Tetra Tech NUS, Inc.<br>661 Andersen Drive<br>Pittsburgh, 15220<br>(412)921-7090 | Project:<br>Site:<br>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 |
|---|---|---|---|---|---|---|---|---|
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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

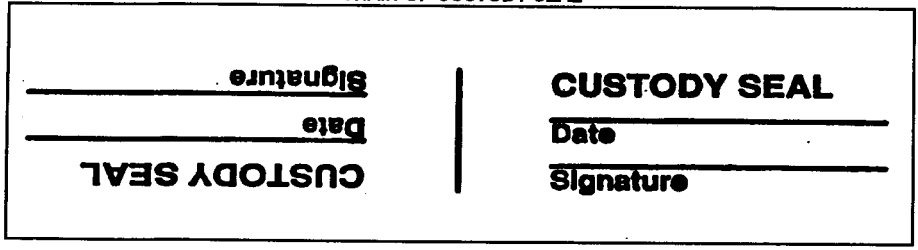
COMMENTS

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

3/99 FORM NO. TtNUS-001

ATTACHMENT B-7

CHAIN-OF-CUSTODY SEAL



## ATTACHMENT B-8

### FIELD ANALYTICAL LOG SHEET
### GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc.

Page __ of __

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

Sampled By: _____ Duplicate: ☐

Field Analyst: _____ Blank: ☐

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

**SAMPLING DATA**

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

**FIELD ANALYTICAL LOG SHEET**
**GEOCHEMICAL PARAMETERS**

Tetra Tech NUS, Inc.

Page __ of __

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

Sampled By: _____ Duplicate: ☐

Field Analyst: _____ Blank: ☐

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

SAMPLE COLLECTION/ANALYSIS INFORMATION

**Sulfide ($S^{2-}$):**

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

Program/Module: 610nm 93

Concentration: _____ mg/L Filtered: ☐

Notes: _____

**Sulfate ($SO_4^{2-}$):**

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

Program/Module: 91

Concentration: _____ mg/L Filtered: ☐

Standard Solution: ☐ Results: _____

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

Notes: _____

**Nitrite ($NO_2^-$-N):**

Analysis Time: _____

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

Program/Module: 60

Concentration: _____ mg/L Reagent Blank Correction: ☐

Standard Solution: ☐ Results: ☐

Notes: _____

**Nitrate ($NO_3^-$-N):**

Analysis Time: _____

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

Program/Module: 55

Concentration: _____ mg/L

Nitrite Interference Treatment: ☐

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

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

Notes: _____

## ATTACHMENT B-8 (Continued)

### FIELD ANALYTICAL LOG SHEET
### GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc. Page __ of __

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

Sampled By: _____ Duplicate: ☐

Field Analyst: _____ Blank: ☐

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

SAMPLE COLLECTION/ANALYSIS INFORMATION

**Manganese ($Mn^{2+}$):**

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

Program/Module: 525nm 41

Concentration: _____ mg/L Filtered: ☐

Digestion: ☐

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

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

Notes: _____

**Ferrous Iron ($Fe^{2+}$):**

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

Program/Module: 500nm 33

Concentration: _____ mg/L Filtered: ☐

Notes: _____

**Hydrogen Sulfide ($H_2S$):**

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

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

Notes: _____

**QA/QC Checklist:**

All data fields have been completed as necessary: ☐

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

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

Multiplication is correct for each *Multiplier* table: ☐

Final calculated 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 |
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* 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 (FL) | DRAW DOWN OR RECOVERY (FL) | PUMPING RATE (GPM) | FLOW METER READING (GAL) | REMARKS |
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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) |
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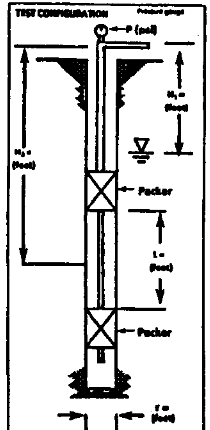
CP = (1/(2 π L)) ln( L/r) (70,315.5)
7.48 Gallons = 1 Ft³
1 psi = 2.31 ft head
Remarks: ______

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




| Length of Test Section in feet, L | Cp | | | |
|---|---|---|---|---|
| | Drilling Bit Size | | | |
| | EX | AX | BX | NX |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 10 | [illegible] | [illegible] | [illegible] | [illegible] |
| 15 | [illegible] | [illegible] | [illegible] | [illegible] |
| 20 | [illegible] | [illegible] | [illegible] | [illegible] |

## 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 Sampling Conditions* or Rock Hardness | MATERIAL DESCRIPTION: Color | MATERIAL DESCRIPTION: Material Classification | USCS* | Remarks | PID/FID Reading (ppm): Sample | PID/FID Reading (ppm): Bore Hole | PID/FID Reading (ppm): Background | PID/FID Reading (ppm): Breathing Zone |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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* When rock coring, enter rock brokenness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: _____

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

## ATTACHMENT C4 (Continued)

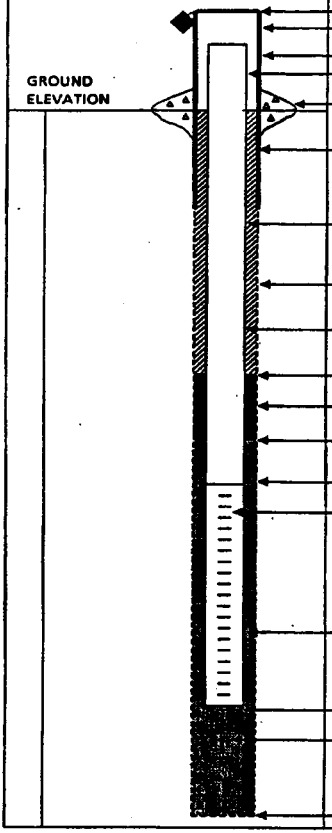
## ATTACHMENT C-5
## EXAMPLE OVERBURDEN MONITORING WELL SHEET

BORING NO.: _____

**OVERBURDEN**
**MONITORING WELL SHEET**

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

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____




ELEVATION OF TOP OF SURFACE CASING : _____
ELEVATION OF TOP OF RISER PIPE: _____
STICK - UP TOP OF SURFACE CASING: _____
STICK - UP RISER PIPE : _____
TYPE OF SURFACE SEAL: _____
I.D. OF SURFACE CASING: _____
TYPE OF SURFACE CASING: _____
RISER PIPE I.D. _____
TYPE OF RISER PIPE: _____
BOREHOLE DIAMETER: _____
TYPE OF BACKFILL: _____
ELEVATION / DEPTH TOP OF SEAL: _____ / _____
TYPE OF SEAL: _____
DEPTH TOP OF SAND PACK: _____
ELEVATION / DEPTH TOP OF SCREEN: _____ / _____
TYPE OF SCREEN: _____
SLOT SIZE x LENGTH: _____
I.D. OF SCREEN: _____
TYPE OF SAND PACK: _____
ELEVATION / DEPTH BOTTOM OF SCREEN: _____ / _____
ELEVATION / DEPTH BOTTOM OF SAND PACK: _____ / _____
TYPE OF BACKFILL BELOW OBSERVATION WELL: _____
ELEVATION / DEPTH OF HOLE: _____ / _____

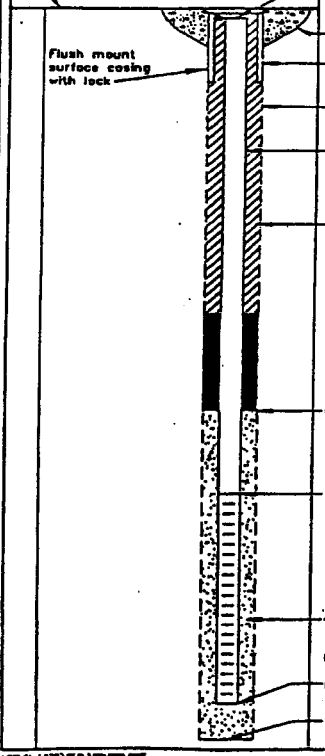
## ATTACHMENT C-5A
## EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)

BORING NO.: _____

# MONITORING WELL SHEET

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

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____




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

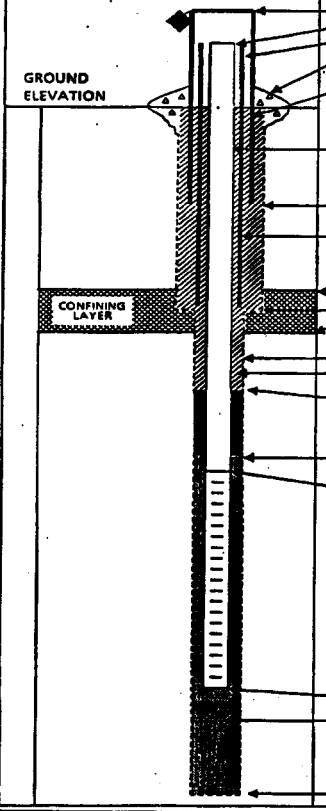
## ATTACHMENT C-6
## EXAMPLE CONFINING LAYER MONITORING WELL SHEET

BORING NO.: _____

### CONFINING LAYER
### MONITORING WELL SHEET

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

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____




ELEVATION OF TOP OF SURFACE CASING : _____
ELEVATION OF TOP OF RISER PIPE: _____
ELEVATION TOP OF PERM. CASING: _____
TYPE OF SURFACE SEAL: _____
I.D. OF SURFACE CASING: _____
TYPE OF SURFACE CASING: _____
RISER PIPE I.D. _____
TYPE OF RISER PIPE: _____
BOREHOLE DIAMETER: _____
PERM. CASING I.D. _____
TYPE OF CASING & BACKFILL: _____
ELEVATION / DEPTH TOP CONFINING LAYER: _____
ELEVATION / DEPTH BOTTOM OF CASING: _____
ELEVATION / DEPTH BOT. CONFINING LAYER: _____
BOREHOLE DIA. BELOW CASING: _____
TYPE OF BACKFILL: _____
ELEVATION / DEPTH TOP OF SEAL: _____
TYPE OF SEAL: _____
DEPTH TOP OF SAND PACK: _____
ELEVATION/DEPTH TOP OF SCREEN: _____
TYPE OF SCREEN: _____
TYPE OF SAND PACK: _____
ELEVATION / DEPTH BOTTOM OF SCREEN: _____
ELEVATION / DEPTH BOTTOM OF SAND PACK: _____
TYPE OF BACKFILL BELOW OBSERVATION WELL: _____
ELEVATION / DEPTH OF HOLE: _____

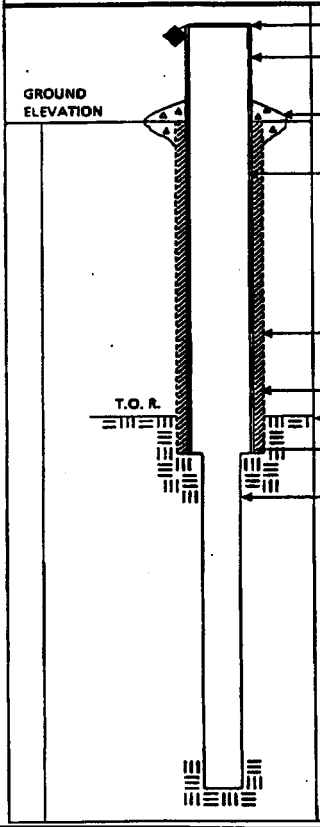
## ATTACHMENT C-7
## EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL

BORING NO.: _____

**BEDROCK**
**MONITORING WELL SHEET**
**OPEN HOLE WELL**

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

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____




ELEVATION OF TOP OF CASING: _____

STICK UP OF CASING ABOVE GROUND SURFACE: _____

TYPE OF SURFACE SEAL: _____

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

TEMP. / PERM.: _____

DIAMETER OF HOLE: _____

TYPE OF CASING SEAL: _____

DEPTH TO TOP OF ROCK: _____

DEPTH TO BOTTOM CASING: _____

DIAMETER OF HOLE IN BEDROCK: _____

DESCRIBE IF CORE / REAMED WITH BIT:

_____
_____
_____

DESCRIBE JOINTS IN BEDROCK AND DEPTH:

_____
_____
_____

ELEVATION / DEPTH OF HOLE: _____ / _____

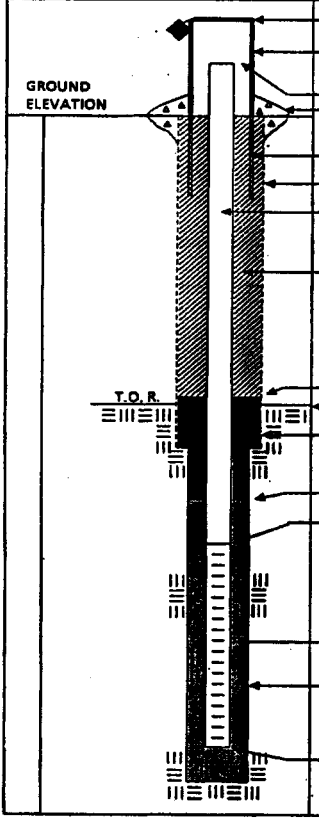
## ATTACHMENT C-8
## EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK

BORING NO.: _____

# BEDROCK
# MONITORING WELL SHEET
## WELL INSTALLED IN BEDROCK

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

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____




ELEVATION OF TOP OF SURFACE CASING: _____

STICK UP OF CASING ABOVE GROUND SURFACE: _____

ELEVATION TOP OF RISER: _____

TYPE OF SURFACE SEAL: _____

I.D. OF SURFACE CASING: _____

DIAMETER OF HOLE: _____

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

TYPE OF BACKFILL: _____

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

TYPE OF SEAL: _____

ELEVATION / DEPTH TOP OF SAND: _____ / _____

ELEVATION / DEPTH TOP OF SCREEN: _____ / _____

TYPE OF SCREEN: _____

SLOT SIZE x LENGTH: _____

I.D. SCREEN: _____

TYPE OF SAND PACK: _____

DIAMETER OF HOLE IN BEDROCK:

CORE / REAM: _____

ELEVATION / DEPTH BOTTOM SCREEN: _____ / _____

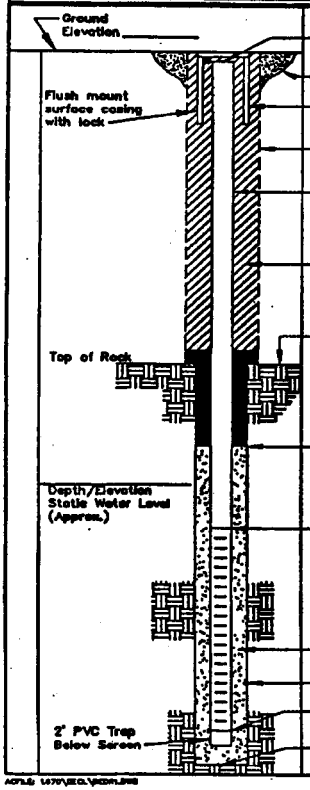
ELEVATION / DEPTH BOTTOM OF HOLE: _____ / _____

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

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: _____

## 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 (Boundary) | MATERIAL DESCRIPTION (Soil Density / Consistency, Color) | VOCs | 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.) |
|---|---|---|---|---|---|---|---|---|
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## 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 | | |
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## 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 |
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COMMENTS: _____

APPROVED BY:

_____ _____

Tt NUS REPRESENTATIVE DRILLER

DATE: _____

**ATTACHMENT F**
**FIELD TRIP SUMMARY REPORT**
**PAGE 1 OF 2**

**SUNDAY**
Date: _____ Personnel: _____
Weather: _____ Onsite: _____

Site Activities: _____

**MONDAY**
Date: _____ Personnel: _____
Weather: _____ Onsite: _____

Site Activities: _____

**TUESDAY**
Date: _____ Personnel: _____
Weather: _____ Onsite: _____

Site Activities: _____

**WEDNESDAY**
Date: _____ Personnel: _____
Weather: _____ Onsite: _____

Site Activities: _____

**ATTACHMENT F**
**PAGE 2 OF 2**
**FIELD TRIP SUMMARY REPORT**

**THURSDAY**

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

_____

_____

_____

**FRIDAY**

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

_____

_____

_____

**SATURDAY**

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

_____

_____

_____

# APPENDIX D

# HEALTH AND SAFETY PLAN

Rev. 0
03/21/02

# Health and Safety Plan
for
# Monitoring Well Installation
and
# Multi-media Sampling

## Naval Air Station Pensacola
Pensacola, Florida

**Southern Division**
**Naval Facilities Engineering Command**
**Contract No. N62467-94-D-0888**
**Contract Task Order 0222**

March 2002

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# HEALTH AND SAFETY PLAN
# FOR
# MONITORING WELL INSTALLATION
# AND
# MULTI-MEDIA SAMPLING

**NAVAL AIR STATION PENSACOLA**
**PENSACOLA, FLORIDA**

**COMPREHENSIVE LONG-TERM**
**ENVIRONMENTAL ACTION-NAVY (CLEAN) CONTRACT**

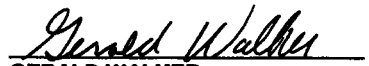
**Submitted to:**
**Southern Division**
**Naval Facilities Engineering Command**
**2155 Eagle Drive**
**North Charleston, South Carolina 29406**

**Submitted by:**
**Tetra Tech NUS, Inc.**
**661 Andersen Drive**
**Pittsburgh, Pennsylvania 15222**

**CONTRACT NUMBER N62467-94-D-0888**
**CONTRACT TASK ORDER 0222**

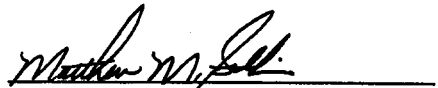
**MARCH 2002**

**PREPARED UNDER THE SUPERVISION OF:**



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

**APPROVED FOR SUBMITTAL BY:**



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

# 1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been written to encompass activities that are to be conducted at Building 3241Tank Site on the Naval Air Station (NAS) Pensacola, Pensacola, Florida as part of Contract Task Order (CTO) 0222. Specifically, this HASP addresses the investigation to determine the extent of petroleum contamination resulting from the former Underground Storage Tank (UST) at Building 3241.

This HASP is 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 (SOUTHNAVFACENGCOM), 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 Code of Federal Regulations (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. 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 onsite 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 onsite activities. Personnel assigned to these positions will exercise the primary responsibility for all onsite 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 onsite activities.

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

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

  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 Site Safety Officer (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 onsite activities.
  v. Verifies training and medical clearance of onsite personnel status in relation to site activities.
  vi. Implements Hazard Communication, Respiratory Protection Programs, and other associated health and safety programs as they may apply to site activities.
  vii. Coordinates emergency services.
  viii. Provides site-specific training for all onsite 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 monitoring well installation and multi media sampling

**Proposed Dates of Work:** March 2002 - March 2003

**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 Snyder | Project Health and Safety Officer (PHSO) |
| TBD | Site Safety Officer (SSO) |

| **Non-TtNUS Personnel** | **Affiliation/Discipline/Tasks Assigned** |
|---|---|
| TBD | Drilling Subcontractor(s) |
| TBD | IDW Subcontractor |

Prepared By: Clyde 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. All site activities will be coordinated with NAS Pensacola fire protection and emergency services prior to commencement. In the event of an emergency, which cannot be mitigated using onsite resources, personnel will evacuate to a safe place of refuge and the FOL will call 911 and 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 onsite), with Material Safety Data Sheets (MSDS).

- Onsite personnel medical records (medical data sheets).
- A logbook identifying personnel onsite 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)<br>(Police, Fire, and Ambulance Services) | **911** |
| NAS Pensacola - Emergency Dispatch | (850) 452-3333 |
| Navy Engineer-in-Charge<br>Byas Glover | (843) 820-5651 |
| Facility Point of Contact<br>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<br>Northwest Region Office | (850) 265-3676 |
| WorkCare | (800) 229-3674 |
| TtNUS Tallahassee Office<br>and Task Order Manager (Gerry Walker) | (850) 385-9899 |
| CLEAN Health and Safety Manager<br>Matthew M. Soltis, CIH, CSP | (412) 921-8912 |
| Project Health and Safety Officer<br>Clyde Snyder | (412) 921-8904 |

## 2.8 ROUTE TO HOSPITALS

Two hospitals could potentially be used during this project depending on the circumstances and degree of the emergency. 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 2-2.

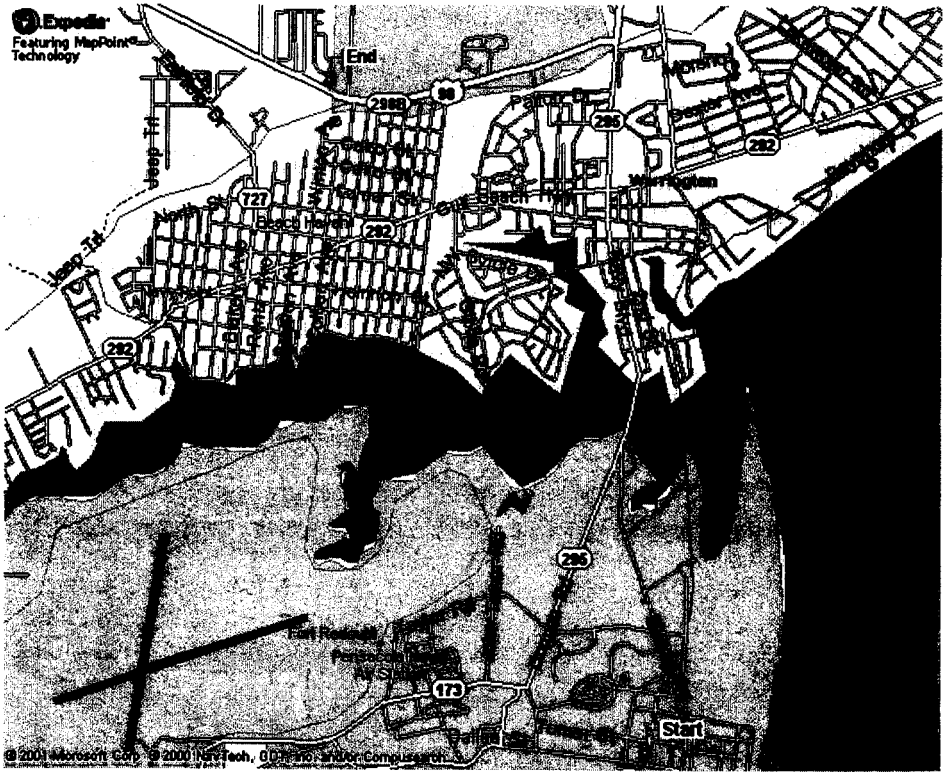
Navy Hospital
6000 W. Highway 98
Pensacola, Florida 32512
(850) 505-6600

Directions to the Navy Hospital from the site are as follows:

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**

**Route to Naval Hospital Pensacola**



Baptist Hospital
1000 West Moreno Blvd.
Pensacola, FL 32508
(850-469-2313)

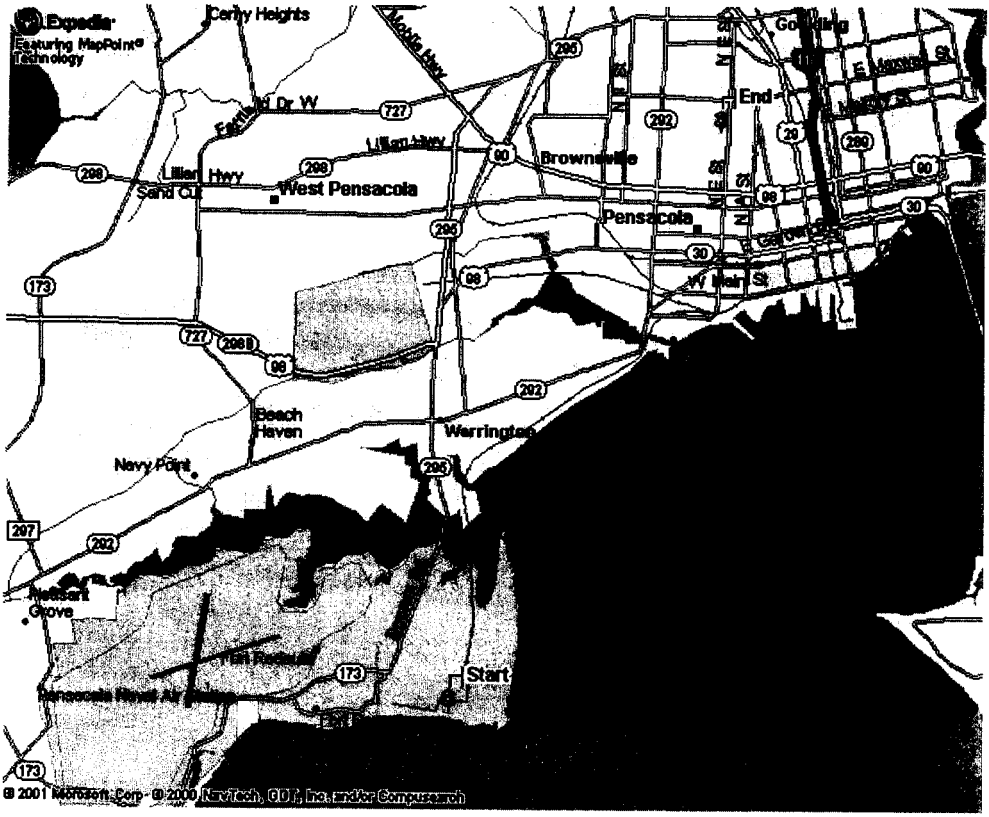
Directions to this Hospital from the Main Gate of NAS Pensacola are:

Proceed out of Main Gate (Navy Blvd) heading north to Hwy 292. Turn right (heading east) on Hwy 292 until it turns into Garden Street (approx. 3 miles). Take Garden Street to intersection with "E" Street. Turn left onto "E" Street and proceed approximately 1 mile to Hospital on left.

**Figure 2-2**

**Route to Baptist Hospital**

Navy Hospital



## 2.9 DECONTAMINATION PROCEDURES/EMERGENCY MEDICAL TREATMENT

During any site evacuation, decontamination procedures will be performed only if doing so does not further jeopardize the welfare of site workers. Decontamination will not be performed if the incident warrants immediate evacuation. However, it is unlikely that an evacuation would occur 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 2-3.**

## 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 2-3
## 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 TtNUS 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 TtNUS employee(s).
  - Name and phone number of an informed site officer who will be responsible for further investigations.
  - Fax appropriate information to WorkCare at (714) 456-2154.
- Contact Corporate Health and Safety Department (Matt Soltis) at 1-800-245-2730.

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 2-3 (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.

### 3.1.1 Building 3241 Tank Site

Building 3241 is located in the western side of the base, north of the Naval Aviation Museum and south of Building 3221, the Aircraft Maintenance and Restoration Facility. During the excavation and closure of the Building 3241 Tank, soil contamination was discovered.

# 4.0 SCOPE OF WORK

The following is a list of activities that are covered in this HASP for the CTO 0222 project:

- Mobilization/demobilization
  - Coordination with NAS Pensacola personnel and subcontractors; purchase of expendable materials; preparation, packaging, and shipping of all required field equipment and materials; and performance of site-specific health and safety training for all onsite personnel.
- Monitoring well installation of six shallow (20') monitoring wells and two deep (45') monitoring wells will be installed using Direct Push Technologies (DPT).
- Multi-Media Sampling
  - Subsurface Soil Sampling
  - Groundwater sampling, including:
- Aquifer testing, using slug tests, will be conducted at 3 wells.
- A limited tidal survey will be completed to determine the onsite tidal effects.
- Decontamination of sampling equipment
- Investigative-Derived Wastes (IDW) management:
  - Approximately 6 drums of soil and 4 drums of aqueous IDW will be generated at the site during the investigation and will require one mobilization for disposal.
  - IDW samples will not be collected. Instead, data from analysis of environmental samples will be provided to the facility.
  - Drums will be kept at the facility's designated IDW storage area until the results of the chemical analysis are completed.
  - IDW management will be completed during a separate mobilization.

# 5.0 TASKS/HAZARDS/ASSOCIATED CONTROL MEASURES SUMMARIZATION

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 accompanies 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 TtNUS 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 it's 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.

**TABLE 5-1**
**Tasks/Hazards/Control Measures Compendium**
Building 3241 NAS Pensacola
Pensacola, Florida

| Tasks/Operation/ Locations | Anticipated Hazards | Recommended Control Measures | Hazard Monitoring | Personal Protective Equipment<br>*Items in italics are deemed optional as conditions or the FOL or SSO require.* | Decontamination Procedures |
|---|---|---|---|---|---|
| Soil borings and installation of monitoring wells using Direct Push Technology | ***Chemical Hazards:***<br><br>1) Primary types of contaminants include VOCs associated with petroleum products. Based on historical analytical data, none of the VOCs of concern (ethylbenzene, tetrachloroethane and toluene) are at concentrations that would pose an inhalation hazard to site personnel. Refer to Table 6-1 for additional information on site contaminants of concern.<br><br>It is recommended that exposure (via inhalation, ingestion, or skin contact) to these contaminants be minimized, as some are considered potential carcinogens to either animals or humans. While some site contaminants are volatile others may be present in the form of particulates (dusts). Further information on these contaminants and other potential contaminants is presented in Table 6-1.<br><br>2) Transfer of contamination into clean areas or onto persons.<br><br>***Physical hazards*:**<br><br>3) Pinch/compression points.<br><br>4) Noise.<br><br>5) Energized systems. (Underground/Above ground utilities)<br><br>6) Heavy/ Awkward/Lifting.<br><br>7) Natural Hazards (Insect/animal bites and stings).<br><br>8) Inclement weather. | 1) For volatile organic compounds (VOCs), use real-time monitoring instrumentation, action levels, and identified PPE to control exposures to potentially contaminated media (air, water, soils, etc.). Generation of dusts should be minimized to the greatest extent possible to avoid exposure to contaminants that may be present as particulates or bound to particulates. If airborne dusts are observed, area wetting methods will be used to reduce the generation of dusts created during DPT activities. If area wetting methods are not feasible, termination of activities will be used to minimize exposure to observed airborne dusts.<br>2) Decontaminate all equipment and supplies between boreholes and prior to leaving the site.<br>3) All equipment to be used will be<br>- Inspected in accordance with Federal safety and transportation guidelines, OSHA (1926.600,.601,.602), and manufacturers design and documented as such using the Equipment Record Sheet (See Appendix III of this HASP or Section 10.0 of the TtNUS Health and Safety Guidance Manual).<br>- Operated by qualified operators and knowledgeable ground crew.<br>- Used within establish safe zones and routes of approach.<br>- Only manufacturer approved equipment may be used in conjunction with equipment repair procedures (i.e. pins, etc.).<br>In addition, to equipment considerations the following safe operating procedures will be incorporated:<br>- All personnel not directly supporting this operation will remain at least 25 ft from the point of operation.<br>- Hydraulic masts or other projecting devices shall be at least 20 ft from overhead power sources and a minimum of 3 ft from underground utilities unless the exact location of the underground utility is known.<br>- Hand signals will be established prior to the commencement of the operation.<br>- Only manufacturer approved equipment may be used in conjunction with equipment repair procedures (i.e., flight connectors etc.).<br>- Work areas will be kept clear of clutter.<br>- Secure all loose articles to avoid possible entanglement.<br>- All equipment will be equipped with movement warning systems.<br>- All personnel working in high equipment traffic areas are required to wear reflective vests for high visibility and to establish unimpeded work areas around the operation. This activity may require areas of the building to be cordoned off during this operation.<br>- All personnel will be instructed in the location and operations of the emergency shut off device(s). This device will be tested initially (and then periodically) to ensure its operational status.<br>- Areas will be inspected prior to the movement of DPT rig and support vehicles to eliminate any physical hazards. This will be the responsibility of the FOL and/or SSO.<br>- The DPT rig and support vehicles will be moved no closer than 3 ft to floor openings, sidewalls, and excavations.<br>4) Hearing protection will be used during all subsurface activities.<br>5) All utility clearances will be obtained prior to subsurface activities. Prior to any subsurface investigations, the locations of all underground utilities will be identified and marked. Obtain written permit clearance prior to all subsurface investigations. See Appendix II Utility Locating And Excavation Clearance of this HASP.<br>6) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques.<br>7) Avoid nesting areas and use commercially available repellents. Report potential hazards to the SSO.<br>8) Suspend or terminate operations until directed otherwise by SSO. | Based on available analytical data from previous field activities, elevated readings in the worker breathing zone are not anticipated. A direct reading Photoionization Detector (PID) with a 11.7 eV lamp, or a Flameionization Detector (FID), will be used to screen samples and to detect the presence of any potential volatile organics. Source monitoring of the borehole will be conducted at regular intervals to be determined by the SSO. Positive sustained results at a source or downwind location(s) which may impact operations crew will require the following actions:<br><br>Monitor the breathing zone of at-risk and downwind employees. Any sustained reading (greater than 1 minute in duration) above daily-established background levels in worker breathing zones requires site activities to be suspended and site personnel to report to an unaffected area.<br><br>Work may resume when airborne readings in the worker breathing zone returns to background levels.<br><br>Where the utility clearance cannot be obtained in a reasonable period or not located, intrusive activities shall proceed with extreme caution using a magnetometer for periodic downhole surveys every 2 ft to a depth of at least 6 ft. See Appendix II Utility Locating And Excavation Clearance of this HASP. | All subsurface operations are to be initiated in Level D protection. Level D protection constitutes the following minimum protection:<br>- Standard field attire (sleeved shirt; long pants).<br>- *Tyvek coveralls and disposable boot covers if surface contamination is present or if the potential exists for soiling work attire.*<br>- Nitrile gloves with surgical style inner gloves.<br>- Steel toe safety shoes.<br>- Safety glasses.<br>- Hardhat.<br>- *Hearing protection for high noise areas, as directed by the SSO.*<br>- *Reflective vest for high traffic areas.*<br><br>**Note:** The Safe Work Permit(s) for this task (see Appendix IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task. | **Personnel Decontamination** will consist of a soap/water wash and rinse for outer protective equipment [boots, gloves, polyvinyl chloride (PVC) splash suits, etc.]. This function will take place at an area adjacent to the site activities. This procedure will consist of:<br>- Equipment drop.<br>- Soap/water wash and rinse of outer boots and gloves.<br>- Soap/water wash and rinse of the outer splash suit, as applicable.<br>- Outer suit, boot covers, outer glove removal.<br>- Wash hands and face, leave contamination reduction zone.<br>- Shower at the end of each shift or after exposure to contaminants. |

**TABLE 5-1**
**Tasks/Hazards/Control Measures Compendium**
Building 3241 NAS Pensacola
Pensacola, Florida

| Tasks/Operation/ Locations | Anticipated Hazards | Recommended Control Measures | Hazard Monitoring | Personal Protective Equipment<br>*Items in italics are deemed optional as conditions or the FOL or SSO require.* | Decontamination Procedures |
|---|---|---|---|---|---|
| Multi-media sampling, including soil and groundwater sampling. This task also includes water level measurement, monitoring well development and purging, and IDW handling. | *Chemical Hazards*<br><br>1) Primary types of contaminants include VOCs associated with petroleum products. Based on historical analytical data, none of the VOCs of concern (ethylbenzene, tetrachloroethane and toluene) are at concentrations that would pose an inhalation hazard to site personnel. Refer to Table 6-1 for additional information on site contaminants of concern.<br><br>It is recommended that exposure (via inhalation, ingestion, or skin contact) to these contaminants be minimized, as some are considered potential carcinogens to either animals or humans. While some site contaminants are volatile others may be present in the form of particulates (dusts). Further information on these contaminants and other potential contaminants<br><br>2) Transfer of contamination into clean areas or onto persons.<br><br>***Physical hazards*:**<br><br>3) Lifting.<br><br>4) Noise.<br><br>5) Flying Projectiles.<br><br>6) Slips/Trips/Falls | 1) Use real-time monitoring instrumentation, action levels, and identified PPE to control exposures to potentially contaminated media (e.g. air, water, soils). Minimize dust generation to the greatest extent possible. If airborne dusts are observed, use area-wetting methods. If area-wetting methods are not feasible, terminate activities to minimize exposure to observed airborne dusts.<br><br>2) Decontaminate all equipment and supplies between sampling locations and prior to leaving the site.<br><br>3) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques.<br><br>4) Preview work locations for unstable/uneven terrain.<br><br>5) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding cold/heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual.<br><br>6 Preview work locations and site lines for uneven and unstable terrain. Clear necessary vegetation and establish temporary means for traversing hazardous terrain (e.g. rope ladders). | Based on available analytical data from previous field activities, elevated readings in the worker breathing zone are not anticipated. A direct reading Photoionization Detector (PID) with a 11.7 eV lamp, or a Flameionization Detector (FID), will be used to screen samples and to detect the presence of any potential volatile organics. Source monitoring of the borehole will be conducted at regular intervals to be determined by the SSO. Positive sustained results at a source or downwind location(s) which may impact operations crew will require the following actions:<br><br>Monitor the breathing zone of at-risk and downwind employees. Any sustained reading (greater than 1 minute in duration) above daily-established background levels in worker breathing zones requires site activities to be suspended and site personnel to report to an unaffected area.<br><br>Work may resume when airborne readings in the worker breathing zone returns to background levels.<br><br>Where the utility clearance cannot be obtained in a reasonable period or not located, intrusive activities shall proceed with extreme caution using a magnetometer for periodic downhole surveys every 2 ft to a depth of at least 6 ft. See Appendix II Utility Locating And Excavation Clearance of this HASP. | Level D protection will be utilized for the initiation of all sampling activities.<br><br>Level D - (Minimum Requirements)<br>- Standard field attire (sleeved shirt; long pants).<br>- Steel toe safety shoes.<br>- Safety glasses.<br>- Surgical style gloves (*double-layered if necessary*).<br>- *Reflective vest for high traffic area.s*<br>- *Hardhat (when overhead hazards exists, or identified as a operation requirement).*<br>- *Tyvek coveralls and disposable boot covers if surface contamination is present or if the potential for soiling work attire exists.*<br>- *Hearing protection for high noise areas, or as directed on an operation by operation scenario.*<br><br>**Note:** The Safe Work Permit(s) for this task (Appendix IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions, special considerations, or conditions associated with any identified task. | **Personnel Decontamination** will consist of a removal and disposal of non-reusable PPE (gloves, coveralls, etc.) as applicable. The decontamination function will take place at an area adjacent to the site activities. This procedure will consist of:<br><br>- Equipment drop.<br>- Outer coveralls, boot covers, and/or outer glove removal (as applicable).<br>- Removal, segregation, and disposal of non-reusable PPE in bags/containers provided.<br>- Soap/water wash and rinse of reusable PPE (e.g., hardhat) if potentially contaminated.<br>- Wash hands and face, leave contamination reduction zone.<br>- Shower at the end of each shift or after exposure to contaminants. |

**TABLE 5-1**
**Tasks/Hazards/Control Measures Compendium**
Building 3241 NAS Pensacola
Pensacola, Florida

| Tasks/Operation/ Locations | Anticipated Hazards | Recommended Control Measures | Hazard Monitoring | Personal Protective Equipment<br>*Items in italics are deemed optional as conditions or the FOL or SSO require.* | Decontamination Procedures |
|---|---|---|---|---|---|
| Geographical surveying activities | ***Chemical hazards:***<br><br>**Exposure to potential site contaminants during surveying activities is unlikely given the nature of surveying work and the limited contact with potentially contaminated media (soil and groundwater). To further reduce the potential for exposure, site personnel performing surveying activities will minimize contact with potentially contaminated media and will avoid areas where chemical hazards may exist.**<br><br>Refer to Section 6.0 for a list of potential and representative site contaminants.<br><br>***Physical hazards:***<br><br>1) Slip, trips, and falls.<br><br>2) Natural hazards (Insect/animal bites and stings, poisonous plants).<br><br>3) Inclement weather. | 1) Preview work locations and site lines for uneven and unstable terrain. Clear necessary vegetation and establish temporary means for traversing hazardous terrain (e.g. rope ladders).<br><br>2) Avoid potential nesting areas of biting/stinging insects and animals. Use commercially available insect repellents. Avoid contact with poisonous vegetation. Wear appropriate clothing. Tape ankle and wrists areas to prevent ticks, chiggers, etc. from attaching themselves to skin. Wear light-colored clothing so that ticks and other biting insects can be easily visible and be removed. If working in areas where snakes are a threat, wear snake chaps to protect against bites. Follow directions as specified in Section 6.3 concerning natural hazards.<br><br>3) All operations will be temporarily suspended during electrical storms. | No air monitoring is needed given that the potential for exposure to site contaminants during this activity is considered minimal. | Surveying activities will be performed in Level D protection.<br><br>Level D Protection consists of the following:<br>- Standard field dress including sleeved shirt and long pants.<br>- Steel toe safety shoes.<br>- *Safety glasses, hard hats (if working near machinery).*<br>- *Tyvek coveralls may be worn to provide additional protection against poisonous plants and insects, particularly ticks.*<br>- *Work gloves may be worn if desired.*<br>- *Snake chaps for heavily wooded area where encounters are likely.*<br><br>**Note:** The Safe Work Permit(s) for this task (Appendix IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions, special considerations, or conditions associated with any identified task. | **Personnel Decontamination** - A structured decontamination is not required, as the likelihood of encountering contaminated media is considered remote. However, survey parties should inspect themselves and one another for the presence of ticks when exiting wooded areas, grassy fields, etc. Any ticks found should be promptly removed. See the Health and Safety Guidance Manual for more information. |
| Mobilization/ Demobilization | *Physical Hazards*<br><br>1) Lifting (muscle strains and pulls).<br><br>2) Slip, trips, and falls.<br><br>3) Inclement weather.<br><br>Natural Hazards<br><br>4) Insect/animal bites and stings. | 1) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques.<br>2) Preview work locations for unstable/uneven terrain.<br>3) Employ proper lifting techniques as described in Table 5-1, Mobilization/Demobilization.<br>4) Avoid nesting areas and use repellents. Report potential hazards to the SSO. | Not required. | Level D - (Minimum Requirements)<br>- Standard field attire (sleeved shirt; long pants).<br>- Steel toe safety shoes.<br>- *Safety glasses.*<br>- *Hardhat (when overhead hazards exists, or identified as a operation requirement).*<br>- *Reflective vest for high traffic areas.*<br><br>**Note:** The Safe Work Permit(s) for this task (Appendix IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions, special considerations, or conditions associated with any identified task. | Not required. |

**TABLE 5-1**
**Tasks/Hazards/Control Measures Compendium**
Building 3241 NAS Pensacola
Pensacola, Florida

| Tasks/Operation/ Locations | Anticipated Hazards | Recommended Control Measures | Hazard Monitoring | Personal Protective Equipment<br>*Items in italics are deemed optional as conditions or the FOL or SSO require.* | Decontamination Procedures |
|---|---|---|---|---|---|
| Decontamination of Sampling and Heavy Equipment<br><br>It is anticipated that this activity will take place at centralized locations. Gross contamination will be removed to the extent possible at the site. Contaminated tooling then will be wrapped in polyethylene sheeting for transport to the centralized location for a full decontamination and evaluation. | *Chemical Hazards*<br><br>1) Primary types of contaminants include VOCs associated with petroleum products. Based on historical analytical data, none of the VOCs of concern (ethylbenzene, tetrachloroethane and toluene) are at concentrations that would pose an inhalation hazard to site personnel. Refer to Table 6-1 for additional information on site contaminants of concern.<br><br>It is recommended that exposure (via inhalation, ingestion, or skin contact) to these contaminants be minimized, as some are considered potential carcinogens to either animals or humans. While some site contaminants are volatile others may be present in the form of particulates (dusts). Further information on these contaminants and other potential contaminants is presented in Table 6-1.<br><br>2) Transfer of contamination into clean areas or onto persons.<br><br>***Physical hazards*:**<br><br>3) Lifting.<br><br>4) Noise.<br><br>5) Flying Projectiles.<br><br>6) Slips/Trips/Falls | 1) and 2) Use protective equipment to minimize contact with site contaminants and hazardous decontamination fluids. Control potential non-occupational exposures through good work hygiene practices (i.e., avoid hand to mouth contact, wash hands and face before breaks and lunch, minimize contact with contaminated media). Obtain manufacturer's MSDS for any decontamination fluids used on-site. Solvents may only be used in well-ventilated areas, such as outdoors. Use appropriate PPE as identified on MSDS or within this HASP. All chemicals used must be listed on the Chemical Inventory for the site, and site activities must be consistent with the Hazard Communication Program provided in Section 5.0 of the TtNUS Health and Safety Guidance Manual.<br><br>3) Use multiple persons where necessary for lifting and handling heavy equipment, such as auger flights for decontamination purposes.<br><br>Employ proper lifting techniques as described in Table 5-1, Mobilization/Demobilization.<br><br>4) Wear hearing protection when operating the pressure washer and/or steam cleaner. Sound pressure levels measured during the operation of similar pieces of equipment indicate a range of 87 to 93 dBA.<br><br>5) Use eye and face protective equipment when operating the pressure washer and/or steam cleaner due to flying projectiles. All other personnel must be restricted from the area. In addition to minimize hazards (flying projectiles, water lacerations and burns) associated with this operation, the following controls will be implemented:<br>• A Fan Tip 25° or greater will be used on pressurized systems over 3,000 pounds per square inch. This will reduce the possibility of water lacerations or punctures.<br>• Thermostat control will be in place and operational to control the temperature levels of the water where applicable.<br>• Visual evaluations of hoses and fittings for structural defects.<br>• Construct deflection screens as necessary to control overspray and to guard against dispersion of contaminants driven off by the spray.<br><br>6) The decontamination pad should be constructed to contain wash waters generated during decontamination procedures. Temporary decontamination pads are usually 10-30 mil polyethylene or polyvinyl chloride tarp construction. Although these items when used as a liner offer containment, they also present a slipping hazard. When these temporary liners are employed, it is recommended that a light coating of sand be spread over the walking surface to provide traction.<br><br>In addition, adequate slope should be provided to the pad to permit drainage away from the object being cleaned. The collection point for wash waters should be of adequate distance that the decontamination workers do not have to walk through the wash waters while completing their tasks.<br><br>Hoses should be gathered when not in use to eliminate potential tripping hazards. | Use visual observation and real-time monitoring instrumentation to ensure all equipment has been properly cleaned of contamination and dried. | **For heavy equipment**<br>This applies to pressure washing and/or steam cleaning operations and soap/water wash and rinse procedures.<br><br>Level D Minimum requirements:<br>- Standard field attire (long sleeve shirt; long pants).<br>- Safety shoes (steel toe/shank).<br>- Chemical resistant boot covers.<br>- Hard hat.<br>- Nitrile gloves.<br>- Safety glasses underneath a splash shield when operating pressure washer.<br>- Hearing protection (plugs or muffs) when operating pressure washer<br>- Hooded PVC rainsuits or protective equipment (PE) or PVC coated Tyvek<br><br>For sampling equipment (trowels, Macro-Core samplers, bailers, etc.), the following PPE is required:<br><br>**Note**: Consult MSDS for PPE guidance. Otherwise, observe the following.<br><br>Level D Minimum requirements -<br>- Standard field attire (long sleeve shirt; long pants).<br>- Safety shoes (steel toe/shank).<br>- Nitrile outer gloves over nitrile inner gloves.<br>- Safety glasses.<br>- Impermeable apron.<br><br>In the event of overspray of chemical decontamination fluids, employ PVC rainsuits or PE or PVC coated Tyvek as necessary.<br><br>**Note:** The Safe Work Permit(s) for this task (Appendix IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions, special considerations, or conditions associated with any identified task. | **Personnel Decontamination** will consist of a soap/water wash and rinse for reusable and non-reusable outer protective equipment (boots, gloves, PVC splash suits) as applicable. This decontamination function may be subdivided into two locations.<br>Gross contamination of outer boots and outer gloves will be removed at a satellite location near the operation.<br>Final wash and rinse will take place at the centralized decontamination pad.<br>The sequential procedure is as follows:<br>Stage 1: Equipment drop, remove outer protective wrapping; personnel will wipe down the outer shell and pass hand equipment through as necessary.<br>Stage 2: Soap/water wash and rinse of outer boots and gloves<br>Stage 3: Soap/water wash and rinse of the outer splash suit, as applicable.<br>Stage 4: Disposable PPE will be removed and bagged.<br>Stage 5: Wash face and hands.<br>Stage 6: Depending on ambient conditions, personnel may be required to report for medical evaluation. This evaluation consists of pulse, breathing rate, oral temperature, and body weight. This medical screening will be performed when ambient conditions dictate and during periods of acclimatization.<br><br>**Equipment Decontamination** - All heavy equipment decontamination will take place at a centralized decontamination pad utilizing a steam cleaner. Heavy equipment will have the wheels and tires cleaned, along with any loose debris removed, prior to transporting to the central decontamination area. All site vehicles will have restricted access to exclusion zones and have their wheels/tires sprayed off as not to track mud onto the roadways servicing this installation. Roadways shall be cleared of any debris resulting from the on-site activity.<br><br>**Sampling Equipment Decontamination** – Sampling equipment will be decontaminated as per the requirements in the SAP and/or Work Plan.<br><br>All equipment used in the exclusion zone will require a complete decontamination between locations and prior to removal from the site.<br><br>The FOL or the SSO will be responsible for evaluating equipment arriving on-site, leaving the site, and between locations. No equipment will be authorized access, exit, or movement to another location without this evaluation. This will include the screening process for radiological contaminants. |

# 6.0 HAZARD ASSESSMENT

The following 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, which is included as part of this HASP, provides various information, exposure limits, symptoms of exposure, physical properties, and air monitoring and sampling data. Section 6.1 provides general information regarding all contaminants that may be present at the sites.

## 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 class of contaminants, including the specific compound(s) of interest:

- Volatile Organic Compounds (VOCs), specifically ethylbenzene, tetrachloroethane and toluene.

Table 6-1 provides information on the compounds and individual substances likely to be present at the sites to be investigated. Included is information on the toxicological, chemical, and physical properties of these substances. It is anticipated that the greatest potential for exposure to site contaminants is during intrusive activities (DPT, soil sampling, etc.). Exposure to these compounds is most likely to occur through ingestion and inhalation 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. Inhalation exposure will be avoided by using appropriate PPE and engineering controls where necessary. Significant exposure via inhalation is not anticipated during the planned scope of work, based on available analytical data from previous sampling activities.

**TABLE 6-1**
**CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA**
**NAVAL AIR STATION PENSACOLA, FLORIDA**
**PAGE 1 OF 2**

| Substance | CAS No. | Air monitoring/sampling information | | Exposure limits | Warning Property Rating | Physical Properties | Health Hazard Information |
|---|---|---|---|---|---|---|---|
| Toluene | 108-88-3 | PID: I.P 8.82 eV, High response with PID and 10.2 eV lamp.<br><br>FID: 110% response with FID. | Air sample using charcoal tube; carbon disulfide desorption. Sampling and analytical protocol shall proceed in accordance with OSHA Method #07, or NIOSH Method #1500. | OSHA: 200 ppm<br>300 ppm (Ceiling)<br><br>ACGIH: 50 ppm (skin)<br><br>NIOSH: 100 ppm 150 ppm STEL<br><br>IDLH: 500 ppm | Adequate - Odor threshold 1.6 ppm is considered good. Can use air-purifying respirator with organic vapor cartridge up to 1,000 ppm.<br><br>**Recommended gloves:** Teflon >15.00 hrs; Viton >16.00 hrs; silver shield >6,00 hrs; supported nitrile (Useable time limit 0.5 hr, complete submersion for the nitrile selection); PV alcohol >25.00 hrs | **Boiling Pt:** 232°F; 111°C<br>**Melting Pt:** -139°F; -95°C<br>**Solubility:** 0.05% (61°F;16°C)<br>**Flash Pt:** 40°F; 4°C<br>**LEL/LFL:** 1.2%<br>**UEL/UFL:** 7.1%<br>**Vapor Density:** 3.14<br>**Vapor Pressure:** 20 mmHg @ 65°F; 18°C<br>**Specific Gravity:** 0.87<br>**Incompatibilities:** Strong oxidizers<br>**Appearance and odor:** Colorless liquid with a sweet pungent aromatic odor. | Overexposure to this substance may result in mild to moderate irritation at all points of contact, and CNS changes including euphoria, confusion, nervousness, and possibly paresthesia characterized by an abnormal burning sensation, pricking, or numbness.<br>At 200-500 ppm exposure has resulted in headaches, nausea, eye irritation, loss of appetite, bad taste, impair coordination, fatigue, and weariness. Chronically, toluene overexposure may result in dermatitis, liver, and kidney damage. |

**CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA**
**NAVAL AIR STATION PENSACOLA, FLORIDA**
**PAGE 2 OF 2**

| Substance | CAS# | Air Monitoring/Sampling Information | | Exposure Limits | Warning Property/Rating | Physical Properties | Health Hazard Information |
|---|---|---|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | 79-34-5 | PID: I.P. 11.1 eV, relative response ratio unknown.<br><br>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 #1003. | OSHA: 5 ppm (skin)<br><br>ACGIH; NIOSH: 1 ppm (skin)<br><br>IDLH: 100 ppm | Odor threshold for this substance is 7.3 ppm. This level in comparison to the TLV is considered poor. Air purifying elements (organic vapor/acid gas) are recommended for escape purposes only. Combination units (APR/airline respirator) are recommended for working in concentrations in excess of the TLV.<br><br>**Recommended glove:** Butyl rubber 4.6 hrs; solvent dipped, unsupported.<br>PV alcohol >8.00 hrs; Teflon >15.20 hrs;<br>Viton >8.00 hrs | **Boiling Pt:** 296°F; 147°C<br>**Melting Pt:** -33 to -47°F; -36 to -43.8°C<br>**Solubility:** 0.3%<br>**Flash Pt:** Not available<br>**LEL/LFL:** Not available<br>**UEL/UFL:** Not available<br>**Vapor Density:** Not available<br>**Vapor Pressure:** 9 mmHg @ 86°F; 30°C<br>**Specific Gravity:** 1.59 @ 77° F; 25°C<br>**Incompatibilities:** Strong oxidizers, alkalis, fuming sulfuric acid, and chemically active metals. When heated to decomposition temperatures will emit toxic fumes of chlorine.<br>**Appearance and Odor:** Colorless to pale yellow liquid with a pungent chloroform like odor. | Overexposure may result in CNS effects including depression, sleepiness, hallucinations, distorted perceptions, tremors(fingers), and stupor (narcosis). Systemically, symptoms may result in nausea, vomiting, abdominal pains, and cramps. May also irritate the eyes, skin, and mucous membranes. Chronic exposures may result in dermatitis, enlarged tender liver, jaundice, hepatitis, kidney, and lung damage. |
| Ethylbenzene | 100-41-4 | PID: I.P 8.76, High response with PID and 10.2 eV lamp.<br><br>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<br><br>OSHA: 100 ppm<br><br>IDLH: 800 ppm | Adequate - Can use air-purifying respirator with organic vapor cartridge up to 1,000 ppm.<br><br>**Recommended gloves:** Neoprene or nitrile w/ silver shield when potential for saturation; Teflon >3.00 hrs | **Boiling Pt:** 277°F; 136°C<br>**Melting Pt:** -139°F; -95°C<br>**Solubility:** 0.01%<br>**Flash Pt:** 55°F; 13°C<br>**LEL/LFL:** 1.0%<br>**UEL/UFL:** 6.7%<br>**Vapor Density:** 3.66<br>**Vapor Pressure:** 10 mmHg @ 79°F; 26°C<br>**Specific Gravity:** 0.87<br>**Incompatibilities:** Strong oxidizers<br>**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. |

## 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.

- Slips, trips, and falls
- Energized systems (contact with underground or overhead utilities)
- Lifting (strain/muscle pulls)
- 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 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 TtNUS 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.

### 6.2.2 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. The SSO will recommend additional heat stress control measures as they are

deemed necessary as per American Conference of Governmental Industrial Hygienists (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

All 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 (See Attachment V) and the FOL and SSO notified. There are several species indigenous to Florida that may be found on site and should be considered.

**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.

**Copperhead** - Average adult size is 22-36 inches (56-91 cm), record is 53 inches (135 cm). It is a stout-bodied snake with broad, light brown to gray cross bands, alternating with dark brown to reddish-brown cross bands. Constrictions along the backbone give the dark bands an hourglass shape. On the sides of the body the dark bands usually have light centers, and occasionally one dark spot. Southern copperheads sometimes have an overall pinkish tint. The top of head in front of the eyes is covered with large plate-like scales. The pupil is elliptical, a catlike vertical slit. There is a deep facial pit between the nostril and the eye. The preferred habitat is low, wet areas around swamps, streambeds, river bottoms, and damp ravines, but it also occurs on the hillsides above the wet areas. It also is found in suburban neighborhoods near people. Copperhead bites are extremely painful but usually are not life-threatening for healthy adults. As with all poisonous snakebites, the victim should seek immediate medical care from a physician or hospital experienced in treating snakebite

**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).

**Timber Rattlesnake** - Average adult size is 36-60 inches (76-152 cm), record is 74.5 inches (189 cm). Can be a large, heavy-bodied snake. The reddish brown stripe running down the center of the back is disrupted by a series of large, black, chevron-like cross bands on the pinkish gray or tan body. The tail is uniform black. The head is large and sometimes with a dark diagonal line through the eye or just behind the eye. The pupil is vertical (catlike) and there is a facial pit between the nostril and the eye. The tail ends in a rattle. Timber rattlesnakes in Florida prefer low bottomlands where it is fairly damp, river beds, hammocks pine flat woods, swamps, and cane thickets. This snake should be given a wide berth and left alone. Because of its cryptic coloration (camouflage), it can be easily overlooked, especially if it does not rattle.

**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 all the way 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.

**Mosquito-Borne Illness**

The Florida Department of Agriculture and Consumer Services (FDACS), Florida Fish and Wildlife Conservation Commission and Florida Department of Health Bureau of Epidemiology monitors mosquitoes in the state and takes actions to control their populations. There have been nine reported cases of West Nile Virus (WNV) in Florida. Escambia County is one of the 49 Florida Counties under a Medical Alert from the Florida Department of Health for WNV.

**West Nile Virus**

Encephalitis caused by WNV is transmitted to humans by mosquitoes. The mosquito becomes infected by feeding on birds infected with the WNV. Infected mosquitoes then transmit the WNV to humans and animals when biting (or taking a blood-meal).

Mosquitoes become infected after biting infected birds. The symptoms for mosquito-borne illnesses may include headache, moderate to high fever, stiff neck and confusion. In serious cases coma, seizures or paralysis can result. Symptoms usually appear between 5 to 15 days after exposure to infected mosquitoes. Mosquito-borne illnesses may be mild or serious and can lead to death.

WNV encephalitis is NOT transmitted from person-to-person. There is no evidence that a person can get the virus from handling live or dead infected birds. However, avoid bare-handed contact when handling any dead animals, including dead birds. Ticks have not been implicated as vectors of West Nile-like virus.

Mild infections are common and include fever, headache, and body aches, often with skin rash and swollen lymph glands. More severe infection is marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, occasional convulsions, paralysis and, rarely, and death (especially in the elderly and very young). The incubation period of WNV encephalitis is usually 3 to 12 days. There is no specific therapy or vaccine against WNV encephalitis. The Florida Department of Health has tracked nine human encephalitis case caused by the WNV.

**Eastern Equine Encephalitis**

Eastern Equine Encephalitis (EEE) virus circulates in nature primarily in a bird-mosquito cycle with man, horses and exotic gamebirds (Pheasants and Chukar partridges) as dead end hosts. The virus appears to be confined primarily to states along the Atlantic and Gulf coasts causing clinical cases in unvaccinated equines every summer. Epidemics in humans are quite rare; occurring only four time in the past 62 years in Massachusetts, Louisiana and New Jersey. The virus is usually circulated throughout the year in fresh-

water swamps by mosquitoes that prefer feeding on wild birds. An incubation period of 3 to 7 days is usually followed by acute onset of fever, headache, stiff neck, disorientation, and lethargy, convulsions, and other signs of encephalitis sometimes followed by coma and death.

Precautions include:

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

**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.

**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.

An Office of Natural Resources or similar entity on NAS Pensacola should be contacted for further direction on the hazards and precautions of naturally occurring wildlife and insects.

All 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 (See Attachment V) and the FOL and SSO notified.

### 6.3.2 Inclement Weather

As the Florida Panhandle 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**

| [illegible] | [illegible] | [illegible] |
|---|---|---|
| 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 DESCRIPTIO | DEFINITIO | ACTIONS |
|---|---|---|
| Tropical Storm Watch | Tropical storm conditions are possible in the specified area of the watch, usually within 36 hours | Weather conditions should be monitored for further advisories. *Prepare for possible evacuation by local officials* |
| Tropical Storm Warning | Tropical storm conditions are expected in the specified area of the warning, usually within 24 hours. | Work should be suspended in areas where lightning, high winds and rainfall could pose a threat to life. *Mandatory evacuations may be enforced by local officials.* |
| Hurricane Watch | Hurricane conditions are possible in the specified area of the watch, usually within 36 hours. | Weather conditions should be monitored for further advisories. *Prepare for possible evacuation by local officials* |
| Hurricane Warning | Hurricane conditions are expected in the specified area of the warning, usually within 24 hours. | *Mandatory evacuations will most likely be enforced by local officials.* |

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

# 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 that may present an exposure potential to site personnel, a Photoionization Detector (PID) using a lamp energy of 11.7 electron Volts (eV) or higher will be used. This instrument will be used to monitor potential source areas and to screen the breathing zones of employees during site activities. The PID 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 presents 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 | | |
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# 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
Tetra Tech NUS, Inc.
Task Order Manager
1401 Oven Park Drive, Suite 102
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 (DOD), Environmental Protection Agency (EPA), etc.) who may enter the site to perform functions that may or may not be directly related to site operations. Site-Specific training will include:

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

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

## 8.3 MEDICAL SURVEILLANCE

### 8.3.1 Medical Surveillance Requirements for TtNUS Personnel

All TtNUS personnel participating in project field activities will have had a physical examination meeting the requirements of 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

I have been given the opportunity to ask questions and all of my questions have been answered to my satisfaction. I further state, that the dates 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 |
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### 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 Attachment V of this HASP. 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 III HSM, 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
Tetra Tech NUS, Inc.
Task Order Manager
1401 Oven Park Drive, Suite 102
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 DPT. 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 soil borings 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

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

Modifications/Exceptions: _____

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

VI. Additional Safety Equipment/Procedures

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

Modifications/Exceptions: _____

VII. Procedure review with permit acceptors

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

VIII. Site Preparation

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

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

X. Special instructions, precautions: _____

Permit Issued by: _____ Permit Accepted by: _____

## 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 onsite activities to be terminated until that visitor can be removed. Removal of unauthorized visitors will be accomplished with support from the Base Contact, if necessary. At a minimum, the 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.

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

**Emergency Phone Numbers and Directions to the Hospital(s) (posted)** - This list of numbers and directions will be maintained at 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 (see Attachment V)

**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 Department of Defense (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 ACRONYMS

| | |
|---|---|
| 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 |
| DEET | N,N-diethyl-meta-toluamide |
| DFM | Diesel Fuel, Marine |
| DOD | United States Department of Defense |
| DOT | Department of Transportation |
| DPT | Direct Push Technologies |
| EEE | Eastern Equine Encephalitis |
| EPA | Environmental Protection Agency |
| eV | electron Volts |
| FDACS | Florida Department of Agriculture and Consumer Services |
| 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 |
| NAS | Naval Air Station |
| NHP | Naval Hospital Pensacola |
| NIOSH | National Institute for Occupational Safety and Health |
| NOAA | National Oceanic and Atmospheric Administration |
| OSHA | Occupational Safety and Health Administration (U.S. Department of Labor) |
| PHSO | Project Health and Safety Officer |
| PID | Photoionization Detector |
| PPE | Personal Protective Equipment |
| PVC | poly vinyl chloride |
| SOPs | Standard Operating Procedures |

| | |
|---|---|
| SOUTHNAVFACENGCOM | Southern Division Naval Facilities Engineering Command |
| SSO | Site Safety Officer |
| SVOCs | Semi-Volatile Organic Compounds |
| TBD | To be determined |
| TOM | Task Order Manager |
| TPH | Total Petroleum Hydrocarbons |
| TtNUS | Tetra Tech NUS, Inc. |
| UST | Underground Storage Tank |
| VOCs | Volatile Organic Compounds |
| WNV | West Nile Virus |

# ATTACHMENT I

# INJURY/ILLNESS PROCEDURE AND REPORT FORM

**TETRA TECH NUS, INC.**

**INJURY/ILLNESS PROCEDURE**
**WORKER'S COMPENSATION PROGRAM**

---

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

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

**ADDITIONAL QUESTIONS REGARDING WORKER'S COMPENSATION:**

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

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

**WHO IS COVERED:**

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

**WHAT IS COVERED:**

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

CASE NO. _____

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

To: Corporate Health and Safety Manager
Human Resource Administrator

Prepared by: _____
Position: _____
Office: _____
Telephone: _____

Project Name: _____
Project No. _____

**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.)

CASE NO. _____

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

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

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## 1.0 PURPOSE

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

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

## 2.0 SCOPE

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

## 3.0 GLOSSARY

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

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

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

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

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

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

## 4.0 RESPONSIBILITIES

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

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

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

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

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

## 5.0 PROCEDURES

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

### 5.1 Buried Utilities

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

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

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

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

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

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

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

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

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

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

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

## 5.2 Overhead Power Lines

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

though conductive materials, tools, or equipment.

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

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

## 6.0 UNDERGROUND LOCATING TECHNIQUES

### 6.1 Geophysical Methods

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

**Electromagnetic Induction**

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

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

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

**Magnetics**

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

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

**Ground Penetrating Radar**

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

## 6.2 Passive Detection Surveys

**Acoustic Surveys**

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

**Thermal Imaging**

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

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

## 6.3 Intrusive Detection Surveys

**Vacuum Excavation**

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

**Hand-auger Surveys**

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

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

**Tile Probe Surveys**

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

## 7.0 INTRUSIVE ACTIVITIES SUMMARY

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

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

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

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

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

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

## 8.0 REFERENCES

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

## ATTACHMENT 1
## LISTING OF UNDERGROUND UTILITY CLEARANCE RESOURCES

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

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

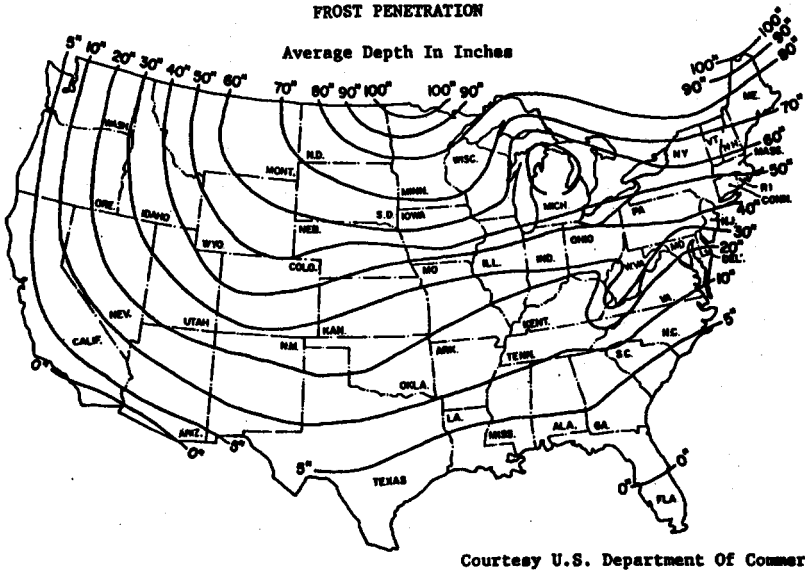
Wyoming One-Call
(800) 348-1030

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<br>Name _____ Telephone: _____ Date: _____ | yes no N/A |
| g) | State One-Call agency called?<br>Caller: _____<br>Ticket Number: _____ Date: _____ | yes no N/A |
| h) | Geophysical survey performed?<br>Survey performed by: _____<br>Method: _____ Date: _____ | yes no N/A |
| i) | Hand augering performed?<br>Augering completed by: _____<br>Total depth: _____ feet Date: _____ | yes no N/A |
| j) | Trench/excavation probed?<br>Probing completed by: _____<br>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**
**DECONTAMINATION ACTIVITIES**
**PENSACOLA NAS**
**CTO 0222**

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

**SECTION I: General Job Scope**

I. Work limited to the following (description, area, equipment used): Decontamination of sampling equipment and machinery (i.e., DPT, augers, backhoe). Brushes and spray bottles will be used to decon small sampling equipment. Pressure washers or steam cleaning units will be used to decon the DPT rig at Building 3241.

SECTION II

II. Required Monitoring Instrument(s): PID or FID (used to screen equipment)

III. Field Crew: _____

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

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

IV. Protective equipment required

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

Respiratory equipment required

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

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

| V. Chemicals of Concern | Action Level(s) | Response Measures |
|---|---|---|
| Site contaminants VOCs include (ethylbenzene, tetrachloroethane and toluene). See Table 5-1 for specific sites and chemicals. | Any sustained readings in BZ above above background. Avoid generating dust. | Suspend site activities and report to an unaffected area. |

VI. Additional Safety Equipment/Procedures

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

Modifications/Exceptions: PVC rain suits or PE or PVC coated Tyvek for protection against splashes and overspray. Chemical resistant boot covers if excessive liquids are generated or to protect footwear.

VII. Procedure review with permit acceptors

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

VIII. 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: To minimize the potential for exposure, site personnel will use PPE and prevent contact with potentially contaminated equipment. Refer to the manufacturer's MSDS regarding PPE, handling, storage, and first-aid measures related to decontamination fluids.

Permit Issued by: _____ Permit Accepted by: _____

**SAFE WORK PERMIT FOR**
**SOIL BORINGS AND WELL INSTALLATION**
**PENSACOLA NAS**
**CTO 222**

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

**SECTION I: General Job Scope**

I. Work limited to the following (description, area, equipment used): Soil borings using Direct Push Technology. Monitoring well installation is included in this task. At Building 3241

II. Required Monitoring Instruments: FID or PID

III. Field Crew: _____

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

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

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

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

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes, safety glasses, hardhat, and nitrile gloves or leather gloves with surgical-style inner gloves.

| VI. Chemicals of Concern | Action Level(s) | Response Measures |
|---|---|---|
| Site contaminants include VOCs ethylbenzene, tetrachloroethane and toluene. See Table 5-1 for specific sites and chemicals. | Any sustained readings in BZ above above background. Avoid generating dust. | Suspend site activities and report to an unaffected area. |

VII. Additional Safety Equipment/Procedures

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

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

VIII. Procedure review with permit acceptors

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

IX. 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, complete permit required or contact Health Sciences, Pittsburgh Office*

XI. Special instructions, precautions: Follow TtNUS SOP "Utility Locating and Excavation Clearance". Minimize generation of airborne dusts.

Permit Issued by: _____ Permit Accepted by: _____

**SAFE WORK PERMIT FOR**
**IDW MANAGEMENT, AND STAGING OF DRUMS**
**PENSACOLA NAS**
**CTO 222**

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

**SECTION I: General Job Scope**

I. Work limited to the following (description, area, equipment used): Handling, sampling, and staging of IDW drums at Building 3241.

II. Required Monitoring Instruments: PID or FID to detect presence of site contaminants

III. Field Crew: _____

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

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

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

Respiratory equipment required

| | | | |
|---|---|---|---|
| Full face APR | ☐ | Escape Pack | ☐ |
| Half face APR | ☐ | Airline/SCBA | ☐ |
| SAR | ☐ | Bottle trailer | ☐ |
| Skid Rig | ☐ | None | ☒ |

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes, hardhat, nitrile outer gloves with surgical-style inner gloves, impermeable boot covers.

VI.

| Chemicals of Concern | Action Level(s) | Response Measures |
|---|---|---|
| Site contaminants include VOCs ethylbenzene, tetrachloroethane and toluene. See Table 5-1 for specific sites and chemicals. | Any sustained readings in BZ above above background. Avoid generating dust. | Suspend site activities and report to an unaffected area. |

VII. Additional Safety Equipment/Procedures

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

Modifications/Exceptions: Tyvek coverall if there is a potiential for soiling clothes. Work/rest regimen to be determined by SSO & site personnel. Cotton or leather gloves with surgical inner gloves.

VIII. Procedure review with permit acceptors

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

IX. 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, complete permit required or contact Health Sciences, Pittsburgh Office*

XI. Special instructions, precautions: _____

Permit Issued by: _____ Permit Accepted by: _____

# SAFE WORK PERMIT FOR MULTI-MEDIA SAMPLING PENSACOLA NAS CTO 0222

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

**SECTION I: General Job Scope**

I. Work limited to the following (description, area, equipment used): Multi-media sampling including groundwater, soil, at Building 3241

II. Required Monitoring Instrument(s): PID or FID

III. Field Crew: _____

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

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

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

Respiratory equipment required

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

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes, surgical style gloves, and safety glasses. Hard hats and hearing protection will be worn when working near operating equipment or when required by the SSO. Reflective vests will be worn for high traffic areas.

V. Chemicals of Concern: Site contaminants VOCs include Ethylbenzene, Tetrachloroethane and toluene. See Table 5-1 for specific sites and chemicals.

Action Level(s): Any sustained readings in BZ above above background. Avoid generating dust.

Response Measures: Suspend site activities and report to an unaffected area.

VI. Additional Safety Equipment/Procedures

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

Modifications/Exceptions: Tyvek coverall if there is a potential for soiling work cloths. SSO may require double-layering gloves.

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: Follow TtNUS SOP "Utility Locating and Excavation Clearance". Minimize generation of airborne dusts.

Permit Issued by: _____ Permit Accepted by: _____

**PENSACOLA NAS**
**CTO 222**
**SAFE WORK PERMIT FOR**
**SOIL BORINGS**

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

**SECTION I: General Job Scope**

I. Work limited to the following (description, area, equipment used): Soil borings using Direct Push Technology at Building 3241

II. Required Monitoring Instrument(s): PID or FID

III. Field Crew: _____

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

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

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

Respiratory equipment required

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

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety footwear, and nitrile gloves w/cotton liner or layered nitrile gloves. Safety glasses, hearing protection, and hard hats will be worn during DPT operations.

| Chemicals of Concern | Action Level(s) | Response Measures |
|---|---|---|
| Site contaminants include VOC's ethylbenzene, tetrachloroethane and toluene. See Table 5-1 for specific sites and chemicals. | Any sustained readings in BZ above above background. Avoid generating dust. | Suspend site activities and report to an unaffected area. |

VII. Additional Safety Equipment/Procedures

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

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

VIII. Procedure review with permit acceptors

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

IX. 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, complete permit required or contact Health Sciences, Pittsburgh Office*

XI. Special instructions, precautions: Follow TtNUS SOP "Utility Locating and Excavation Clearance"

Permit Issued by: _____ Permit Accepted by: _____

Job Completed by: _____ Date: _____

# ATTACHMENT V

# MEDICAL DATA SHEET

# MEDICAL DATA SHEET

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

Project _____

Name _____ Home Telephone _____

Address _____

Age _____ Height _____ Weight _____

Name of Next Kin _____

Drug or other Allergies _____

Particular Sensitivities _____

Do You Wear Contacts? _____

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

_____

_____

What medications are you presently using? _____

_____

_____

Do you have any medical restrictions? _____

_____

_____

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

_____

_____

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

_____ _____

Signature Date

# APPENDIX E

# FDEP STANDARD OPERATING PROCEDURES

# FS 2000. GENERAL AQUEOUS SAMPLING

## 1. COMMON PROCEDURES

The following procedures are applicable to the collection of all water samples.

1.1. Refer to FS 1000 for procedures that are common to all types of sample collection.

1.2. Collection Techniques

1.2.1. When filling a sample container that already contains premeasured preservative, slowly pour the sample down the side of the container so that the preservative does not splatter. If the preservative is concentrated acid, and the sample water is added too quickly, the reaction between the water and the acid can generate enough heat to burn unprotected skin.

1.2.2. Collect grab samples (single, discrete samples) unless directed by permit, program, or approved sampling plan or work plan to collect composite samples.

1.3. Collecting Filtered/Dissolved Samples

1.3.1. For certain studies or projects, it may be necessary to obtain dissolved (i.e., filtered) samples. Identify all analytes in samples that are filtered as "dissolved" or "filtered" in field notes or laboratory transmittal forms and on final reports.

1.3.2. Collect both filtered and unfiltered samples from the same water in a collection device (e.g., bailer, intermediate container) or consecutively if sampling from a pump.

1.3.3. Collect dissolved metals in groundwater according to the procedures discussed in FS 2225. **Do not** collect filtered samples from metals from groundwater sources unless:

1.3.3.1. The FDEP has required or approved the protocol and the FDEP program allows the use of the procedure; or

1.3.3.2. The organization is documenting that a filtered groundwater sample is as or more representative of the groundwater quality. In this case, collect **both** unfiltered and filtered samples for analysis. Submit the results of both samples the FDEP for review.

1.3.4. If collecting filtered samples from static surface water sources (i.e., subsurface samples from lakes, ponds, lagoons or ocean), use the sampling protocols that are specified for groundwater (FS 2225) since exposure to air can change the concentration of metals in solution.

1.3.5. If sampling from moving sources (i.e., rivers or streams) or just below the surface, filtered samples may be collected into an intermediate container and filtered with syringe-type or tripod-type filtration units or by using vacuum filtration.

1.3.6. Filtration, when performed, must begin within 15 minutes of sample collection.

1.3.7. Collect dissolved groundwater samples for metals with a one-piece molded construction 1 µm filter unless otherwise specified by an FDEP program. Use a 0.45 µm filter when filtering all other constituents **including** metals in surface water.

1.3.8. The filter must be compatible with the analyte to be filtered (e.g., zero carbon content for carbon analysis; non-protein binding filters for nitrogen).

1.3.9. Equipment blanks, when collected, must be processed through the filtration apparatus and analyzed for the analytes of interest.

1.4. pH Preserved Samples: The pH of all pH-preserved samples (except volatile organics) must be verified in the field. If samples are routinely collected from the same sample location, a pH check is not required each time sample are collected.

1.4.1. If the frequency of sample collection at a specified location is greater than once per month (i.e. weekly or daily), check the pH of **at least one** sample per parameter group according to the following schedule:

1.4.1.1. Weekly sampling: 1 pH check per month

1.4.1.2. Daily sampling: 1 pH check per week

1.4.2. For all other sample collection frequencies, pH checks may be reduced as follows:

1.4.2.1. During the first sampling event at a particular site, check **all** samples (except volatile organics) that are pH-adjusted, and

1.4.2.2. During subsequent visits to a particular site, check **at least one** sample per parameter group that must be pH-adjusted.

THE FOLLOWING ARE SPECIAL CONSIDERATIONS FOR VARIOUS ANALYTE GROUPS:

## FS 2001. pH Preserved Samples

1. SAMPLE CONTAINERS

1.1. Use properly cleaned sample containers (see FC 1300).

1.2. Inspect all containers for defects or contamination. Discard if defects are present or containers do not appear clean.

2. SAMPLE COLLECTION PROCEDURES

2.1. Perform any filtration **before** the sample is poured into the container and **before** the sample is preserved.

2.2. Remove the cap from the sample container, and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

3. PRESERVATION

3.1. Preserve the sample with the chemical specified by the method or preservation charts (Tables FS 1000-4 to FS 1000-8).

3.2. The chemical reagents must be pure enough so that the reagent does not contribute contamination or interferences to the analytes of interest.

3.3. Preserve the sample within 15 minutes of sample collection or filtration (if applicable) unless collected as a 24-hour composite or for analysis of lead and copper for drinking water compliance (see FS 2301, section 2).

3.4. The pH of the acidified sample must meet the pH criterion of the applicable preservation chart (see Tables FS 1000-4 to FS 1000-8). **Do not over acidify the sample.**

3.5. If the preservative is added after the sample is collected (the container is not prepreserved), do not fill the container to the rim.

3.6. Preserve the sample by adding an accurately measured amount of preservative to the container. Premeasured vials of acid, or a graduated container or pipet, may be used.

3.6.1. Tightly cap the sample container and gently tip the container two to three times to distribute the chemical.

3.6.2. Pour an aliquot of the preserved sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH meets the required level. **Do not put the pH paper directly into the sample container.**

3.6.3. If the pH does not meet the required level, add additional measured amounts of preservative and test with narrow range pH paper (see section 3.6.2 above) until the pH meets the pH requirement.

3.6.4. Record the total amount of preservative that was added to the sample. This documentation is necessary for the next site visit, since additional acid may need to be added to the sample on subsequent visits.

3.6.5. Cooling to 4°C may be required.

3.7. Acidify at least one of the equipment blanks with the **greatest** amount of preservative that was required in the sample set and note the amount in field documentation.

3.8. After the sample has been preserved, screw the cap on tightly.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Complete the field notes.

4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

## FS 2002. Metals

1. SAMPLE CONTAINERS

1.1. Use properly cleaned containers (see FC 1300).

1.2. Visually inspect the containers and caps for defects or contamination. Do not use if defects are present or containers do not appear clean.

2. SAMPLE COLLECTION PROCEDURES

2.1. Perform any filtration **before** the sample is poured into the container and **before** the sample is preserved.

2.2. Remove the cap from the sample container and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

3. PRESERVATION

3.1. Preserve sample with a grade of nitric acid ($HNO_3$) that is suitable for use for metals analysis unless the sample will be analyzed for Chromium VI (see section 3.4 below).

3.1.1. Samples collected for lead and copper for drinking water compliance do not require acid preservation (see FS 2301, section 2). The laboratory must be informed, however, that the samples are unpreserved.

3.2. Preserve the sample within 15 minutes of sample collection or filtration (if applicable) unless collected as a 24-hour composite or for analysis of lead and copper for drinking water compliance (see FS 2301, section 2).

3.3. The pH of the acidified sample must be less than 2. **Do not over acidify the sample.**

3.4. Do not add acid to samples that are to be analyzed for Chromium VI.

3.5. If the preservative is added after the sample is collected (the container is not prepreserved), do not fill the container to the rim.

3.6. Preserve the sample by adding an accurately measured amount of concentrated $HNO_3$ or 1+1 $HNO_3$ to the container. Premeasured vials of acid, or a graduated container or pipet, may be used.

3.6.1. Cap the sample container tightly and shake to distribute the acid.

3.6.2. Pour an aliquot of the acidified sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH is less than 2. **Do not put the pH paper directly into the sample container.**

3.6.3. If the pH is greater than 2, add additional measured amounts of acid and test with narrow range pH paper (see FS 2001, section 3.6.2) until the pH has been reduced to just below 2 pH units. **Do not over acidify the sample by adding more acid than is needed.**

3.6.4. Record the total amount of acid that was added to the sample.

3.6.5. Cooling to 4°C is not required but samples should be protected from direct sunlight.

3.7. Acidify at least one of the equipment blanks with the **greatest** amount of acid that was required in the sample set and note the amount in field documentation.

3.8. After the sample has been preserved, screw the cap on tightly.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Complete the field notes.

4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

## FS 2003. Extractable Organics

1. SAMPLE CONTAINERS

1.1. Most samples are collected in glass containers with Teflon-lined caps. Note: Teflon containers are also acceptable. There are some exceptions such as collecting samples in amber glass (e.g., nitroamines, nitroaromatics, etc.). If in doubt, verify the proper container type in Tables FS 1000-4 through FS 1000-8.

1.2. Visually inspect glass bottles to assure that there are no glass or liner defects. If defects are present and/or the sample containers do not appear clean, the bottles must be discarded.

1.3. Collect composite samples from automatic sample collection devices in refrigerated glass containers through Teflon tubing.

2. SAMPLE COLLECTION PROCEDURES

2.1. Remove the cap from the sample container without touching the interior Teflon liner.

2.2. Carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

2.3. Fill bottle with sample to almost full capacity.

3. PRESERVATION

3.1. In general, these types of samples must be preserved by cooling to 4°C.

3.1.1. Some analyte groups require a chemical preservation. See Tables FS 1000-4 through FS 1000-8 for any additional preservation.

3.1.2. If the samples for pesticides cannot be extracted within 72 hours of collection, the sample pH must be in the range of 5 to 9. If needed, adjust sample to the specified pH range with sodium hydroxide or sulfuric acid.

3.1.3. Add sodium thiosulfate if residual chlorine is present.

3.2. Place samples on wet ice within 15 minutes of sample collection. Do not freeze. If samples are cooled to at least 6°C prior to shipment, samples may be shipped with frozen ice packs if a temperature of less than 6°C is maintained during shipment. Sample temperature must not exceed 6°C.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Put the sample bottle in an untreated plastic sample bag and place on wet ice immediately.

4.3. Complete the field notes.

4.4. Make notes on the lab transmittal form and the field records about any sample that appears highly contaminated or exhibits other abnormal characteristics (i.e., foaming, odor, etc.).

## FS 2004. Volatile Organics

1. SAMPLE CONTAINERS

1.1. Use a glass sample vial that is sealed with a Teflon-coated septum.

1.2. Collect **at least two** vials of each sample. Some laboratories may require three or more vials, therefore verify the laboratory's policy on the number of vials they require unless the laboratory provides the sampling kit.

1.3. Inspect the vials for glass or septum defects (e.g., rim must not have nicks or visible depressions and the septum must not be deformed). Do not use if defects are present or containers do not appear clean.

2. SAMPLE COLLECTION PROCEDURES

2.1. Special precautions for petroleum sources:

2.1.1. If possible, transport and store fuels in a separate vehicle from empty vials and collected samples. If vials and collected samples must be transported in the same vehicle as fuel, store the fuels as far away from the vials as possible.

2.1.2. Place all fuel or exhaust sources downwind of the sampling location.

2.1.3. Position all petroleum-fueled engines (including the vehicle) downwind of the sampling operations.

2.2. Do not allow the sampling equipment or hands to touch the rim of the sample container.

2.3. **DO NOT PRERINSE VOC VIALS.**

2.4. Do not aerate the sample during sample collection.

2.5. If preservation is required, proceed to section 3 below unless the laboratory supplied vials with premeasured quantities of acid, and the sample does not need to be dechlorinated (3.2 below).

2.5.1. If no preservation is required, or if the vials are prepreserved (see 2.5 above), slowly and carefully allow the sample to flow down the **side** of the vial to minimize turbulence. Fill the vial until the surface tension holds the water in a "convex meniscus."

2.5.2. If a vial overflows during the filling process, document the problem and notify the laboratory that the vial may not contain sufficient acid.

2.5.3. If using a bailer, the bailer must be equipped with a controlled flow bottom assembly.

3. PRESERVATION

3.1. Preserve the sample **during** the sample collection process.

3.2. Dechlorination: Some treated water samples (drinking water and treated wastewater) may contain residual chlorine that must be removed with a declorination agent such as sodium thiosulfate or ascorbic acid. This process must occur **before** any additional preservatives (i.e., acid) are added. The dechlorination agent must be **in the vial** before the sample is added.

3.2.1. Laboratories may supply vials with premeasured quantities of declorination agent. If acid preservation **is not required**, fill the vials (see section 2.5.1 above) and proceed to section 4 below.

3.2.2. For chlorinated drinking water samples, add 3 mg sodium thiosulfate per 40 mL vial.

3.2.3. If the chlorine level is unknown, the concentration must be measured (see FT 2000). For sources other than drinking water (e.g., chlorinated effluent), 10 mg sodium thiosulfate per 40 mL vial will remove up to 5 ppm $Cl_2$.

3.3. Acid Preservation

3.3.1. Chlorinated Samples

3.3.1.1. If acid preservation is required, carefully fill the vial with sample, but not to a convex meniscus as described in section 2.5.1 above.

3.3.1.2. Add four drops of concentrated HCl (more acid may be needed if the sample is known to contain high levels of bicarbonate or is otherwise buffered).

3.3.1.3. Add additional sample to create a convex meniscus.

NOTE: If the sample reacts with the acid by generating gas, do not submit preserved samples for analysis. Instead, collect unpreserved samples (seven-day holding time must be met).

3.3.2. Unchlorinated Samples

3.3.2.1. The laboratory may supply vials with premeasured quantities of acid. In this case, proceed to section 2.5.1 above. If a vial overflows during the filling process, document the problem and notify the laboratory that the vial may not contain sufficient acid.

3.3.2.2. If the samples are preserved in the field, follow the procedure in section 3.3 above.

4. CAPPING THE VIAL

4.1. Fill the vial so that the sample surface is above the container rim (convex meniscus).

4.2. **Immediately** cap the vial with the Teflon seal contacting the sample. Some sample may overflow while tightening the cap.

4.3. If acid has been added to the sample, tip the vial gently two or three times to distribute the preservative.

4.4. Turn the vial over and tap it to check for the presence of bubbles.

4.4.1. If bubbles are present, and the total volume of the bubbles is less than 5 mm in diameter, the sample may be submitted.

4.4.2. If the total volume of the bubbles is greater than 5 mm in diameter, discard the vial and fill a new one.

4.4.3. **Do not open a vial to add additional sample.**

5. SAMPLE PACKING

5.1. Label each vial with an appropriate field ID number and preservation (e.g., preserved with acid, sodium thiosulfate/acid, etc.).

5.2. Wrap each vial in a protective material (e.g., bubble wrap).

5.3. Place the set of vials in a small, sealable, untreated plastic bag unless the laboratory supplies an alternate method of packing.

5.4. Place samples on **wet** ice within 15 minutes of sample collection. Do not freeze. If samples are cooled to at least 4°C prior to shipment, samples may be shipped with frozen ice packs if a temperature of less than 6°C is maintained during shipment. Sample temperature must not exceed 6°C.

5.5. Protect samples from environmental contamination during storage and transport to the laboratory.

5.6. As an added measure, FDEP recommends wrapping the set of replicate samples in bubble wrap and sealing them in a container. This procedure will add further protection from potential contamination.

6. DOCUMENTATION

6.1. Label all the vials.

6.2. Complete field records.

6.3. Make note in the field records of any samples that appear highly contaminated or appear to effervesce when acid is added.

## FS 2005. Bacteriological Sampling

1. SAMPLE CONTAINERS

1.1. Collect the samples in properly sterilized containers.

1.1.1. Presterilized Whirl-pak bags (or equivalent) are generally used.

1.1.2. If Whirl-pak bags are not used, the sample container must have a volume of at least 125 mL.

1.1.3. If using bottles, the caps must be sterilized. If the caps are lined, there must be documentation to show that the liner does not produce toxic compounds when sterilized.

1.3. Bottles and caps must be sterilized according to procedures in FC 1220 or purchased presterilized from a commercial vendor.

2. SAMPLE COLLECTION PROCEDURES

2.1. Unless a composite is specified by permit, all samples must be grab samples.

2.2. Do not open the container once it has been sealed.

2.3. Do not rinse sample container before collecting the sample.

2.4. Use aseptic techniques to collect the sample:

2.4.1. If an intermediate container is used, thoroughly rinse the container with the sample water. FDEP recommends that microbiological samples be the last samples collected with the sampling device.

2.4.2. Do not put fingers into the mouth of the container or on the interior of the cap.

2.4.3. Do not disinfect the sample equipment or sampling port with alcohol or flame unless directed by the program. If alcohol is used, the port must be completely dried and rinsed thoroughly with sample water before collecting the sample.

2.5. Rinse the sampling equipment with sample water before collecting the sample. Therefore, collect microbiological samples at the end of a sampling sequence.

2.6. Wells with In-Place Plumbing, Spigots and/or Faucets

2.6.1. Turn on spigots and flush at maximum velocity (see FS 2301, section 3.3).

2.6.2. After flushing, reduce the water flow to approximately 500 mL/min and allow the water to flow for a few minutes before collecting samples.

2.6.3. **Do not stop the flow before or during the filling process.**

2.7. Surface Water Sample Collection

2.7.1. Hold a rigid container near the base and plunge neck downward, below the surface. Turn container until the neck points slightly upward with the mouth directed toward the current. Fill to within about 1/2 inch of the top and cap immediately.

2.7.2. Whirl-pak bags (or equivalent)

2.7.2.1. Open the bag by zipping off the top and pulling the white tabs to open the bag. Hold the bag behind the wire ties, attach to a long handle and plunge neck downward and up in one sweeping arc; or

2.7.2.2. Zip off the top of the bag. Hold bag so that the mouth and wire ties are in front of the hands and fingers. Immerse the bag, and open the bag into the current.

2.7.2.3. Bring the bag to the surface, and press out excess water.

2.7.2.4. Seal the bag by folding the open ends at least three times and securely twisting the wire ties.

2.7.3. When using an intermediate sampling device (bailer, DO dunker, niskin bottle, etc.), obtain sufficient sample in the sample collection device to completely fill the sample container. Begin pouring sample out of the device BEFORE collecting into the container. Continue to pour sample out of the device, place container under flowing stream, and fill. **Do not stop the flow before or during the filling process.**

3. PRESERVATION

3.1. Preserve samples according to Tables FS 1000-4 through FS 1000-8.

3.2. Place all samples on wet ice immediately after sample collection.

3.3. If the water contains residual chlorine, add a dechlorinating agent such as sodium thiosulfate to the sample container.

3.3.1. The final concentration of sodium thiosulfate must be approximately 100 milligrams per liter (mg/L) in the sample (add 0.1 mL of a 10% solution of thiosulfate to a 125 mL sample).

4. HOLDING TIME

4.1. The holding time for microbiological samples is very short. Let the laboratory know the approximate time that samples will be collected and when they are expected to be delivered to the laboratory.

4.2. The holding time begins at the time (hours and minutes) the sample is collected.

4.3. For non-potable sources, the sample analysis (preparation) must begin within six hours of sample collection.

5. DOCUMENTATION

5.1. Label each sample container with an appropriate field ID number.

5.2. Place samples on wet ice within 15 minutes of sample collection. Samples may not be frozen, and the temperature must not exceed 6°C (except drinking water compliance samples which may be received with temperatures up to 10°C).

5.3. Complete field records.

5.4. Make note in the field records of any unusual sample appearances or sampling conditions.

## FS 2006. Oil and Grease (O&G) and Total Recoverable Petroleum Hydrocarbons (TRPHs)

1. SAMPLE CONTAINERS

1.1. Collect samples for O&G and TRPHs in 1-liter wide mouth amber glass bottles.

1.2. The cap must have a Teflon liner.

1.3. Visually inspect glass bottles and caps for defects. Do not use if defects are present or containers do not appear clean.

2. SELECTION OF SAMPLING POINTS

2.1. Oil and grease may be present in wastewater as a surface film, an emulsion, a solution, or as a combination of these forms. Since it is very difficult to collect a representative ambient sample for oil and grease analysis, the sampler must carefully evaluate the location of the sampling point.

2.1.1. Select a point of greatest mixing.

2.1.2. For compliance samples at a facility, collect samples from a point that best represents oil and grease concentrations.

3. SAMPLE COLLECTION PROCEDURES

3.1. All samples must be grab samples.

3.1.1. If composite data are required, collect individual grab samples over the specified time period.

3.1.2. Submit all samples for analysis.

3.1.3. Average the concentrations of the results to determine the average concentration over time.

3.2. Do not collect the sample by skimming the surface.

3.3. Collect a discrete sample that will be used for analysis. This sample may not be used for any other test.

3.4. Remove the cap from the glass bottle without touching the interior of the container or lid.

3.5. Do not rinse the sampling device or the sample container with sample water.

3.6. Collect the sample directly into the container.

3.6.1. If intermediate sampling equipment is needed, do not allow the sampling equipment to touch the rim of the sample container.

3.6.2. Do not use automatic samplers to collect these types of samples.

3.6.3. Fill the bottle with the sample water to almost full capacity.

3.6.4. Add preservatives (see section 4 below).

3.6.5. Quickly cap the container and tighten securely.

4. PRESERVATION

4.1. Preserve the sample within 15 minutes of sample collection.

4.2. The pH of the acidified sample must be less than 2. **Do not over acidify the sample.**

4.3. Preserve the sample by adding an accurately measured amount of sulfuric or hydrochloric acid to the container. Premeasured vials of acid, or a graduated container or pipet, may be used.

4.3.1. Tightly cap the sample container and shake to distribute the acid.

4.3.2. Pour an aliquot of the acidified sample into a disposable container (e.g., sampling cup) or onto a piece of narrow range pH paper to determine if the pH is less than 2. **Do not put the pH paper directly into the sample container.**

4.3.3. If the pH is greater than 2, add additional measured amounts of acid and test with narrow range pH paper (see section 4.3.2 above) until the pH has been reduced to below 2 pH units.

4.3.4. Record the total amount of acid that was added to the sample.

4.4. Acidify at least one of the equipment blanks with the **greatest** amount of acid that was required in the sample set and note the amount in field documentation.

4.5. After the sample has been preserved, screw the cap on tightly.

4.6. Immediately place the sample on **wet** ice after preserving with acid. Do not freeze. If samples are cooled to at least 6°C prior to shipment, samples may be shipped with frozen ice packs if a temperature of less than 6°C is maintained during shipment. Sample temperature must not exceed 6°C.

5. DOCUMENTATION

5.1. Label each vial with an appropriate field ID number.

5.2. Protect glass container from breakage ("bubble wrap" is recommended).

5.3. Complete field records.

5.4. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

## FS 2007. Radiological Sampling (Excludes Radon)

1. SAMPLE CONTAINERS

1.1. Use polyethylene, polyvinyl chloride (PVC), or Teflon containers.

1.2. Visually inspect the containers and caps for defects. If defects are present and/or sample containers do not appear to be clean, do not use the containers.

2. SAMPLE COLLECTION PROCEDURES

2.1. On unknown sites, survey the area with a beta-gamma survey instrument, such as a Geiger-Müller meter.

2.1.1. If radiation levels are above instrument background, consult a radiation safety specialist to determine appropriate safety procedures.

2.2. Remove the cap from the sample container and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

3. PRESERVATION

3.1. Preserve the sample with a suitable grade of nitric acid ($HNO_3$).

3.2. Preserve the sample within 15 minutes of sample collection.

3.3. The pH of the acidified sample must be less than 2. **Do not over acidify the sample.**

3.4. If the preservative is added after the sample is collected (the container is not prepreserved), do not fill the container to the rim.

3.5. Preserve the sample by adding an accurately measured volume of concentrated $HNO_3$ or 1+1 $HNO_3$ to the container. Premeasured vials of acid, or a graduated container or pipet, may be used.

3.5.1. Tightly cap the sample container and shake to distribute the acid.

3.5.2. Pour an aliquot of the acidified sample into a disposable container (e.g., sampling cup) or onto a piece of narrow range pH paper to determine if the pH is less than 2. **Do not put the pH paper directly into the sample container.**

3.5.3. If the pH is greater than 2, add additional measured amounts of acid and test with narrow range pH paper (see section 3.5.2 above) until the pH has been reduced to just below 2 pH units.

3.5.4. Record the total amount of acid that was added to the sample.

3.5.5. Cooling to 4°C is not required.

3.6. Acidify at least one of the equipment blanks with the **greatest** amount of acid that was required in the sample set and note the amount in field documentation.

3.7. After the sample has been preserved, screw the cap on tightly.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Complete the field notes.

4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

## FS 2008. Radon Sampling

Radon is a gas and is easily removed from water sources. Therefore, follow the same precautions and care used to collect volatile organic samples. Minimize contact with air during sample collection. Other sample collection techniques may be appropriate, depending on the analytical technique. Follow the procedures specified in the analytical method if they are different from the protocol outlined below.

1. SAMPLE CONTAINERS

1.1. Use glass sample vials containing a premeasured portion of the scintillation "cocktail."

1.2. Visually inspect the containers and caps for defects. If defects are present and/or sample containers do not appear to be clean, do not use the containers.

1.3. Collect at least two samples.

2. PRESERVATION: The scintillation cocktail is the only required preservative.

3. SAMPLE COLLECTION PROCEDURES

Obtain specific sample collection instructions from the laboratory that will analyze the samples. These instructions must include proper handling as well as sample size and packing instructions. The following are general instructions for collecting the samples:

3.1. Carefully fill a syringe (usually 10 mL) with sample water so that air bubbles are not pulled in with the sample before, during or after filling.

3.2. Place the tip of the syringe BELOW the scintillation cocktail and slowly dispense the sample BENEATH the cocktail surface.

3.3. Replace the lid and cap tightly.

3.4. Generally, the vial is used in the laboratory analytical instrument and labels or ID numbers on the sides of the containers may interfere with the analysis. Check with the laboratory for proper placement of labels or field ID numbers.

3.5. Ship in an upright position in the shipping containers that have been provided by the laboratory. If none are provided, protect vials from breakage ("bubble wrap" is recommended), segregate replicate samples in separate plastic bags, and ship to the laboratory in an upright position.

4. DOCUMENTATION

4.1. Complete the field notes.

4.2. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

## FS 2009. Cyanide Sampling

Cyanide is a very reactive and unstable species and is highly toxic. Samples suspected of containing cyanide must be handled very carefully.

1. SAMPLE CONTAINERS

1.1. Use polyethylene or glass sample containers.

1.2. Use properly cleaned containers (see FC 1300).

1.3. Visually inspect the containers and caps for defects. If defects are present and/or sample containers do not appear to be clean, do not use the containers.

2. SAMPLE COLLECTION PROCEDURES

2.1. Remove the cap from the sample container, and carefully pour the sample into the container without allowing sampling equipment or hands to touch the rim of the sample container.

3. PRESERVATION

3.1. Some pretreatment may be necessary **before** adding the sodium hydroxide preserving agent (see sections 3.2 and 3.3 below).

3.2. Preserve the sample within 15 minutes of sample collection.

3.3. Preserve samples with sodium hydroxide to a pH greater than 12.

3.4. Preserve the sample by adding an accurately measured amount of a sodium hydroxide solution or sodium hydroxide pellets to the container. Use a graduated container or pipet to add the solution.

3.4.1. Tightly cap the sample container and shake to distribute the acid.

3.4.2. Pour an aliquot of the acidified sample into a disposable container (e.g., sampling cup) or onto a piece of **narrow** range pH paper to determine if the pH is greater than 12. **Do not put the pH paper directly into the sample container.**

3.4.3. If the pH is less than 12, add additional measured amounts of the preservative and test with narrow range pH paper (see section 3.4.2 above) until the pH has been raised to above 12 pH units.

3.4.4. Record the total amount of preservative that was added to the sample.

3.5. After the sample has been preserved, screw the cap on tightly.

3.6. Immediately put the sample on **wet** ice. Do not freeze. If samples are cooled to at least 6°C prior to shipment, samples may be shipped with frozen ice packs if a temperature of less than 6°C is maintained during shipment. Sample temperature must not exceed 6°C.

3.7. Sulfides tend to be a regional problem in Florida and can cause interference with cyanide analyses.

3.7.1. Test all samples for sulfides with test papers or kits. However, these tests may not detect sulfides in low enough concentrations to be useful.

3.7.2. Samples that may or may not contain sulfides must be preserved in one of two ways: (1) samples are tested for sulfides, preserved with NaOH to a pH>12 and sent to the lab for analysis within 24 hours; or (2) samples are tested for sulfides and pretreated as follows:

3.7.2.1. Samples with visible particulates must be filtered. Keep this filter.

3.7.2.2. Test the sample for sulfides (see precautionary note in section 3.7.1 above).

3.7.2.3. Remove sulfide by adding cadmium (or lead) nitrate (or carbonate) powder to the sample (filtrate) to precipitate the sulfides.

3.7.2.4. Test for presence of sulfides. Repeat steps described in sections 3.7.2.2 and 3.7.2.3 above, until the test shows no sulfides are present.

3.7.2.5. Remove the precipitate (sulfides) from the sample by filtration and discard this filter.

3.7.2.6. Reconstitute the sample by adding the solids collected on the original filter (see section 3.7.2.1 above) back to the filtrate.

3.7.2.7. Add NaOH until the sample pH is greater than 12 (see section 3.3 above) and cool to 4°C on wet ice.

3.7.2.8. Maximum holding time is now 14 days.

3.8. All samples known to contain oxidizing agents (chlorine) must first be tested as follows:

3.8.1. Test sample with KI-starch paper.

3.8.2. Add a few crystals of ascorbic acid, mix sample and retest.

3.8.3. Continue to add ascorbic acid until the test is negative.

3.8.4. Add an additional 0.6 grams of ascorbic acid per liter of sample to remove chlorine.

3.9. Preserve at least one of the equipment blanks with all the reagents and the **greatest** amount of sodium hydroxide that was required in the sample set and note the amount in field documentation.

4. DOCUMENTATION

4.1. Complete the sample container label and stick firmly on the container.

4.2. Complete the field notes.

4.3. Make notes on the transmittal form and in field records about any relevant observations or problems such as entrained sediment.

# FC 1000. CLEANING / DECONTAMINATION PROCEDURES

1. PERFORMANCE CRITERIA

1.1. The cleaning/decontamination procedures must ensure that all equipment that contacts a sample during sample collection are free from the analytes of interest and constituents that would interfere with the analytes of interest.

1.2. The detergents and other cleaning supplies cannot contribute analytes of interest or interfering constituents unless these are effectively removed during a subsequent step in the cleaning procedure.

1.3. The result of any cleaning procedure (including all cleaning reagents) must be equipment blanks with reported non-detected values.

The cleaning procedures outlined in this SOP are designed to meet the above-mentioned performance criteria. Alternative cleaning reagents or procedures may be used. However, the organization must be prepared to demonstrate through documentation (i.e., company-written protocols and analytical records) and historical data (i.e., absence of analytes of interest in equipment blanks) that it consistently meets these performance criteria. Field quality control measures (see FQ 1210) must support the use of alternative reagents or procedures.

## FC 1001. Cleaning Reagents

Recommendations for the types and grades of various cleaning supplies are outlined below. The recommended reagent types or grades were selected to ensure that the cleaned equipment is free from any detectable contamination.

1. DETERGENTS: Use Liqui-Nox (or a non-phosphate equivalent) or Alconox (or equivalent). Liqui-Nox (or equivalent) is recommended by EPA, although Alconox (or equivalent) may be substituted if the sampling equipment will not be used to collect phosphorus or phosphorus-containing compounds.

2. SOLVENTS

2.1. Use pesticide grade isopropanol as the rinse solvent in routine equipment cleaning procedures. This grade of alcohol must be purchased from a laboratory supply vendor. Rubbing alcohol or other commonly available sources of isopropanol **are not acceptable**.

2.2. Other solvents, such as acetone or methanol, may be used as the final rinse solvent if they are pesticide grade. However, methanol is more toxic to the environment and acetone may be an analyte of interest for volatile organics.

2.2.1. **Do not use** acetone if volatile organics are of interest.

2.2.2. Containerize all methanol wastes (including rinses) and dispose as a hazardous waste.

2.3. Preclean equipment that is heavily contaminated (see FC 1120, section 3) with organic analytes with reagent grade acetone and hexane or other suitable solvents.

2.4. Use pesticide grade methylene chloride when cleaning sample containers.

2.5. Store all solvents away from potential sources of contamination (gas, copier supplies, etc.).

3. ANALYTE-FREE WATER SOURCES

3.1. Analyte-free water is water in which all analytes of interest and all interferences are below method detection limits.

3.2. Maintain documentation (such as results from equipment blanks) to demonstrate the reliability and purity of analyte-free water source(s).

3.3. The source of the water must meet the requirements of the analytical method and must be free from the analytes of interest. In general, the following water types are associated with specific analyte groups:

- Milli-Q (or equivalent polished water): suitable for all analyses.
- Organic-free: suitable for volatile and extractable organics.
- Deionized water: may not be suitable for volatile and extractable organics.
- Distilled water: not suitable for volatile and extractable organics, metals or ultra-trace metals.

3.4. Use analyte-free water for blank preparation and the final decontamination water rinse.

3.5. In order to minimize long-term storage and potential leaching problems, obtain or purchase analyte-free water just prior to the sampling event. If obtained from a source (such as a laboratory), fill the transport containers and use the contents for a single sampling event. Empty the transport container(s) at the end of the sampling event.

3.6. Discard any analyte-free water that is transferred to a dispensing container (such as a wash bottle) at the end of each sampling day.

4. ACIDS

4.1. Reagent Grade Nitric Acid: 10 - 15% (one volume concentrated nitric acid and five volumes deionized water).

4.1.1. Use for the acid rinse unless nitrogen components (e.g., nitrate, nitrite, etc.) are to be sampled.

4.1.2. If sampling for ultra-trace levels of metals, use an ultra-pure grade acid.

4.2. Reagent Grade Hydrochloric Acid: 10% hydrochloric acid (one volume concentrated hydrochloric and three volumes deionized water).

4.2.1. Use when nitrogen components are to be sampled.

4.3. If samples for both metals and the nitrogen-containing components (see FC 1001, section 4.1.1 above) are collected with the equipment, use the hydrochloric acid rinse, or thoroughly rinse with hydrochloric acid after a nitric acid rinse.

4.4. If sampling for ultra trace levels of metals, use an ultra-pure grade acid.

4.5. Freshly prepared acid solutions may be recycled during the sampling event or cleaning process. Dispose appropriately at the end of the sampling event, cleaning process or if acid is discolored or appears otherwise contaminated (e.g., floating particulates).

4.5.1. Transport only the quantity necessary to complete the sampling event.

4.6. Dispose of any unused acids according to FDEP and local ordinances.

## FC 1002. Reagent Storage Containers

The contents of all containers must be clearly marked.

1. DETERGENTS: Store in the original container or in a high density polyethylene (HDPE) or polypropylene (PP) container.

2. SOLVENTS

2.1. Store solvents to be used for cleaning or decontamination in the original container until use in the field. If transferred to another container for field use, the container must be either glass or Teflon.

2.2. Use dispensing containers constructed of glass, Teflon or stainless steel. Note: if stainless steel sprayers are used, any gaskets that contact the solvents must be constructed of inert materials.

3. ANALYTE-FREE WATER: Transport in containers appropriate to the type of water to be stored. If the water is commercially purchased (e.g., grocery store), use the original containers when transporting the water to the field. Containers made of glass, Teflon, polypropylene, or HDPE are acceptable.

3.1. Use glass or Teflon to transport organic-free sources of water on-site. Polypropylene or HDPE may be used but are not recommended.

3.2. Dispense water from containers made of glass, Teflon, HDPE or polypropylene.

3.3. Do not store water in transport containers for more than three days before beginning a sampling event.

3.4. If working on a project that has oversight from EPA Region 4, use glass containers for the transport and storage of all water.

3.5. Store and dispense acids using containers made of glass, Teflon or plastic.

## FC 1003. General Requirements

1. Before using any equipment, clean/decontaminate all sampling equipment (pumps, tubing, lanyards, split spoons, etc.) that are exposed to the sample.

1.1. Before installing, clean (or obtain as certified precleaned) all equipment that is dedicated to a single sampling point and remains in contact with the sample medium (e.g., permanently installed groundwater pump (see FS2220, section 3.3.4).

1.2. Clean this equipment any time it is removed for maintenance or repair.

1.3. Replace dedicated tubing if discolored or damaged.

2. Clean all equipment in a designated area having a controlled environment (house, laboratory, or base of field operations) and transport to the field precleaned and ready to use, unless otherwise justified.

3. Rinse all equipment with water after use, even if it is to be field-cleaned for other sites. Rinse equipment used at contaminated sites or used to collect in-process (e.g., untreated or partially treated wastewater) samples immediately with water.

4. Whenever possible, transport sufficient clean equipment to the field so that an entire sampling event can be conducted without the need for cleaning equipment in the field.

5. Segregate equipment that is only used once (i.e., not cleaned in the field) from clean equipment and return to the in-house cleaning facility to be cleaned in a controlled environment.

6. Protect decontaminated field equipment from environmental contamination by securely wrapping and sealing with one of the following:

6.1. Aluminum foil (commercial grade is acceptable);

6.2. Untreated butcher paper; or

6.3. Clean, untreated, disposable plastic bags. Plastic bags may be used:

6.3.1. For all analyte groups except volatile and extractable organics;

6.3.2. For volatile and extractable organics if the equipment is first wrapped in foil or butcher paper or if the equipment is completely dry.

## FC 1100. Cleaning Sample Collection Equipment

### FC 1110. On-Site/In-Field Cleaning

1. Cleaning equipment on-site is not recommended because:

1.1. Environmental conditions cannot be controlled.

1.2. Wastes (solvents and acids) must be containerized for proper disposal.

2. If performed, follow the appropriate cleaning procedure as outlined in FC 1130. Ambient temperature water may be substituted in the hot, sudsy water bath, and hot water rinses.

**Note: Properly dispose of all solvents and acids.**

3. Rinse all equipment with water after use, even if it is to be field-cleaned for other sites. Rinse equipment used at contaminated sites or used to collect in-process (e.g., untreated or partially treated wastewater) samples immediately with water.

### FC 1120. Heavily Contaminated Equipment

In order to avoid contaminating other samples, isolate heavily contaminated equipment from other equipment and thoroughly decontaminate the equipment before further use. Equipment is considered heavily contaminated if it:

- Has been used to collect samples from a source known to contain significantly higher levels than background;
- Has been used to collect free product; or
- Has been used to collect industrial products (e.g., pesticides or solvents) or their by-products.

1. Cleaning heavily contaminated equipment in the field is not recommended.

2. On-site Procedures

2.1. Protect all other equipment, personnel and samples from exposure by isolating the equipment immediately after use.

2.2. At a minimum, place the equipment in a tightly sealed untreated plastic bag.

2.3. Do not store or ship the contaminated equipment next to clean, decontaminated equipment, unused sample containers, or filled sample containers.

2.4. Transport the equipment back to the base of operations for thorough decontamination.

2.5. If cleaning must occur in the field, and in order to document the effectiveness of the procedure, collect and analyze blanks on the cleaned equipment (see FQ 1000).

3. CLEANING PROCEDURES

3.1. If organic contamination cannot be readily removed with scrubbing and a detergent solution, prerinse equipment by thoroughly rinsing or soaking the equipment in acetone.

3.1.1. Use hexane only if preceded and followed by acetone.

3.2. In extreme cases, it may be necessary to steam clean the field equipment before proceeding with routine cleaning procedures.

3.3. After the solvent rinses (and/or steam cleaning), use the appropriate cleaning procedure (see FC 1130).

3.3.1. Scrub, rather than soak all equipment with sudsy water.

3.3.2. If high levels of metals are suspected and the equipment cannot be cleaned without acid rinsing, soak the equipment in the appropriate acid. Since stainless steel equipment should not be exposed to acid rinses, do not use stainless steel equipment when heavy metal contamination is suspected or present.

3.4. If the field equipment cannot be cleaned utilizing these procedures, discard unless further cleaning with stronger solvents and/or oxidizing solutions is effective as evidenced by visual observation and blanks.

3.5. Clearly mark or disable all discarded equipment to discourage use.

## FC 1130. GENERAL CLEANING

Follow these procedures when cleaning equipment under controlled conditions. See FC 1110 for modifications if cleaning is performed on-site. Check manufacturer's instructions for cleaning restrictions and/or recommendations.

## FC 1131. Procedure for Teflon, Stainless Steel and Glass Sampling Equipment

This procedure must be used when sampling for **ALL** analyte groups: extractable organics, metals, nutrients, etc. or if a single decontamination protocol is desired to clean all Teflon, stainless steel and glass equipment.

1. Rinse equipment with hot tap water.

2. Soak equipment in a hot, sudsy water solution (Liqui-Nox or equivalent - see FC 1001, section 1).

3. If necessary, use a brush to remove particulate matter or surface film.

4. Rinse thoroughly with hot tap water.

5. If samples for trace metals or inorganic analytes will be collected with the equipment and the equipment **is not** stainless steel, thoroughly rinse (wet all surfaces) with the appropriate acid solution (see FC 1001, section 4).

6. Rinse thoroughly with analyte-free water. Use enough water to ensure that all equipment surfaces are thoroughly flushed with water.

7. If samples for volatile or extractable organics will be collected, rinse with isopropanol. Wet equipment surfaces thoroughly with free-flowing solvent. Rinse thoroughly with analyte-free water (see FC 1001, section 3).

8. Allow to air dry. Wrap and seal according to FC 1003, section 6 as soon as the equipment is air-dried.

9. If isopropanol is used, the equipment may be air-dried without the final analyte-free water rinse (see FC 1131, section 8 above); however, **the equipment must be completely dry before wrapping or use**.

10. Wrap clean sampling equipment according to the procedure described in FC 1003, section 6.

## FC 1132. General Cleaning Procedure for Plastic Sampling Equipment

1. Rinse equipment with hot tap water.

2. Soak equipment in a hot, sudsy water solution (Liqui-Nox or equivalent - see FC 1001, section 1).

3. If necessary, use a brush to remove particulate matter or surface film.

4. Rinse thoroughly with hot tap water.

5. Thoroughly rinse (wet all surfaces) with the appropriate acid solution (see FC 1001, section 4). Check manufacturer's instructions for cleaning restrictions and/or recommendations.

6. Rinse thoroughly with analyte-free water. Use enough water to ensure that all equipment surfaces are thoroughly flushed with water. Allow to air dry as long as possible.

7. Wrap clean sampling equipment according to the procedure described in FC 1003, section 6.

## FC 1133. Cleaning Procedure by Analyte Group

See Table FC 1000-1 for the procedures to be used to decontaminate equipment based on construction of sampling equipment, and analyte groups to be sampled.

## FC 1140. Automatic Samplers, Sampling Trains and Bottles

1. When automatic samplers are deployed for extended time periods, clean the sampler using the following procedures when routine maintenance is performed. Inspect deployed samplers prior to each use. At a minimum, change the tubing if it has become discolored or has lost elasticity (FC 1140, section 2.3 below).

2. Clean all automatic samplers (such as ISCO) as follows:

   2.1. Wash the exterior and accessible interior portions of the automatic samplers (excluding the waterproof timing mechanisms) with laboratory detergent (see FC 1001, section 1) and rinse with tap water.

   2.2. Clean the face of the timing case mechanisms with a clean, damp cloth.

2.3. Check all tubing (sample intake and pump tubing). Change the tubing every six months (if used frequently) or if it has become discolored (i.e., affected by mold and algae) or if it has lost its elasticity.

2.4. See FC 1160, section 4 for the procedures associated with cleaning the tubing in the pump head.

3. AUTOMATIC SAMPLER ROTARY FUNNEL AND DISTRIBUTOR

3.1. Clean with hot sudsy water and a brush (see FC 1001, section 1 for appropriate detergent type).

3.2. Rinse thoroughly with analyte-free water.

3.3. Air dry.

3.4. Replace in sampler.

4. SAMPLER METAL TUBE: Clean as outlined in FC 1160, section 5.

5. REUSABLE GLASS COMPOSITE SAMPLE CONTAINERS

5.1. If containers are used to collect samples that contain oil, grease or other hard to remove materials, it may be necessary to rinse the container several times with reagent-grade acetone before the detergent wash. If material cannot be removed with acetone, discard the container.

5.2. Wash containers following the procedure outlined in FC 1131 above. End with a final solvent rinse if organics are to be sampled.

5.3. Invert containers to drain and air dry for at least 24 hours.

5.4. Cap with aluminum foil, Teflon film or the decontaminated Teflon-lined lid.

5.5. After use, rinse with water in the field, seal with aluminum foil to keep the interior of the container wet, and return to the laboratory or base of operations.

5.6. **Do not recycle or reuse containers if:**

5.6.1. They were used to collect in-process (i.e., untreated or partially treated) wastewater samples at industrial facilities;

5.6.2. A visible film, scale or discoloration remains in the container after the cleaning procedures have been used; or

5.6.3. The containers were used to collect samples at pesticide, herbicide or other chemical manufacturing facilities that produce toxic or noxious compounds. Such containers must be properly disposed of (preferably at the facility) at the conclusion of the sampling activities.

5.6.4. If the containers described above are reused, check no less than 10% of the cleaned containers for the analytes of interest **before** use. If found to be contaminated, (i.e., constituents of interest are found at method detection levels or higher), the **discard the containers**.

6. REUSABLE PLASTIC COMPOSITE SAMPLE CONTAINERS

6.1. Follow FC 1132.

6.2. Inspect the containers. Determine if the containers can be reused by the criteria in FC 1140, section 5 above.

7. GLASS SEQUENTIAL SAMPLE BOTTLES FOR AUTOMATIC SAMPLER BASED FOR SEQUENTIAL MODE

7.1. Clean glass sequential sample bottles to be used for collecting inorganic samples by using a laboratory dishwasher (see FC 1140, sections 7.1.1 through 7.1.3 below) or manually following the procedures in FC 1131.

7.1.1. Rinse with appropriate acid solution (see FC 1001, section 4).

7.1.2. Rinse thoroughly with tap water.

7.1.3. Wash in dishwasher at wash cycle, using laboratory detergent cycle, followed by tap and analyte-free water rinse cycles.

7.2. Replace bottles in covered, automatic sampler base; cover with aluminum foil for storage.

7.3. Rinse bottles in the field with water as soon as possible after sampling event.

8. Glass Sequential Sample Bottles (Automatic Sampler based for Sequential Mode) to be used for Collecting Samples for Organic Compounds

8.1. Use cleaning procedures outlined in FC 1131. Allow containers to thoroughly air dry before use.

8.2. Replace bottles in covered, automatic sampler base; cover with aluminum foil for storage.

9. BOTTLE SIPHONS USED TO TRANSFER SAMPLES FROM COMPOSITE CONTAINERS

9.1. Rinse tubing with solvent and dry overnight in a drying oven.

9.2. Cap ends with aluminum foil and/or Teflon film for storage.

9.3. Seal in plastic for storage and transport.

9.4. Flush siphon thoroughly with sample before use.

10. REUSABLE TEFLON COMPOSITE MIXER RODS

10.1. Follow procedures outlined in FC 1131.

10.2. Wrap in aluminum foil for storage.

## FC 1150. FILTRATION EQUIPMENT

1. DISSOLVED CONSTITUENTS USING IN-LINE, MOLDED AND DISPOSABLE FILTER UNITS

1.1. Peristaltic Pump

1.1.1. Clean the pump following procedures in FC 1170, section 2.2.

1.1.2. Clean the pump head tubing following FC 1160, section 4.

1.1.3. If Teflon tubing is used, clean following the procedures in FC 1160, section 3.

1.1.4. Clean other tubing types such as polyethylene according to the appropriate procedures listed in FC 1160, section 7.

1.2. Other Equipment Types (e.g., pressurized Teflon bailer)

1.2.1. Follow the appropriate cleaning regimen specified in FC 1131 through FC 1132 for other types of equipment that utilize in-line, molded and disposable filters.

**Note: filtration units for dissolved metals must follow the configuration and requirements outlined in FS 2225.**

2. DISSOLVED CONSTITUENTS USING NON-DISPOSABLE FILTRATION UNITS (E.G., SYRINGES, "TRIPOD ASSEMBLY")

2.1. Stainless Steel or Glass Units

2.1.1. Follow FC 1131, assembling and applying pressure to the apparatus after each rinse step (water and acid) to drive rinsing solution through the porous filter holder in the bottom of the apparatus.

2.1.2. Remove and clean any transfer tubing according to the appropriate cleaning procedures (see FC 1160).

2.1.3. Assemble the unit and cap both the pressure inlet and sample discharge lines (or whole unit if a syringe) with aluminum foil to prevent contamination during storage.

2.1.4. If the unit will not be used to filter volatile or extractable organics, seal the unit in an untreated plastic bag to prevent contamination.

2.2. Reusable In-Line Filter Holders

2.2.1. Clean, using FC 1131, (if Teflon, glass or stainless steel) or FC 1132 (if plastic) assembling and applying pressure to the apparatus after each rinse step (water and acid) to drive rinsing solution through the porous filter holder in the bottom of the apparatus.

2.2.2. Assemble the unit and wrap with aluminum foil to prevent contamination during storage.

2.2.3. If the unit will **not** be used to filter volatile or extractable organics, seal the unit in an untreated plastic bag to prevent contamination.

3. FILTERS

3.1. Do not clean filters. Instructions for rinsing the filters prior to use are discussed in the applicable sampling SOPs (FS 2000 - FS 8000).

## FC 1160. SAMPLE TUBING DECONTAMINATION

1. Check tubing:

1.1. For discoloration: Remove discolored tubing from use until it can be cleaned. If the discoloration cannot be removed, discard the tubing.

1.2. For elasticity (if used in a peristaltic-type pump): Discard any tubing that has lost its elasticity.

2. Transport all tubing to the field in precut, **precleaned** sections.

3. TEFLON, POLYETHYLENE AND POLYPROPYLENE TUBING

3.1. New Tubing: Follow this procedure unless the manufacturer/supplier provides certification that the tubing is clean.

3.1.1. Teflon

3.1.1.1. Rinse outside of tubing with pesticide-grade solvent (see FC 1001, section 2).

3.1.1.2. Flush inside of tubing with pesticide-grade solvent.

3.1.1.3. Dry overnight in drying oven or equivalent (zero air, nitrogen, etc.).

3.1.2. Polyethylene and Polypropylene

3.1.2.1. Clean the exterior and interior of the tubing by soaking in hot, sudsy water.

3.1.2.2. Thoroughly rinse the exterior and interior of the tubing with tap water, followed by analyte-free water.

3.2. Reused Tubing

Use the following procedure for in-lab cleaning. **Field cleaning is not recommended:**

3.2.1. Clean the exterior of the tubing by soaking in hot, sudsy water (see FC 1001, section 1) in a stainless steel sink (or equivalent non-contaminating material). Use a brush to remove any particulates, if necessary.

3.2.2. Use a small bottle brush and clean the inside of the tubing ends where the barbs are to be inserted or cut 1-2 inches from the ends of the tubing after cleaning.

3.2.3. Rinse tubing exterior and ends liberally with tap water.

3.2.4. Rinse tubing surfaces and ends with the appropriate acid solution (see FC 1001, section 4), tap water, isopropanol (see FC 1001, section 2), and finally analyte-free water.

3.2.4.1. Note: Eliminate the isopropanol rinse for polyethylene or polypropylene tubing.

3.2.5. Place tubing on fresh aluminum foil or clean polyethylene sheeting. Connect all of the precut lengths of tubing with Teflon inserts or barbs.

3.2.6. Cleaning configuration:

3.2.6.1. Place cleaning reagents: [sudsy water (see FC 1001, section 1); acid (see FC 1001, section 4); isopropanol (see FC 1001, section 2)] in an appropriately cleaned container (2-liter glass jar is recommended).

3.2.6.2. Place one end of the Teflon tubing into the cleaning solution.

3.2.6.3. Attach the other end of the Teflon tubing set to the influent end of a pump.

3.2.6.4. Recycle the effluent from the pump by connecting a length of Teflon tubing from the effluent to the glass jar with the cleaning reagents.

3.2.6.5. Recycling as described above may be done for all reagents listed in FC 1160, section 3.2.6.1 above, except the final isopropanol rinse and the final analyte-free water rinse. Disconnect the tubing between the effluent end of the pump and the jar of cleaning reagents.

3.2.6.6. Containerize isopropanol in a waste container for proper disposal.

3.2.6.7. Analyte-free water may be discarded down the drain.

3.2.7. Using the above configuration described in FS 1160, section 3.2.6 above:

3.2.7.1. Pump hot, sudsy water through the connected lengths. Allow the pump to run long enough to pump at least three complete tubing volumes through the tubing set.

3.2.7.2. Using the same procedure, successively pump tap water, the acid solution(s), tap water, isopropanol, and finally analyte-free water through the system.

3.2.7.3. Leave the Teflon inserts or barbs between the precut lengths and cap or connect the remaining ends.

3.2.8. After the interior has been cleaned as described in FC 1160, section 3.2.7 above, rinse the exterior of the tubing with analyte-free water.

3.2.9. Wrap the connected lengths in aluminum foil or untreated butcher paper and store in a clean, dry area until use.

4. FLEXIBLE TUBING USED IN PUMP HEADS OF AUTOMATIC SAMPLERS AND OTHER PERISTALTIC PUMPS

Replace tubing after each sampling point if samples are collected through the tubing. Unless the pump is deployed to collect samples from the same location over a long period of time, remove and wash the tubing after each sampling event (see FC 1140, section 1).

4.1. Flush tubing with hot tap water then sudsy water (see FC 1001, section 1).

4.2. Rinse thoroughly with hot tap water.

4.3. Rinse thoroughly with analyte-free water.

4.4. If used to collect metals samples, flush the tubing with an appropriate acid solution (see FC 1001, section 4), followed by thorough rinsing with analyte-free water. If used to collect both metals and nitrogen components use hydrochloric acid (see FC 1001, section 4.1.1).

4.5. Install tubing in peristaltic pump or automatic sampler.

4.6. Cap both ends with aluminum foil or equivalent.

**Note: change tubing at specified frequencies as part of routine preventative maintenance.**

5. STAINLESS STEEL TUBING

Clean the exterior and interior of stainless steel tubing as follows:

5.1. Using sudsy water (see FC 1001, section 1), scrub the interior and exterior surfaces.

5.2. Rinse with hot tap water.

5.3. Rinse with analyte-free water.

5.4. If volatile or extractable organics are to be sampled, rinse all surfaces with isopropanol (see FC 1001, section 2). Use enough solvent to wet all surfaces with free flowing solvent.

5.5. Allow to air dry or thoroughly rinse with analyte-free water.

6. GLASS TUBING

6.1. Use new glass tubing.

6.2. If volatile or extractable organics are to be sampled, rinse with isopropanol (see FC 1001, section 2).

6.3. Air dry for at least 24 hours.

6.4. Wrap in aluminum foil or untreated butcher paper to prevent contamination during storage.

6.5. Discard tubing after use.

7. MISCELLANEOUS NON-INERT TUBING TYPES (TYGON, RUBBER, PVC, ETC.)

7.1. New Tubing

7.1.1. As a general rule, new tubing may be used without preliminary cleaning.

7.1.2. Protect new tubing from potential environmental contamination by wrapping in aluminum foil and sealing in untreated plastic bags or keep in the original sealed packaging until use.

7.1.3. If new tubing is exposed to potential contamination, rinse the exterior and interior tubing surfaces with hot tap water followed by a thorough rinse with analyte-free water.

7.1.4. If new tubing is to be used to collect samples, thoroughly rinse the tubing with sample water (i.e., pump sample water through the tubing) before collecting samples.

7.2. Reused Tubing

7.2.1. Flush tubing with sudsy solution of hot tap water and laboratory detergent (see FC 1001, section 1).

7.2.2. Rinse exterior and interior thoroughly with hot tap water.

7.2.3. Rinse exterior and interior thoroughly with analyte-free water.

7.2.4. If used to collect only metals samples, flush the tubing with nitric acid (see FC 1001, section 4.1), followed by a thorough rinse with analyte-free water.

7.2.5. If used to collect metals and nitrogen-containing compounds, see FC 1001, section 4.3.

7.2.6. Cap ends in aluminum foil and store in clean, untreated plastic bags to prevent contamination during storage and transport.

## FC 1170. PUMPS

1. SUBMERSIBLE PUMPS

1.1. Pumps used for Purging and Sampling Metals and/or Volatile and Extractable Organics

1.1.1. Construction of pump body and internal mechanisms (bladders, impellers, etc.), including seals and connections, must follow Tables FS 1000-1, FS 1000-2 and FS 1000-3.

1.1.2. Tubing material must follow Tables FS 1000-1, FS 1000-2 and FS 1000-3.

1.1.3. Clean pump exterior following FC 1131. Note: omit the solvent rinse if the pump body is constructed of plastic (e.g., ABS, PVC, etc.).

1.1.4. Clean the pump internal cavity and mechanism as follows:

1.1.4.1. If used only for purging, thoroughly flush the pump with water before purging the next well.

1.1.4.2. If used for purging and sampling, completely disassemble the pump (if practical) and decontaminate between each well.

1.1.4.3. When used for purging and sampling and the pump cannot be (practicably) disassembled, then clean the internal cavity/mechanism by pumping several gallons of sudsy water (see FC 1001, section 1), followed by several gallons of tap water, and finally, several gallons of analyte-free water.

1.1.4.4. If multiple sampling points are located in an area that is not accessible by a vehicle, and it is difficult to return to the vehicle for cleaning or to transport all cleaning materials to the staging location, at a minimum thoroughly rinse the pump with water.

1.1.5. Refer to FC 1160, section 3 to clean Teflon tubing.

1.1.6. Refer to FC 1160, section 5 for stainless steel tubing.

1.1.7. Clean other types of tubing according to FC 1160, sections 6 and 7.

1.2. Pumps used for Purging and Sampling all Analytes except Metals and Volatile and Extractable Organics

1.2.1. Pump construction: no restrictions.

1.2.2. Pump tubing material: no restrictions.

1.2.3. Scrub the exterior of the pump with appropriate metal-free, phosphate-free or ammonia-free detergent solution.

1.2.4. Rinse the exterior with tap water and analyte-free water.

1.2.5. Rinse the interior of the pump and tubing by pumping tap or analyte-free water through the system using a clean bucket or drum.

2. ABOVE-GROUND PUMPS USED FOR PURGING AND SAMPLING

2.1. Pumps used only for Purging

2.1.1. The exterior of the pump must be free of oil and grease.

2.1.2. Select tubing according to Tables FS 1000-1, FS 1000-2 and FS 1000-3.

2.1.3. Clean the tubing that contacts the formation water according to the appropriate protocol for construction materials specified in FC 1160.

2.2. Pumps used for Sampling

2.2.1. Clean the exterior of the pump with a detergent solution followed by a tap water rinse. Use clean cloths or unbleached paper towels that have been moistened with the appropriate solution to wipe down the pump.

2.2.2. Select tubing according to Tables FS 1000-1, FS 1000-2 and FS 1000-3.

2.2.3. Clean the tubing that contacts the formation water according to the appropriate protocol for construction materials specified in FC 1160.

## FC 1180. ANALYTE-FREE WATER CONTAINERS

This section pertains to containers that are purchased to transport, store and dispense analyte-free water. It does not apply to water that has been purchased in containers. See FC 1002, section 3 for appropriate construction materials.

1. NEW CONTAINERS

1.1. Wash containers and caps according to FC 1131, omitting the solvent rinse if plastic (polyethylene or polypropylene) containers are being cleaned.

1.2. Cap with Teflon film or the bottle cap. The bottle cap must be composed of the same material as the container and cannot be lined.

2. REUSED CONTAINERS

2.1. Immediately after emptying, cap with aluminum foil (if not being used for metals), Teflon film or the container cap.

2.2. Wash the exterior of the container with lab-grade detergent solution (see FC 1001, section 1) and rinse with analyte-free water.

2.3. Rinse the interior thoroughly with analyte-free water.

2.4. Invert and allow to drain and dry.

### FC 1190. ICE CHESTS AND SHIPPING CONTAINERS

1. Wash the exterior and interior of all ice chests with laboratory detergent (see FC 1001, section 1) after each use.

2. Rinse with tap water and air dry before storing.

3. If the ice chest becomes severely contaminated with concentrated waste or other toxic or hazardous materials clean as thoroughly as possible, render unusable, and properly dispose.

## FC 1200. Field Instruments and Drilling Equipment

### FC 1210. FIELD INSTRUMENTS (TAPES, METERS, ETC.)

Follow manufacturer's recommendations for cleaning instruments. At a minimum:

1. Wipe down equipment body, probes, and cables with lab-grade detergent solution (see FC 1001, section 1). Check manufacturer's instructions for recommendations and/or restrictions on cleaning.

2. Rinse thoroughly with tap water.

3. Rinse thoroughly with analyte-free water.

4. Store equipment according to the manufacturer's recommendation or wrap equipment in aluminum foil, untreated butcher paper or untreated plastic bags to eliminate potential environmental contamination.

### FC 1220. SOIL BORING EQUIPMENT

This section pertains only to equipment that is not used to collect samples. Clean split spoons, bucket augers and other sampling devices according to FC 1131.

1. Remove oil, grease, and hydraulic fluid from the exterior of the engine and power head, auger stems, bits and other associated equipment with a power washer or steam jenny or wash by hand with a brush and sudsy waster (no degreasers).

2. Rinse thoroughly with tap water.

### FC 1230. Well Casing Cleaning

These are recommended procedures for cleaning well casing and riser pipes. Use procedures specified by a FDEP contract, order, permit, or rule, if different or more stringent than the procedures outlined below.

1. FDEP recommends only using casing that is designed for subsurface environmental groundwater monitoring.

2. Casing that has been contaminated with grease, hydraulic fluid, petroleum fuel, etc. may require additional cleaning or deemed unusable.

3. Clean all casing and riser pipe should be cleaned before installation, unless the casing is received wrapped and ready for installation:

3.1. Steam clean all casing and riser pipe. Steam cleaning criteria shall meet the following: water pressure - 2500 psi; water temperature - 200°F.

3.2. Rinse thoroughly with tap (potable) water. This tap water must be free of the analytes of interest.

## FC 1300. Sample Containers

### FC 1310. Obtaining Clean Containers

1. Obtain clean sample containers in one of three ways:

1.1. From commercial vendors as precleaned containers. The cleaning grades must meet EPA analyte specific requirements. Keep all records for these containers (lot numbers, certification statements, date of receipt, etc.) and document the container intended uses;

1.2. From internal groups within the organization that are responsible for cleaning and maintaining containers according to the procedures outlined in FC 1320; or

1.3. From a subcontracted laboratory that is accredited under the National Environmental Laboratory Accreditation Program (NELAP).

1.3.1. The contractor must verify that the laboratory follows the container cleaning procedures outlined in FC 1320.

1.3.2. If the laboratory cleaning procedures are different, the contractor must require that the laboratory use the following cleaning procedures or provide documentation and historical records to show that their in-house procedure produces containers that are free from the analytes of interest.

### FC 1320. Container Cleaning Procedures

1. Refer to Table FC 1000-2. Follow the cleaning steps in the order specified in the chart.

2. Cleaning procedures that are different from those outlined in FC 1320 may be used as long as blanks collected in the containers are free from the analytes of interest and any analytical interferences and the cleaning procedures are supported by historical and continuing documentation.

3. Inspect all containers before cleaning.

3.1. **Do not recycle or reuse containers if:**

3.1.1. Containers were used to collect in-process (i.e., untreated or partially treated) wastewater samples at industrial facilities;

3.1.2. A visible film, scale or discoloration remains in the container after the cleaning procedures have been used; or

3.1.3. Containers were used to collect samples at pesticide, herbicide or other chemical manufacturing facilities that produce toxic or noxious compounds. Such containers shall be properly disposed of (preferably at the facility) at the conclusion of the sampling activities.

3.1.4. If the containers described above are reused, check no less than 10% of the cleaned containers for the analytes of interest before use. If found to be contaminated (i.e., analytes of interest are found at MDL levels or higher), discard the containers.

## FC 1400. Documentation

Retain all documentation as permanent records for at least five years. If the documentation is associated with samples that are associated with a civil or criminal enforcement case, the court system may require that records be retained for longer periods of time.

### FC 1410. Field Equipment

1. In-Field Cleaning

1.1. Initially identify the procedures that are used to clean equipment in the field by SOP numbers and dates of usage.

1.2. Record the date and time that equipment was cleaned.

2. In-House Cleaning

2.1. Retain any cleaning certificates, whether from a laboratory or commercial vendor.

2.2. Identify the procedure(s) that are used to clean equipment by the SOP number and dates of usage.

2.3. Record the date that the equipment was cleaned.

### FC 1420. Sample Containers

1. Organizations that order precleaned containers must retain the packing slips, and lot numbers of each shipment, any certification statements provided by the vendor and the vendor cleaning procedures.

2. Organizations that clean containers must maintain permanent records of the following:

2.1. Procedure(s) used to clean containers by SOP number and dates of usage.

2.2. If containers are certified clean by the laboratory the laboratory must record:

- Type of container;
- Date cleaned;
- SOP used;

- Person responsible for cleaning;
- Lot number (date of cleaning may be used) of the batch of containers that were cleaned using the same reagent lots and the same procedure;
- The results of quality control tests that were run on lot numbers; and
- Any additional cleaning or problems that were encountered with a specific lot.

### FC 1430. REAGENTS AND OTHER CLEANING SUPPLIES

Maintain a record of the lot number with the inclusive dates of use for all acids, solvents, and other cleaning supplies.

## FC 2000. REFERENCES

1. Florida Department of Environmental Protection, DEP Standard Operating Procedures for Laboratory Operations and Sample Collection Activities, DEP QA-001/92, September 1992.

2. U.S. Environmental Protection Agency, Region 4, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, May 1996

## Appendix FC 1000
## Tables, Figures and Forms

Table FC 1000-1 Procedures for Decontamination at the Base of Operations or On-site
Table FC 1000-2 Container Cleaning Procedures

**Table FC 1000-1**
**Procedures for Decontamination at the Base of Operations or On-Site**

| Construction Material | Analyte Group Sampled | SOP Reference | Base of Operations | On-Site |
|---|---|---|---|---|
| Teflon or Glass | All | FC 1131 | Follow as written | May substitute ambient temperature water for the hot water rinses and hot detergent solution |
| | Extractable & Volatile Organics<br>Petroleum Hydrocarbons | | May omit acid rinse | May substitute ambient temperature water for the hot water rinses and hot detergent solution<br>May omit acid rinse |
| | Metals[1]<br>Radionuclides<br>For ultra trace metals, refer to FS 8200 | | May omit solvent rinse | May substitute ambient temperature water for the hot water rinses and hot detergent solution<br>May omit solvent rinse |
| | Inorganic Nonmetallics<br>Physical & Aggregate Properties<br>Aggregate Organics<br>Biologicals<br>Volatile Inorganics | | May omit solvent rinse | Rinse several times with water<br>Rinse several times with sample water from the next sampling location |
| | Microbiological – Viruses<br>Microbiological - Bacteria | | Omit solvent and acid rinses | Rinse several times with water<br>Rinse several times with sample water from the next sampling location |
| Metallic (stainless steel, brass, etc.) | All<br>Extractable & Volatile Organics<br>Petroleum Hydrocarbons | FC 1131 | Omit the acid rinse | May substitute ambient temperature water for the hot water rinses and hot detergent solution<br>Omit the acid rinse |
| | Metals<br>Radionuclides | | Omit the acid rinse<br>May omit the solvent rinse | May substitute ambient temperature water for the hot water rinses and hot detergent solution<br>Omit the acid rinse<br>May omit the solvent rinse |
| | Inorganic Nonmetallics<br>Physical & Aggregate Properties<br>Aggregate Organics<br>Biologicals<br>Volatile Inorganics | | Omit solvent rinse<br>May omit the acid rinse | Rinse several times with water<br>Rinse several times with sample water from the next sampling location |

**Table FC 1000-1**
**Procedures for Decontamination at the Base of Operations or On-Site**

| Construction Material | Analyte Group Sampled | SOP Reference | Base of Operations | On-Site |
|---|---|---|---|---|
| | Microbiological – Viruses<br>Microbiological - Bacteria | | Omit solvent and acid rinses | Rinse several times with water<br>Rinse several times with sample water from the next sampling location |
| Plastic | All except Volatile and Extractable Organics and Petroleum Hydrocarbons | FC 1132 | Follow as written | May substitute ambient temperature water for the hot water rinses and hot detergent solution |
| | Inorganic Nonmetallics<br>Physical & Aggregate Properties<br>Aggregate Organics<br>Biologicals<br>Volatile Inorganics | | May omit the acid rinse | Rinse several times with water<br>Rinse several times with sample water from the next sampling location |
| | Microbiological – Viruses<br>Microbiological - Bacteria | | Omit acid rinse | Rinse several times with water<br>Rinse several times with sample water from the next sampling location |

[1] Do not use glass if collecting samples for boron or silica.

**Table FC 1000-2**
**Container Cleaning Procedures**

| ANALYSIS / ANALYTE GROUP | CLEANING STEPS See Description Below |
|---|---|
| Extractable Organics | 1, 2, 4, 6, (5 and 7 optional), 11 |
| Volatile Organics | 1, 2, 4, (6 optional, methanol only), 7 |
| Metals | 1, 2, 3, 4, 8, 11 ** **Procedures to clean containers for ultra-trace metals are found in FS 8200 |
| Inorganic Nonmetallics, Radionuclides, Physical and Aggregate Properties, Aggregate Inorganics, and Volatile Inorganics | 1, 2, 3*, 4, 8, 11 * For nutrients, replace nitric acid with hydrochloric acid, or use a hydrochloric acid rinse after the nitric acid rinse. See FC 1001, section 4 |
| Petroleum Hydrocarbons, and Oil and Grease | 1, 2, 3, 4, (5, 6, 7 optional), 11 |
| Microbiological (all) | 1, 2, 4, 8, 9, 11 |
| Toxicity Tests (Includes Bioassays) | 1, 2, 10, 2, 4, 6.1, (10 optional), 11 |

**NOTE:** Steps 1 and 2 may be omitted when cleaning new, uncertified containers.

1. Wash with hot tap water and a brush using a suitable laboratory-grade detergent:

   1.1. Volatile and Extractable Organics, Petroleum Hydrocarbon, Oil and Grease: Liqui-Nox, Alconox or equivalent;

   1.2. Inorganic nonmetallics: Liqui-Nox or equivalent;

   1.3. Metals: Liqui-Nox, Acationox, Micro or equivalents:

   1.4. Microbiologicals (all): Must pass an inhibitory residue test.

2. Rinse thoroughly with hot tap water.
3. Rinse with 10% nitric acid solution.
4. Rinse thoroughly with analyte-free water (deionized or better).
5. Rinse thoroughly with pesticide-grade methylene chloride.
6. Rinse thoroughly with pesticide-grade isopropanol, acetone or methanol.

   6.1. For bioassays, use only acetone, and only when containers are glass.

7. Oven dry at 103°C to 125°C for at least 1 hour.

   7.1. VOC vials and containers must remain in the oven in a contaminant-free environment until needed. They should be capped in a contaminant-free environment just prior to dispatch to the field.

**Table FC 1000-2**
**Container Cleaning Procedures**

8. Invert and air-dry in a contaminant-free environment.
9. Sterilize containers:
   - 9.1. Plastic: 60 min at 170°C, loosen caps to prevent distortion.
   - 9.2. Glass: 15 min at 121°C.
10. Rinse with 10% hydrochloric acid followed by a sodium bicarbonate solution.
11. Cap tightly and store in a contaminant-free environment until use. Do not use glass if collecting samples for boron or silica.

# FS 2200. Groundwater Sampling

1. INTRODUCTION AND SCOPE

1.1. Use these Standard Operating Procedures to collect groundwater samples. They are designed to ensure that the collected samples will be representative of water in the aquifer or target formation and that the samples have not been altered or contaminated by the sampling and handling procedures. Use of alternative, FDEP-approved and properly documented procedures (e.g., Corporate SOP, ASTM Standards, alternative equipment, etc.) is acceptable if they meet the intent (e.g., sample representativeness and integrity) of this standard (see FA 1000).

1.2. The topics in this SOP include equipment and supply selection, equipment construction materials, and purging and sampling techniques.

1.3. Use the following FDEP SOPs in conjunction with FS 2200:

- FA 1000 Regulatory Scope and Administrative Procedures for Use of DEP SOPs
- FC 1000 Cleaning/Decontamination Procedures
- FD 1000 Documentation Procedures
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FS 2000 General Aqueous Sampling
- FT 1000 Field Testing and Measurement

1.4. Groundwater samples may be collected from a number of different configurations. Each configuration is associated with a unique set of sampling equipment requirements and techniques:

1.4.1. Wells without Plumbing: These wells require that equipment be brought to the well to purge and sample unless dedicated equipment is placed in the well.

1.4.2. Wells with In-Place Plumbing: Wells with in-place plumbing do not require that equipment be brought to the well to purge and sample. In-place plumbing is generally considered permanent equipment routinely used for purposes other than purging and sampling, such as for water supply. They are generally found at wellfields, industrial facilities, and private residences. See FS 2300 for procedures to sample potable water wells.

1.4.3. Air Strippers or Remedial Systems: These types of systems are installed as remediation devices. Sample these wells like drinking water wells (see FS 2300).

## FS 2201. Equipment and Supplies

Use groundwater purging and sampling equipment constructed of only non-reactive, non-leachable materials that are compatible with the environment and the selected analytes. In selecting groundwater purging and sampling equipment, give consideration to the depth of the well, the depth to groundwater, the volume of water to be evacuated, the sampling and purging technique, and the analytes of interest. Refer to Tables FS 1000-1, FS 1000-2, FS 1000-3 and FS 2200-1 for selection of appropriate equipment.

Additional supplies such as reagents and preservatives may be necessary.

1. PUMPS: All pumps or pump tubing must be lowered and retrieved from the well slowly and carefully to minimize disturbance to the formation water. This is especially critical at the air/water interface.

1.1. Above-Ground Pumps

1.1.1. Variable Speed Peristaltic Pump: Use a variable speed peristaltic pump to purge groundwater from wells when the static water level in the well is no greater than 20-25 feet below land surface (BLS). If the water levels are deeper than 18-20 feet BLS, the pumping velocity will decrease.

1.1.1.1. A variable speed peristaltic pump can be used for normal purging and sampling (FS 2213 and FS 2221), sampling low permeability aquifers or formations (FS 2222) and collecting filtered groundwater samples (FS 2225, section 1).

1.1.1.2. Most analyte groups can be sampled with a peristaltic pump if the tubing and pump configurations are appropriate. See Table FS 1000-3 for proper tubing selection and pump configurations.

1.1.2. Variable Speed Centrifugal Pump: A variable speed centrifugal pump can be used to purge groundwater from 2-inch and larger internal diameter wells. **Do not use** this type of pump to collect groundwater samples.

1.1.2.1. When purging is complete, do not allow the water that remains in the tubing to fall back into the well. Install a check valve at the end of the purge tubing, and withdraw the tubing slowly from the well while the pump is still running.

1.1.2.2. See Table FS 1000-3 for proper tubing selection and allowable analyte groups.

1.2. Submersible Pumps

1.2.1. Variable Speed Electric Submersible Pump: A variable speed submersible pump can be used to purge and sample groundwater from 2-inch and larger internal diameter wells.

1.2.1.1. A variable speed submersible pump can be used for normal purging and sampling (FS 2213 and FS 2221), sampling low permeability aquifers or formations (FS 2222) and collecting filtered groundwater samples (FS 2225, section 1).

1.2.1.2. Make sure that the pump housing, fittings, check valves and associated hardware are constructed of stainless steel. Make sure that any other materials are compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

1.2.1.3. Install a check valve at the output side of the pump to prevent backflow.

1.2.1.4. If purging **and** sampling for organics:

- The entire length of the delivery tube must be Teflon, Polyethylene or Polypropylene (PP) tubing.
- The electrical cord must be sealed in Teflon, Polyethylene or PP and any cabling must be sealed in Teflon, Polyethylene or PP, or be constructed of stainless steel.
- All interior components that contact the sample water (impeller, seals, gaskets, etc.) must be constructed of stainless steel or Teflon.

1.2.2. Variable Speed Bladder Pump: A variable speed positive displacement bladder pump (no-gas contact) can be used to purge and sample groundwater from 3/4-inch and larger internal diameter wells.

1.2.2.1. A variable speed bladder pump can be used for normal purging and sampling (FS 2213 and FS 2221), sampling low permeability aquifers or formations (FS 2222) and collecting filtered groundwater samples (FS 2225, section 1).

1.2.2.2. The bladder pump system is composed of the pump, the compressed air tubing, the water discharge tubing, the controller and a compressor or compressed gas supply.

1.2.2.3. The pump consists of a bladder and an exterior casing or pump body that surrounds the bladder and two (2) check valves. These parts can be composed of various materials, usually combinations of polyvinyl chloride (PVC), Teflon, Polyethylene, PP and stainless steel. Other materials must be compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

1.2.2.4. If purging and sampling for organics:

- The pump body must be constructed of stainless steel and the valves and bladder must be Teflon, Polyethylene or PP.
- The entire length of the delivery tube must be Teflon, Polyethylene or PP.
- Any cabling must be sealed in Teflon, Polyethylene or PP, or be constructed of stainless steel.

1.2.2.5. Permanently installed pumps may have a PVC pump body as long as the pump remains in contact with the water in the well.

2. BAILERS:

2.1. Purging: FDEP does not recommend using bailers for purging unless no other equipment can be used or purging with a bailer has been specifically authorized by an FDEP program, permit, contract or order (see Table FS 2200-3). Use a bailer if there is non-aqueous phase liquid (free product) in the well or non-aqueous phase liquid is suspected to be in the well. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate FDEP program or project manager. If a bailer is used, follow FS 2213, section 4 with no deviations.

2.2. Sampling: Bailers may be used to routinely collect some analyte groups or under specific circumstances for other analyte groups (see Table FS 2200-3).

2.3. Construction and Type:

2.3.1. Bailers must be constructed of materials compatible with the analytes of interest. See Table FS 1000-3 for restrictions.

2.3.1.1. Stainless steel, Teflon, Polyethylene and PP bailers may be used to sample all analytes.

2.3.2. Use disposable bailers when sampling grossly contaminated sample sources.

2.3.3. FDEP recommends using dual check valve bailers when collecting samples.

2.3.4. Use bailers with a controlled flow bottom when collecting volatile organic samples.

using a bailer at a site or during a particular sampling event, contact the appropriate FDEP program or project manager.

2. INITIAL INSPECTION

2.1. Remove the well cover and remove all standing water around the top of the well casing (manhole) before opening the well.

2.2. Inspect the exterior protective casing of the monitoring well for damage and document the results of the inspection if there is a problem.

2.3. It is recommended that you place a protective covering around the well head. Replace the covering if it becomes soiled or ripped.

2.4. Inspect the well lock and determine whether the cap fits tightly. Replace the cap if necessary.

3. WATER LEVEL MEASUREMENTS: Use an electronic probe or chalked tape to determine the water level.

3.1. Decontaminate all equipment before use.

3.2. Measure the depth to groundwater from the top of well casing to the nearest 0.01 foot and always measure from the same reference point or survey mark on the well casing.

3.3. Record the measurement.

3.4. Electronic Probe

3.4.1. Decontaminate all equipment before use.

3.4.1.1. Follow the manufacturer's instructions for use.

3.4.1.2. Record the measurement.

3.5. Chalked Line Method

3.5.1. Decontaminate all equipment before use.

3.5.2. Lower chalked tape into the well until the lower end is in the water (usually determined by the sound of the weight hitting the water).

3.5.3. Record the length of the tape relative to the reference point (see section 3.2 above).

3.5.4. Remove the tape and note the length of the wetted portion.

3.5.5. Record the length.

3.5.6. Determine the depth to water by subtracting the length of the wetted portion (section 3.5.4 above) from the total length (section 3.5.3 above). Record the result.

4. WATER COLUMN DETERMINATION

4.1. Subtract the depth to the top of the water column from the total well depth to determine the length of the water column.

4.2. The total well depth depends on the well construction. Some wells may be drilled in areas of sinkhole or karst formations or rock leaving an open borehole. Attempt to find the total borehole depth in cases where there is an open borehole below the cased portion.

5. WELL WATER VOLUME

5.1. Calculate the total volume of water in gallons in the well using the following equation:

**V = (0.041)d x d x h**

Where: V = volume in gallons
d = well diameter in inches
h = height of the water column in feet

5.2. The total volume of water in the well may also be determined with the following equation by using a casing volume per foot factor (Gallons per Foot of Water) for the appropriate diameter well:

**V = [Gallons per Foot of Water] x h**

Where: V = volume in gallons
h = height of the water column in feet

| Casing Internal Diameter | Approximate Gallons per Foot of Water |
|---|---|
| 0.75" | 0.02 |
| 1" | 0.04 |
| 1.25" | 0.06 |
| 2" | 0.16 |
| 3" | 0.37 |
| 4" | 0.65 |
| 5" | 1.02 |
| 6" | 1.47 |
| 12" | 5.88 |

5.3. Record all measurements and calculations in the field records.

6. PURGING EQUIPMENT VOLUME

6.1. Calculate the total volume of the pump, associated tubing and flow cell, if used, using the following equation:

**V = p + ((0.041)d x d x l) + fc**

Where: V = volume in gallons
p = volume of pump in gallons
d = tubing diameter in inches
l = length of tubing in feet
fc = volume of flow cell in gallons

7. When collecting samples from multiple wells on a site, if the groundwater elevation data are to be used to construct groundwater elevation contour maps, all water level measurements must be taken within the same 24 hour time interval unless a shorter time period is required by a FDEP program. If the site is tidally influenced, complete the water level measurements within the time frame of an incoming or outgoing tide.

## FS 2212. Well Purging Techniques

The selection of the purging technique and equipment is dependent on the hydrogeologic properties of the aquifer, especially depth to groundwater and hydraulic conductivity. Equipment selection must comply with construction and configuration requirements specified in Table FS 2200-1 and the discussions in FS 2201.

1. MEASURING THE PURGE VOLUME: The volume of water that is removed during purging must be recorded. Therefore, you must measure the volume during the purging operation.

1.1. Collect the water in a graduated container and multiply the number of times the container was emptied by the volume of the container, or

1.2. Estimate the volume based on pumping rate. This technique may be used only if the pumping rate is constant. Determine the pumping rate by measuring the amount of water that is pumped for a fixed period of time or use a flow meter.

1.2.1. Calculate the amount of water that is discharged per minute:

$$D = \frac{\text{Measured amount}}{\text{Total time in minutes}}$$

1.2.2. Calculate the time needed to purge one (1) well volume or one (1) purging equipment volume:

$$\text{Time} = \frac{V}{D}$$

Where: V = well volume determined from FS 2211, section 5 or purging equipment volume

D = discharge rate calculated in section 1.2.1. above

1.2.3. Make new measurements (section 1.2.1 above) each time the pumping rate is changed.

1.3. Use a totalizing flow meter.

1.3.1. Record the reading on the totalizer prior to purging.

1.3.2. Record the reading on the totalizer at the end of purging.

1.3.3. Subtract the reading on the totalizer prior to purging from the reading on the totalizer at the end of purging to obtain the volume purged.

1.4. Record in the field records the times that purging begins and ends.

2. PURGING MEASUREMENT FREQUENCY

2.1. When purging a well that has the well screen fully submerged and the pump or intake tubing is placed within the well casing above the well screen or open hole, purge a minimum of one (1) well volume prior to collecting measurements of the field parameters. Allow at least one quarter (1/4) well volume to purge between subsequent measurements.

2.2. When purging a well that has the pump or intake tubing placed within a fully submerged well screen or open hole, purge until the water level has stabilized (well recovery rate equals the purge rate), then purge a minimum of one (1) volume of the pump, associated tubing and flow cell (if used) prior to collecting measurements of the field parameters. Take measurements of the field parameters no sooner than two (2) to three (3)

minutes apart. Purge at least three (3) volumes of the pump, associated tubing and flow cell, if used, prior to collecting a sample.

2.3. When purging a well that has a partially submerged well screen, purge a minimum of one (1) well volume prior to collecting measurements of the field parameters. Take measurements of the field parameters no sooner than two (2) to three (3) minutes apart.

3. PURGING COMPLETION: Purging is considered complete if any one of the following three (3) criteria are satisfied:

3.1. Three (3) consecutive measurements in which the three (3) parameters listed below are within the stated limits, Dissolved Oxygen is no greater than 20 percent of saturation at the field measured temperature, and Turbidity is no greater than 20 Nephelometric Turbidity Units (NTUs).

- Temperature: ± 0.2° C
- pH: ± 0.2 Standard Units
- Specific Conductance: ± 5.0% of reading

Document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

3.2. If it is impossible to get Dissolved Oxygen at or below 20 percent of saturation at the field measured temperature, or Turbidity at or below 20 NTUs, then three (3) consecutive measurements of Temperature, pH, Specific Conductance and the parameter(s) Dissolved Oxygen and/or Turbidity that does not meet the requirements in section 3.1 above must be within the limits listed below:

- Temperature: + 0.2° C
- pH: ± 0.2 Standard Units
- Specific Conductance: ± 5.0% of reading
- Dissolved Oxygen: ± 0.2 mg/L or 10%, whichever is greater
- Turbidity: ± 5 NTUs or 10%, whichever is greater

Additionally, document and report the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.

- A description of conditions at the site that may cause the Dissolved Oxygen to be high and/or Dissolved Oxygen measurements made within the screened or open hole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that may cause the Turbidity to be high and any procedures that will be used to minimize Turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

If from review of the submitted data the Department determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first two (2) items are required to be submitted in future reports. However, if the Department cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first two (2) items, a description of the conditions at the site that may have caused the affected parameter(s) to be high is required to be submitted in future reports.

3.3. If after five (5) well volumes, three (3) consecutive measurements of the field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen, and Turbidity are not within the limits stated in section 3.2 above, check the instrument condition and calibration, purging flow rate and all tubing connections to determine if they might be affecting the ability to achieve stable measurements. It is at the discretion of the project leader whether or not to collect a sample or to continue purging.

Further, the report in which the data are submitted must include the following, as applicable, except that the last four (4) items only need to be submitted once:

- Purging rate.
- Drawdown in the well, if any.
- A description of conditions at the site that may cause the Dissolved Oxygen to be high and/or Dissolved Oxygen measurements made within the screened or open hole portion of the well with a downhole dissolved oxygen probe.
- A description of conditions at the site that may cause the turbidity to be high and any procedures that will be used to minimize turbidity in the future.
- A description of the process and the data used to design the well.
- The equipment and procedure used to install the well.
- The well development procedure.
- Pertinent lithologic or hydrogeologic information.

If from review of the submitted data the FDEP determines that both the elevated Dissolved Oxygen and Turbidity measurements are due to naturally occurring conditions, then only the first two (2) items are required to be submitted in future reports. However, if the FDEP cannot determine if the Dissolved Oxygen or Turbidity is elevated due to naturally occurring conditions, then in addition to the first two (2) items, a description of the conditions at the site that may have caused the affected parameter(s) to be high is required to be submitted in future reports.

3.4. One fully dry purge (not recommended). This criterion applies only if purging was attempted per FS 2212, FS 2213, and section 3.4.1 below, and if it is impossible to balance the pumping rate with the rate of recharge at very low pumping rates (< 100 mL/minute).

3.4.1. If wells have previously and consistently purged dry, when purged according to FS 2212 and FS 2213, and the current depth to groundwater indicates that the well will purge dry during the current sampling event, minimize the amount of water removed from the well by using the same pump to purge and collect the sample:

3.4.1.1. Place the pump or tubing intake within the well screened interval.

3.4.1.2. Use very small diameter Teflon, Polyethylene or PP tubing and the smallest possible pump chamber volume to minimize the total volume of water pumped from the well and to reduce drawdown.

3.4.1.3. Select tubing that is thick enough to minimize oxygen transfer through the tubing walls while pumping.

3.4.1.4. Pump at the lowest possible rate (100 mL/minute or less) to reduce drawdown to a minimum.

3.4.1.5. Purge at least two (2) volumes of the pumping system (pump, tubing and flow cell, if used).

3.4.1.6. Measure pH, Specific Conductance, Temperature, Dissolved Oxygen and Turbidity and begin to collect the samples (see FS 2222)..

4. Collect samples immediately after purging is complete. The time period between completing the purge and sampling cannot exceed six (6) hours. If sample collection does not occur within one (1) hour of purging completion, re-measure the five (5) field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen and Turbidity just prior to collecting the sample. If the measured values are not within 10 percent of the previous measurements, re-purge the well. The exception is "dry" wells (see section 3.4 above).

5. LANYARDS

5.1. Securely fasten lanyards, if used, to any downhole equipment (bailers, pumps, etc.).

5.2. See FS 2201, section 3 for acceptable lanyard types and use.

5.3. Use bailer lanyards in such a way that they do not touch the ground surface.

## FS 2213. Wells Without Plumbing

1. TUBING/PUMP PLACEMENT

1.1. If you are attempting to minimize the volume of purge water, the pump will be used for both purging and sampling, the well screen interval is less than or equal to 10 feet, and the well screen is fully submerged, position the intake hose or pump at the midpoint of the screened or open hole interval.

1.2. If monitoring well conditions do not allow minimizing of the purge water volume (see 1.1 above) or you intend to collect samples with equipment different than that used to purge, position the pump or intake hose near the top of the water column. This will ensure that all stagnant water in the casing is removed.

1.3. If the well screen or borehole is partially submerged, and the pump will be used for both purging and sampling, position the pump midway between the measured water level and the bottom of the screen. Otherwise position the pump as described in 1.2 above.

2. NON-DEDICATED (PORTABLE) PUMPS

2.1. Variable Speed Peristaltic Pump

2.1.1. Wear sampling gloves to position the decontaminated pump and tubing.

2.1.2. Attach a short section of tubing to the discharge side of the pump and into a graduated container.

2.1.3. Attach one end of a length of new or precleaned tubing to the pump head flexible hose.

2.1.4. Place the tubing per one of the options in FS 2213, section 1 above.

2.1.5. Change gloves before beginning purging.

2.1.6. Measure the depth to groundwater at frequent intervals.

2.1.7. Record these measurements.

2.1.8. Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.1.9. If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.1.10. If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.1.11. Record the purging rate each time the rate changes.

2.1.12. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.1.13. Record this measurement.

2.1.14. Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.2. Variable Speed Centrifugal Pump

2.2.1. Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

2.2.2. Wear sampling gloves to position the decontaminated pump and tubing.

2.2.3. Place the decontaminated suction hose so that water is always pumped from the top of the water column.

2.2.4. Change gloves before beginning purging.

2.2.5. Equip the suction hose with a foot valve to prevent purge water from re-entering the well.

2.2.6. Measure the depth to groundwater at frequent intervals.

2.2.7. Record these measurements.

2.2.8. Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.2.9. If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.2.10. If the water table continues to drop during pumping, lower the tubing at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.2.11. Record the purging rate each time the rate changes.

2.2.12. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.2.13. Record this measurement.

2.2.14. Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.3. Variable Speed Electric Submersible Pump

2.3.1. Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

2.3.2. Wear sampling gloves to position the decontaminated pump and tubing.

2.3.3. Carefully position the decontaminated pump per one of the options in FS 2213, section 1 above.

2.3.4. Change gloves before beginning purging.

2.3.5. Measure the depth to groundwater at frequent intervals.

2.3.6. Record these measurements.

2.3.7. Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.3.8. If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.3.9. If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.3.10. Record the purging rate each time the rate changes.

2.3.11. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.3.12. Record this measurement.

2.3.13. Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

2.4. Variable Speed Bladder Pump

2.4.1. Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

2.4.2. Wear sampling gloves to position the decontaminated pump and tubing.

2.4.3. Attach the tubing and carefully position the pump per one of the options in FS 2213, section 1 above.

2.4.4. Change gloves before beginning purging.

2.4.5. Measure the depth to groundwater at frequent intervals.

2.4.6. Record these measurements.

2.4.7. Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

2.4.8. If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdrawal rate with the recharge rate.

2.4.9. If the water table continues to drop during pumping, lower the tubing or pump at the approximate rate of drawdown so that the water is removed from the top of the water column.

2.4.10. Record the purging rate each time the rate changes.

2.4.11. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

2.4.12. Record this measurement.

2.4.13. Decontaminate the pump and tubing between wells (see FC 1000) or only the pump if precleaned tubing is used for each well.

3. DEDICATED PORTABLE PUMPS: Place dedicated pumps per one of the options in FS 2213, section 1 above.

3.1. Variable Speed Electric Submersible Pump

3.1.1. Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

3.1.2. Wear sampling gloves.

3.1.3. Measure the depth to groundwater at frequent intervals.

3.1.4. Record these measurements.

3.1.5. Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

3.1.6. If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdraw with the recharge rate.

3.1.7. Record the purging rate each time the rate changes.

3.1.8. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

3.1.9. Record this measurement.

3.2. Variable Speed Bladder Pump

3.2.1. Position fuel powered equipment **downwind** and at least 10 feet from the well head. Make sure that the exhaust faces downwind.

3.2.2. Wear sampling gloves.

3.2.3. Measure the depth to groundwater at frequent intervals.

3.2.4. Record these measurements.

3.2.5. Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.

3.2.6. If the purging rate exceeds the well recovery rate, reduce the pumping rate to balance the withdraw with the recharge rate.

3.2.7. Record the purging rate each time the rate changes.

3.2.8. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

3.2.9. Record this measurement.

4. BAILERS: FDEP recommends against using bailers for purging except as a last contingency, or if free product is present in the well or suspected to be in the well. However, they may be used if approved by an FDEP program, or specified in a permit, contract or FDEP order (see Table FS 2200-3 and FS 2211, section 1.3.2). If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate FDEP program or project manager.

4.1. Minimize handling the bailer as much as possible.

4.1.1. Wear sampling gloves.

4.1.2. Remove the bailer from its protective wrapping just before use.

4.1.3. Attach a lanyard of appropriate material (see FS 2201, section 3).

4.1.4. Use the lanyard to move and position the bailer.

4.2. Lower and retrieve the bailer slowly and smoothly.

4.2.1. Lower the bailer carefully into the well to a depth approximately a foot above the water column.

4.2.1.1. When the bailer is in position, lower the bailer into the water column at a rate of 2 cm/sec until the desired depth is reached (see 4.2.2 below).

4.2.2. Do not lower the top of the bailer more than one (1) foot below the top of the water table so that water is removed from the top of the water column.

4.2.3. Allow time for the bailer to fill with aquifer water as it descends into the water column.

4.2.3.1. Carefully raise the bailer. Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.

4.3. Measure the purge volume by one of the methods outlined in FS 2212, section 1.

4.3.1. Record the volume of the bailer.

4.4. Continue to carefully lower and retrieve the bailer as described above until the purging completion conditions specified in FS 2212, section 3 have been satisfied.

4.4.1. Remove at least one (1) well volume before collecting measurements of the field parameters. Take each subsequent set of measurements after removing at least one quarter (1/4) well volume between measurements.

## FS 2214. Wells With Plumbing (permanently installed pumps or production wells)

Wells with in-place plumbing are commonly found at municipal water treatment plants, industrial water supplies, private residences, etc.

1. Remove all hoses, aerators and filters (if possible).

2. Open the spigot and purge sufficient volume to flush the spigot and lines and until the purging completion criteria in FS 2212, section 3 have been met.

3. Reduce the flow rate to approximately 500 mL/minute (a 1/8" stream) or approximately 0.1 gal/minute before collecting samples.

## FS 2215. Airstrippers and Remedial Treatment Systems

1. Collect influent and effluent samples from air stripping units as described in FS 2214 above.
2. Remove any tubing from the sampling port and flush for one to two minutes.

## FS 2220. GROUNDWATER SAMPLING TECHNIQUES

1. Purge wells using the techniques outlined in FS 2210.

2. Replace the protective covering around the well if it is soiled or torn after completing the purging operations.

3. EQUIPMENT CONSIDERATIONS

3.1. Some pumps may be used for sampling groundwater. Follow all notes and restrictions as defined in Table FS 2200-1 and discussed in Equipment and Supplies (FS 2201) when using pumps to collect samples.

**NOTE: The only pumps that are currently approved for use in collecting volatile organic samples through the pump are stainless steel and Teflon variable speed submersible pumps, stainless steel and Teflon or Polyethylene variable speed bladder pumps, and permanently installed PVC bodied pumps as long as the pump remains in contact with the water in the well at all times.**

3.2. Collect the sample into the sample container from the sampling device. **Do not** use intermediate containers.

3.3. In order to avoid contaminating the sample or loss of analytes from the sample:

3.3.1. Handle the sampling equipment as little as possible.

3.3.2. Minimize the equipment that is exposed to the sample.

3.4. Dedicated Sampling Equipment

3.4.1. Whenever possible, use dedicated equipment because it significantly reduces the chance of cross-contamination.

3.4.2. Dedicated is defined as equipment that is to be used solely for one location for the life of that equipment (e.g., permanently mounted pump).

3.4.3. All material construction and restrictions from Table FS 2200-1 also apply to dedicated equipment. Purchase equipment with the most sensitive analyte of interest in mind.

3.4.4. Cleaning/Decontamination

3.4.4.1. Clean or make sure dedicated pumps are clean before installation. They do not need to be cleaned prior to each use but must be cleaned if they are withdrawn for repair or servicing.

3.4.4.2. Clean or make sure any permanently mounted tubing is clean before installation.

3.4.4.3. Change or clean tubing when the pump is withdrawn for servicing.

3.4.4.4. Clean any replaceable or temporary parts as specified in FC 1000.

3.4.4.5. Collect equipment blanks on dedicated pumping systems when the tubing is cleaned or replaced.

3.4.4.6. Clean or make sure dedicated bailers are clean before placing them into the well.

3.4.4.7. Collect an equipment blank on dedicated bailers before introducing them into the water column.

3.4.4.8. Suspend dedicated bailers above the water column if they are stored in the well.

## FS 2221. Wells Without Plumbing

1. SAMPLING WITH PUMPS: Variable speed stainless steel and Teflon submersible pumps and stainless steel, Teflon or Polyethylene bladder pumps, and permanently installed PVC bodied pumps, as long as the pump remains in contact with the water in the well at all times, may be used to sample for all organics. The delivery tubing must be Teflon, Polyethylene or PP. **Extractable organics** may be collected through a peristaltic pump if flexible interior-wall Teflon, Polyethylene or PP tubing is used in the pump head, or through a peristaltic pump with a vacuum trap (see Figure FS 2200-1 for specific configuration) is used. Follow all notes and restrictions as defined in Table FS 2200-1 and discussed in Equipment and Supplies (FS 2201) when using pumps to collect samples.

1.1. Peristaltic Pump

1.1.1. Volatile Organics:

1.1.1.1. Remove the drop tubing from the inlet side of the pump.

1.1.1.2. Submerse the drop tubing into the water column.

1.1.1.3. Prevent the water in the tubing from flowing back into the well.

1.1.1.4. Remove the drop tubing from the well.

1.1.1.5. Carefully allow the groundwater to gravity drain into the sample vials. Avoid turbulence. Do not aerate the sample.

1.1.1.6. Repeat steps 1.1.1.2 through 1.1.1.5 until enough vials are filled.

Alternatively

1.1.1.7. Use the pump to fill the drop tubing.

1.1.1.8. Quickly remove the tubing from the pump.

1.1.1.9. Prevent the water in the tubing from flowing back into the well.

1.1.1.10. Remove the drop tubing from the well.

1.1.1.11. Carefully allow the groundwater to drain into the sample vials. Avoid turbulence. Do not aerate the sample.

1.1.1.12. Repeat steps 1.1.1.7 through 1.1.1.11 until enough vials are filled.

Or:

1.1.1.13. Use the pump to fill the drop tubing

1.1.1.14. Withdraw the tubing from the well.

1.1.1.15. Reverse the flow on the peristaltic pumps to deliver the sample into the vials at a slow, steady rate.

1.1.1.16. Repeat steps 1.1.1.13 through 1.1.1.15 until enough vials are filled.

1.1.2. Extractable Organics

1.1.2.1. If the tubing in the pump head is Polyethylene or PP, or is Teflon lined, the samples may be collected through the pump.

1.1.2.2. If the tubing in the pump head is not Polyethylene or PP, or is not Teflon lined, use the pump and vacuum trap method.

- Assemble the components of the pump and trap according to Figure FS 2200-1.
- The sample container should be the trap.
- All equipment that contacts the groundwater **before** the sample container must be constructed of Teflon, Polyethylene, PP, stainless steel or glass, including the transport tubing to and from the sample container, the interior liner of the container cap and all fittings. **Do not use a rubber stopper as a cap.**
- Connect the outflow tubing from the container to the influent side of the peristaltic pump.
- Turn the pump on and reduce the flow rate to a smooth and even flow.
- Discard a small portion of the sample to allow an air space.
- Preserve (if required), label and complete the field notes.

1.1.3. Inorganics

1.1.3.1. Inorganic samples may be collected from the effluent tubing. There are a few restrictions on tubing type (see Table FS 2200-1).

1.1.3.2. If samples are collected from the pump, decontaminate all tubing (including the tubing in the head) or change it between wells.

1.1.3.3. Preserve (if required), label and complete field notes.

1.2. Variable Speed Bladder Pump

1.2.1. If sampling for organics the pump body must be constructed of stainless steel and the valves and bladder must be Teflon. All tubing must be Teflon, Polyethylene, or PP and any cabling must be sealed in Teflon, Polyethylene or PP, or made of stainless steel.

1.2.2. After purging to a smooth even flow, reduce the flow rate.

1.2.3. When sampling for volatile organic compounds, reduce the flow rate to 100-200 mL/minute, if possible.

1.3. Variable Speed Submersible Pump

1.3.1. The housing must be stainless steel.

1.3.2. If sampling for organics, the internal impellers, seals and gaskets must be constructed of stainless steel, Teflon, Polyethylene or PP. The delivery tubing must be Teflon, Polyethylene or PP and the electrical cord must be sealed in Teflon and any cabling must be sealed in Teflon or constructed of stainless steel.

1.3.3. After purging to a smooth even flow, reduce the flow rate.

1.3.4. When sampling for volatile organic compounds, reduce the flow rate to 100-200 mL/minute, if possible.

2. SAMPLING WITH BAILERS: A high degree of skill and coordination are necessary to collect representative samples with a bailer. When properly used, bailers may be used to collect samples for certain analyte groups and under specific conditions (see Table FS 2200-3). They must be of an appropriate type and construction (see FS 2201, section 2.2), and must be used as outlined below. If in doubt about the appropriateness of using a bailer at a site or during a particular sampling event, contact the appropriate FDEP program or project manager.

2.1. General Considerations

2.1.1. Minimize handling the bailer as much as possible.

2.1.1.1. Wear sampling gloves.

2.1.1.2. Remove the bailer from its protective wrapping just before use.

2.1.1.3. Attach a lanyard of appropriate material (see FS 2201, section 3).

2.1.1.4. Use the lanyard to move and position the bailers.

2.1.2. Do not allow the bailer or lanyard to touch the ground.

2.1.3. Rinsing

2.1.3.1. If the bailer is certified precleaned, no rinsing is necessary.

2.1.3.2. If both a pump and a bailer are to be used to collect samples, rinse the exterior and interior of the bailer with sample water from the pump before removing the pump.

2.1.3.3. If the purge pump is not appropriate for collecting samples (e.g., non-inert components), rinse the bailer with by collecting a single bailer of the groundwater to be sampled. Use the technique described in 2.2, Bailing Technique, below.

2.1.3.4. Discard the water appropriately.

2.1.3.5. **Do not** rinse the bailer if Oil & Grease, TRPHs, etc. (see FS 2006,) are to be collected.

2.2. Bailing Technique

2.2.1. Collect all samples that are required to be collected with a pump before collecting samples with the bailer.

2.2.2. Raise and lower the bailer gently to minimize stirring up particulate matter in the well and the water column which can increase sample turbidity.

2.2.3. Lower the bailer carefully into the well to a depth approximately a foot above the water column.

2.2.3.1. When the bailer is in position, lower the bailer into the water column at a rate of 2 cm/sec until the desired depth is reached (see 2.2.3 below).

2.2.4. Do not lower the top of the bailer more than one (1) foot below the top of the water table so that water is removed from the top of the water column.

2.2.5. Allow time for the bailer to fill with aquifer water as it descends into the water column.

2.2.6. Do not allow the bailer to touch the bottom of the well or particulate matter will be incorporated into the sample.

2.2.6.1. Carefully raise the bailer (2.2.2.2 above). Retrieve the bailer at the same rate of 2 cm/sec until the bottom of the bailer has cleared to top of the water column.

2.2.7. Lower the bailer to approximately the same depth each time.

2.2.8. Collect the sample.

2.2.8.1. Install a device to control the flow from the bottom of the bailer and discard the first few inches of water.

2.2.8.2. Fill the appropriate sample containers by allowing the sample to slowly flow down the side of the container.

2.2.8.3. Discard the last few inches of water in the bailer.

2.2.9. Repeat steps 2.2.1 through 2.2.9 for additional samples.

2.2.10. As a final step measure the DO, pH, temperature, turbidity and specific conductance after the final sample has been collected.

2.2.10.1. Record all measurements and note the time that sampling was completed.

3. SAMPLING WELLS WITH FLOATING NON-AQUEOUS PHASE LIQUID: FDEP does not recommend the sampling of wells with floating non-aqueous phase liquid for trace contaminants. This concerns primarily petroleum related sites, but includes any chemical product (e.g., solvent) that floats on the water table. Sampling is acceptable if the information is to be used for the purpose of remedial design.

Sample data from such wells cannot provide useful information regarding the level of contamination. Furthermore, FDEP believes that these wells may never provide legitimate data as they may have become (permanently) chemically damaged by the product being in contact with the well casing for an extended period of time.

FDEP does reserve the right to require sampling of these wells, not for levels of trace contaminants, but for confirmation of an appropriate remediation technique. This type of sampling is performed **below** the non-aqueous phase layer (see section 3.2 below).

3.1. Non-Aqueous Phase Liquid Sampling: Non-aqueous phase liquid may be evident in a cased monitoring well or in an open excavation.

3.1.1. Non-aqueous phase liquid is normally sampled for two reasons:

- Documentation for its existence and thickness; and
- Determination of the type of product so that the proper analyses can be performed to determine extent. This is only feasible for relatively recent releases as it may not be possible to identify weathered product.

3.1.2. Disposable plastic (acrylic, clear PVC) bailers are recommended for sampling. Disposable Polyethylene and PP bailers are also acceptable. Other wide mouth vessels may be used for sampling non-aqueous phase liquid in an excavation.

3.1.3. Monitoring Well

3.1.3.1. If a non-aqueous phase liquid is identified in a monitoring well during the water level measurement, measure its thickness in the well. If the thickness of the non-aqueous phase liquid is greater than 0.01 foot or product globules are present, collect a sample using a precleaned disposable bailer.

3.1.3.2. Measure the product thickness to the nearest 0.01 foot after withdrawing the bailer.

3.1.3.3. Pour a portion of the product into a glass sample container.

3.1.3.4. This sample is considered a concentrated waste. Therefore, package the container in protective wrapping to prevent breakage, isolate from other samples, and ice to 4° C.

3.1.4. Excavation

3.1.4.1. If non-aqueous phase liquid is observed in an open excavation, a glass sample container or a precleaned intermediate vessel may be used to collect the sample.

3.1.4.2. Securely tie a lanyard to the container and lower it into the excavation.

3.1.4.3. Gently lower and retrieve the container so that no solid material is released or collected.

3.1.4.4. If sufficient water is available, a bailer can be used.

3.1.4.5. Although not recommended, screened casing can be placed (or augered and placed) in the bottom of the excavation and the product sampled with a bailer.

3.1.4.6. Avoid dangerous situations, such as standing too close to the edge of an excavation, riding in the backhoe bucket, or entering a trench or excavation that may collapse.

3.1.4.7. Follow all applicable OSHA regulations.

3.1.5. Equipment that is dedicated to sampling non-aqueous phase liquid does not need to be cleaned according to the standard, full decontamination protocols. Acrylic or PVC bailers that are never used for trace contaminant sampling may be cleaned as listed below. It is recommended that all cleaning be done in the lab, office or base of operations and not in the field.

3.1.5.1. Disassemble bailers and intermediate vessels and soak in hot, sudsy tap water using a brush to clean away all particulates and greasy films.

3.1.5.2. Rinse with hot tap water.

3.1.5.3. Thoroughly rinse with analyte free water.

3.1.5.4. An optional acid rinse may be used to strip the equipment of any hard to clean residues.

3.1.5.5. The solvent rinse is not mandatory since this equipment is not used for contaminant sampling, other than the product itself. It is not recommended on clear acrylic.

3.2. Sampling Below Product

3.2.1. This type of depth-specific sampling to attempt to sample the dissolved constituents in the water column below the product layer is performed only at the request of FDEP or its designee.

3.2.2. These data provide information that helps define adequate groundwater treatment. Without these data, incorrect (and sometimes unnecessarily expensive) remediation techniques may be designed for a situation where they are not required.

3.2.3. There are some substantial logistical problems involved with sending a sampler through non-aqueous phase liquid to sample the groundwater below. Although there are some products designed specifically for this type of sampling, they are expensive and the results may not be commensurate with their cost. The use of "self-engineered" equipment or coverings may be the best option.

3.2.4. These data are only to be used for qualitative use and will aid in deciding on an appropriate remediation technique.

3.2.5. Wrapping bailers and tubing in plastic seems to be the most popular technique in getting past the product layer.

3.2.6. Although not recommended, some have wrapped submersible pumps in several layers of plastic and retrieved each layer by a separate lanyard. One suggestion would be to use a rigid piece of stainless steel tubing wrapped in plastic.

3.2.6.1. Once the covered tubing is past the layer, pull up on the plastic, piercing the plastic and exposing the (somewhat) clean tubing inlet.

3.2.6.2. Introduce the wrapped hose slowly to not entrain any more product into the dissolved layer located below.

3.2.6.3. Also, perform this procedure with a peristaltic pump or a vacuum pump linked to a trap bottle. To use this setup, the water table must be no deeper than 15-20 feet, realizing that actual sampling may be occurring several feet below the product layer.

## FS 2222. Sampling Low Permeability Aquifers or Wells that have Purged Dry

1. Collect the sample(s) after the well has been purged according to FS 2212, section 3.4.1. Minimize the amount of water removed from the well by using the same pump to purge and collect the sample. If the well has purged dry, collected samples as soon as sufficient sample water is available.

2. Measure the five (5) field parameters Temperature, pH, Specific Conductance, Dissolved Oxygen and Turbidity at the time of sample collection.

3. Advise the analytical laboratory and the client that the usual amount of sample for analysis may not be available.

## FS 2223. Wells With In-Place Plumbing

If a storage tank is present, locate a cold water spigot, valve or other sampling point close to the well head between the pump and the storage tank. If there is no sampling location between the pump and the storage tank, locate the spigot, valve or other sampling point closest to the tank. Remove all screens or aerators and reduce the flow rate to no more than 500 mL/minute. Collect the samples directly into the appropriate containers.

## FS 2224. Airstripper and Remedial Treatment System Sampling

Reduce the flow rate to less than 500 mL/minute and begin sample collection. Collect the samples directly into the appropriate containers.

## FS 2225. Filtering Groundwater Samples

1. FILTERING GROUNDWATER FOR METALS: Filtered groundwater samples can only be collected after approval from the FDEP program or project manager. If filtering is approved, the FDEP program or permit may require both filtered and unfiltered samples to be collected and reported. Unless specified by the program, use a 1 micrometer (µm) filter.

1.1. Use a disposable, high capacity, 1 µm in-line filter.

1.1.1. Flush the filter with 30-50 mL of analyte free water or an inert gas (nitrogen) to remove atmospheric oxygen;

or

1.1.2. Insert the filter on the high pressure side (i.e., on the delivery side) of the pump. Hold the filter upright with the inlet and outlet vertical. Pump water from the aquifer through the filter until all atmospheric oxygen has been removed.

1.2. Use a variable speed pump that can be fitted with an in-line filter on the outlet end. Peristaltic pumps, bladder pumps or submersible pumps can be used when water levels are no greater than 20 to 25 feet deep; bladder pumps or submersible pumps must be used when water levels are greater than 20 to 25 feet deep.

1.2.1. Install new or precleaned silastic tubing in the variable speed peristaltic pump head at each monitoring well.

1.2.2. Use new or precleaned delivery tubing at each monitoring well.

1.3. Collect filtered samples by either of the methods outlined below if the static water level in the well is too deep for a variable speed peristaltic pump and a variable speed electric submersible pump or variable speed bladder pump of appropriate configuration is not available. Do not agitate the sample or expose it to atmospheric oxygen. **Do not** pour the sample into any intermediate vessel for subsequent filtration.

1.3.1. Collect the sample in a Polyethylene, Teflon or PP bailer that can be pressurized. When the bailer has been retrieved, immediately connect the filter and begin to pressurize the bailer;

or

1.3.2. Collect the sample with a bailer and immediately place the intake tube of the peristaltic pump into the full bailer and begin pumping the water through the filter as described in section 1.2 above.

1.4. **Do not** use the following equipment for filtering groundwater samples for metals:

1.4.1. Any pump and apparatus combination in which the filter is on the vacuum (suction) side of the pump.

1.4.2. Any type of syringe or barrel filtration apparatus.

1.4.3. Any filter that is not encased in a one-piece, molded unit.

## FS 2230. REFERENCES

1. Florida Department of Environmental Protection, DEP Standard Operating Procedures for Laboratory Operations and Sample Collection Activities, DEP QA-001/92, September 1992.

2. U.S. Environmental Protection Agency, Region 4, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, May 1996.

## Appendix FS 2200
## Tables, Figures and Forms

| | |
|---|---|
| Table FS 2200–1 | Equipment for Collecting Groundwater Samples |
| Table FS 2200-2 | Dissolved Oxygen Saturation |
| Table FS 2200-3 | Allowable Uses for Bailers |
| Figure FS 2200-1 | Pump and Trap for Extractable Organics |
| Form FD 9000-24 | Groundwater Sampling Log |

**Table FS 2200-1**
**Equipment for Collecting Groundwater Samples**

| Activity | Equipment Type |
|---|---|
| Well Purging | Variable speed centrifugal pump<br>Variable speed submersible pump<br>Variable speed bladder pump<br>Variable speed peristaltic pump<br>Bailer with lanyard: **Not Recommended** |
| Well Stabilization | pH meter<br>DO meter<br>Conductivity meter<br>Thermometer/Thermistor<br>Turbidimeter<br>Flow-through cell<br>Multi-function meters |
| Sample Collection | Variable speed peristaltic pump<br>Variable speed submersible pump<br>Variable speed bladder pump<br>Bailer with lanyard (See Table FS 2200-3) |
| Filtering | Variable speed peristaltic pump<br>Variable speed submersible pump<br>Variable speed bladder pump<br>Pressurized bailer<br>1.0 µm high capacity molded filter |
| Water Level | Electronic sensor<br>Chalked tape |

## Table FS 2200-2
## Dissolved Oxygen Saturation

| TEMP | D.O. | mg/L | TEMP | D.O. | mg/L | TEMP | D.O. | mg/L | TEMP | D.O. | mg/L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| deg C | SAT. | 20% | deg C | SAT. | 20% | deg C | SAT. | 20% | deg C | SAT. | 20% |
| 15.0 | 10.084 | 2.017 | 19.0 | 9.276 | 1.855 | 23.0 | 8.578 | 1.716 | 27.0 | 7.968 | 1.594 |
| 15.1 | 10.062 | 2.012 | 19.1 | 9.258 | 1.852 | 23.1 | 8.562 | 1.712 | 27.1 | 7.954 | 1.591 |
| 15.2 | 10.040 | 2.008 | 19.2 | 9.239 | 1.848 | 23.2 | 8.546 | 1.709 | 27.2 | 7.940 | 1.588 |
| 15.3 | 10.019 | 2.004 | 19.3 | 9.220 | 1.844 | 23.3 | 8.530 | 1.706 | 27.3 | 7.926 | 1.585 |
| 15.4 | 9.997 | 1.999 | 19.4 | 9.202 | 1.840 | 23.4 | 8.514 | 1.703 | 27.4 | 7.912 | 1.582 |
| 15.5 | 9.976 | 1.995 | 19.5 | 9.184 | 1.837 | 23.5 | 8.498 | 1.700 | 27.5 | 7.898 | 1.580 |
| 15.6 | 9.955 | 1.991 | 19.6 | 9.165 | 1.833 | 23.6 | 8.482 | 1.696 | 27.6 | 7.884 | 1.577 |
| 15.7 | 9.934 | 1.987 | 19.7 | 9.147 | 1.829 | 23.7 | 8.466 | 1.693 | 27.7 | 7.870 | 1.574 |
| 15.8 | 9.912 | 1.982 | 19.8 | 9.129 | 1.826 | 23.8 | 8.450 | 1.690 | 27.8 | 7.856 | 1.571 |
| 15.9 | 9.891 | 1.978 | 19.9 | 9.111 | 1.822 | 23.9 | 8.434 | 1.687 | 27.9 | 7.842 | 1.568 |
| 16.0 | 9.870 | 1.974 | 20.0 | 9.092 | 1.818 | 24.0 | 8.418 | 1.684 | 28.0 | 7.828 | 1.566 |
| 16.1 | 9.849 | 1.970 | 20.1 | 9.074 | 1.815 | 24.1 | 8.403 | 1.681 | 28.1 | 7.814 | 1.563 |
| 16.2 | 9.829 | 1.966 | 20.2 | 9.056 | 1.811 | 24.2 | 8.387 | 1.677 | 28.2 | 7.800 | 1.560 |
| 16.3 | 9.808 | 1.962 | 20.3 | 9.039 | 1.808 | 24.3 | 8.371 | 1.674 | 28.3 | 7.786 | 1.557 |
| 16.4 | 9.787 | 1.957 | 20.4 | 9.021 | 1.804 | 24.4 | 8.356 | 1.671 | 28.4 | 7.773 | 1.555 |
| 16.5 | 9.767 | 1.953 | 20.5 | 9.003 | 1.801 | 24.5 | 8.340 | 1.668 | 28.5 | 7.759 | 1.552 |
| 16.6 | 9.746 | 1.949 | 20.6 | 8.985 | 1.797 | 24.6 | 8.325 | 1.665 | 28.6 | 7.745 | 1.549 |
| 16.7 | 9.726 | 1.945 | 20.7 | 8.968 | 1.794 | 24.7 | 8.309 | 1.662 | 28.7 | 7.732 | 1.546 |
| 16.8 | 9.705 | 1.941 | 20.8 | 8.950 | 1.790 | 24.8 | 8.294 | 1.659 | 28.8 | 7.718 | 1.544 |
| 16.9 | 9.685 | 1.937 | 20.9 | 8.932 | 1.786 | 24.9 | 8.279 | 1.656 | 28.9 | 7.705 | 1.541 |
| 17.0 | 9.665 | 1.933 | 21.0 | 8.915 | 1.783 | 25.0 | 8.263 | 1.653 | 29.0 | 7.691 | 1.538 |
| 17.1 | 9.645 | 1.929 | 21.1 | 8.898 | 1.780 | 25.1 | 8.248 | 1.650 | 29.1 | 7.678 | 1.536 |
| 17.2 | 9.625 | 1.925 | 21.2 | 8.880 | 1.776 | 25.2 | 8.233 | 1.647 | 29.2 | 7.664 | 1.533 |
| 17.3 | 9.605 | 1.921 | 21.3 | 8.863 | 1.773 | 25.3 | 8.218 | 1.644 | 29.3 | 7.651 | 1.530 |
| 17.4 | 9.585 | 1.917 | 21.4 | 8.846 | 1.769 | 25.4 | 8.203 | 1.641 | 29.4 | 7.638 | 1.528 |
| 17.5 | 9.565 | 1.913 | 21.5 | 8.829 | 1.766 | 25.5 | 8.188 | 1.638 | 29.5 | 7.625 | 1.525 |
| 17.6 | 9.545 | 1.909 | 21.6 | 8.812 | 1.762 | 25.6 | 8.173 | 1.635 | 29.6 | 7.611 | 1.522 |
| 17.7 | 9.526 | 1.905 | 21.7 | 8.794 | 1.759 | 25.7 | 8.158 | 1.632 | 29.7 | 7.598 | 1.520 |
| 17.8 | 9.506 | 1.901 | 21.8 | 8.777 | 1.755 | 25.8 | 8.143 | 1.629 | 29.8 | 7.585 | 1.517 |
| 17.9 | 9.486 | 1.897 | 21.9 | 8.761 | 1.752 | 25.9 | 8.128 | 1.626 | 29.9 | 7.572 | 1.514 |
| 18.0 | 9.467 | 1.893 | 22.0 | 8.744 | 1.749 | 26.0 | 8.114 | 1.623 | 30.0 | 7.559 | 1.512 |
| 18.1 | 9.448 | 1.890 | 22.1 | 8.727 | 1.745 | 26.1 | 8.099 | 1.620 | 30.1 | 7.546 | 1.509 |
| 18.2 | 9.428 | 1.886 | 22.2 | 8.710 | 1.742 | 26.2 | 8.084 | 1.617 | 30.2 | 7.533 | 1.507 |
| 18.3 | 9.409 | 1.882 | 22.3 | 8.693 | 1.739 | 26.3 | 8.070 | 1.614 | 30.3 | 7.520 | 1.504 |
| 18.4 | 9.390 | 1.878 | 22.4 | 8.677 | 1.735 | 26.4 | 8.055 | 1.611 | 30.4 | 7.507 | 1.501 |
| 18.5 | 9.371 | 1.874 | 22.5 | 8.660 | 1.732 | 26.5 | 8.040 | 1.608 | 30.5 | 7.494 | 1.499 |
| 18.6 | 9.352 | 1.870 | 22.6 | 8.644 | 1.729 | 26.6 | 8.026 | 1.605 | 30.6 | 7.481 | 1.496 |
| 18.7 | 9.333 | 1.867 | 22.7 | 8.627 | 1.725 | 26.7 | 8.012 | 1.602 | 30.7 | 7.468 | 1.494 |
| 18.8 | 9.314 | 1.863 | 22.8 | 8.611 | 1.722 | 26.8 | 7.997 | 1.599 | 30.8 | 7.456 | 1.491 |
| 18.9 | 9.295 | 1.859 | 22.9 | 8.595 | 1.719 | 26.9 | 7.983 | 1.597 | 30.9 | 7.443 | 1.489 |

Derived using the formula in Standard Methods for the Examination of Water and Wastewater, Page 4-101, 18th Edition, 1992

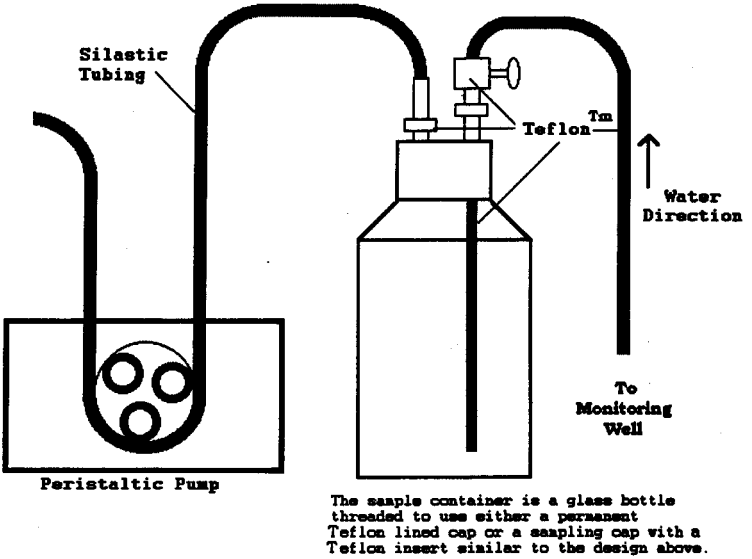
**Table FS 2200-3**
**Allowable Uses for Bailers**

| ANALYTE GROUP(S) | PURGING (Not Recommended) | SAMPLING | |
|---|---|---|---|
| | Use: | Use: | Not Recommended: |
| Volatile Organics<br>Extractable Organics<br>Radionuclides, including Radon<br>Metals<br>Volatile Sufides | If allowed by permit, program, contract or order<br>or<br>If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation. | If concentrations exceed action levels, the purpose is to monitor effective treatment, and the FDEP program allows the use of bailers;<br>or<br>If specified by FDEP permit, program, contract or order.<br>or<br>If operated by a skilled individual with documented training in proper techniques and using appropriate equipment. Field documentation must demonstrate that the procedure in FS 2221, section 2 was followed without deviation. | If concentrations are near or below the stated action levels;<br>or<br>If a critical decision (e.g., clean closure) will be made based on the data;<br>or<br>If data are to demonstrate compliance with a permit or order. |
| Petroleum Hydrocarbons (TRPH) & Oil & Grease | If allowed by permit, program, contract or order<br>or<br>If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation. | Only if allowed by permit, program, contract or order as samples should be collected into the container without intermediate devices. | Unless allowed by permit, program, contract or order. |

**Table FS 2200-3**
**Allowable Uses for Bailers**

| ANALYTE GROUP(S) | PURGING (Not Recommended) | SAMPLING | |
|---|---|---|---|
| | Use: | Use: | Not Recommended: |
| Biologicals<br>Inorganic Non-Metallics<br>Aggregate Organics<br>Microbiological<br>Physical and Aggregate Properties | If allowed by permit, program, contract or order<br>or<br>If operated by a skilled individual with documented training in proper techniques. Field documentation must demonstrate that the procedure in FS 2213, section 4 was followed without deviation. | If all analytes collected from the well can be collected with a bailer;<br>or<br>If collected after collecting all analytes that require the use of a pump. | Before collecting any analytes that must be collected with a pump. |
| Ultra-Trace Metals | Never | Never | |

**Figure FS 2200-1**
**Pump and Trap for Extractable Organics**



# Florida Department of Environmental Protection
# GROUNDWATER SAMPLING LOG

| SITE NAME: | SITE LOCATION: | |
|---|---|---|
| WELL NO: | SAMPLE ID: | DATE: |

## PURGING DATA

| WELL DIAMETER (in): | TOTAL WELL DEPTH (ft): | STATIC DEPTH TO WATER (ft): | WELL CAPACITY (gal/ft): |
|---|---|---|---|

1 WELL VOLUME (gal) = (TOTAL WELL DEPTH – DEPTH TO WATER) X WELL CAPACITY =

= ( – ) X =

| PURGE METHOD: | PURGE INITIATED AT: | PURGE ENDED AT: | TOTAL VOL. PURGED (gal): |
|---|---|---|---|

| TIME | VOLUME PURGED (gal) | CUMUL. VOLUME PURGED (gal) | PURGE RATE (gpm) | DEPTH TO WATER (ft) | pH | TEMP. (°C) | COND. (µmhos) | DISSOLVED OXYGEN (mg/L) | TURBIDITY (NTUs) | COLOR | ODOR |
|---|---|---|---|---|---|---|---|---|---|---|---|
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WELL CAPACITY (Gallons per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88

## SAMPLING DATA

| SAMPLED BY (PRINT) / AFFILIATION | SAMPLER(S) SIGNATURE(S) | |
|---|---|---|
| SAMPLING METHOD(S): | SAMPLING INITIATED AT: | SAMPLING ENDED AT: |
| FIELD DECONTAMINATION: Y N | FIELD-FILTERED: Y N | DUPLICATE: Y N |

| SAMPLE CONTAINER SPECIFICATION | | | SAMPLE PRESERVATION | | | INTENDED ANALYSIS AND/OR METHOD |
|---|---|---|---|---|---|---|
| NO. | MATERIAL CODE | VOLUME | PRESERVATIVE USED | TOTAL VOLUME ADDED IN FIELD (mL) | FINAL pH | |
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REMARKS:

MATERIAL CODES: AG = AMBER GLASS; CG = CLEAR GLASS; PE = POLYETHYLENE; O = OTHER (SPECIFY)

**NOTE: The above do not constitute all of the information required by Chapter 62-160, F.A.C.**

# FT 1100. FIELD MEASUREMENT OF HYDROGEN ION ACTIVITY (pH)

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FD 1000 Documentation Procedures

1. EQUIPMENT AND SUPPLIES

1.1. Field Instrument: Use any pH meter consisting of a potentiometer, a glass electrode, a reference electrode, and a temperature-compensating device.

1.1.1. For routine fieldwork use a pH meter accurate and reproducible to at least 0.2-unit in the range of 0.0 to 14.0 units, and equipped with temperature-compensation adjustment.

1.1.2. Advanced silicon chip pH sensors (with digital meters) may be used if demonstrated to yield equivalent performance to glass electrode sensors for the intended application.

1.2. Standards: Purchased or laboratory-prepared standard buffer solutions of pH values that bracket the expected sample pH range. Use buffers with nominal values of 4.0, 7.0 and 10.0 units for most situations. If the sample pH is outside the range of 4.0 to 10.0, then use two buffers that bracket the expected range with the pH 7 buffer being one of the two buffers. Alternatively, prepare appropriate standards per table I in method SM4500-$H^+$-B.

1.3. Recordkeeping and Documentation Supplies:

- Field notebook (w/ waterproof paper is recommended)
- Field record forms (e.g., forms FD 9000-7, FD 9000-8, and FD 9000-9)
- Indelible pens

2. CALIBRATION AND USE

2.1. General Concerns

2.1.1. Calibrate the meter at the base of operations or in the field. If the calibration is performed at the base of operations, check the instrument on-site, prior to use, since a calibration is likely to change during mobilization.

2.1.2. The acceptance criterion for the initial calibration or the calibration check is a reading of the standard within +/- 0.2-unit of the expected value.

2.1.3. On a weekly basis, check the calibration to ensure the % theoretical slope is greater than 90% (if applicable to your instrument type).

2.1.3.1. Note the % slope in the calibration records.

2.1.3.2. A % slope of less than 90% indicates a bad electrode that must be changed or repaired.

2.1.3.3. If % slope cannot be determined on your meter, or the manufacturer's optimum specifications are different, follow the manufacturer's recommendation for maintaining optimum meter performance.

2.2. Interferences

2.2.1. Sodium at pH $\geq$ 10.0 units can be reduced or eliminated by using a low sodium error electrode.

2.2.2. Coatings of oils, greases, and particles may impair the electrode's response. Pat the electrode bulb dry with lint-free paper or cloth and rinse with de-ionized water. For cleaning hard-to-remove films, use acetone very sparingly so that the electronic surface is not damaged.

2.2.3. Temperature effects on the electrometric measurement of pH are controlled by using instruments having temperature compensation or by calibrating the meter at the temperature of the samples.

2.2.4. Poorly buffered solutions with low specific conductance (< 200 µmhos/cm) may cause fluctuations in the pH readings. Equilibrate electrode by immersing in several aliquots of sample before taking pH.

2.3. Calibration: Follow the manufacturer's calibration instructions specific to your meter. Most instruments allow for a two-point calibration and a few models can perform a three-point calibration. Use the appropriate number of standard buffer solutions for calibration. Do not reuse buffers after they have been in contact with the probe or sensor.

2.3.1. Check the battery before mobilizing and turn on the meter when you reach the first site or facility and allow it to equilibrate to ambient temperature.

2.3.2. Follow the calibration quality control procedures specified in FT 1000, section 2.2.

2.3.3. Calibrate the meter/electrode system with at least two buffers. Always use a pH 7 buffer first. The second buffer must be at least three pH units (4 or 10) and must bracket the expected sample pH. Check historical data for expected pH or use narrow-range pH paper on an aliquot to estimate.

2.3.4. If the pH sample range is expected to be wider than 3 pH units (e.g., some samples at pH 4 and others at pH 8), then add a third calibration point (buffer must be at least 4 or 10 pH units). If the instrument cannot be calibrated with three buffers, calibrate the instrument on the range that is expected and used the third buffer as a calibration check on the range.

2.3.4.1. To be acceptable, a calibration check must be within +/- 0.2 pH unit of the stated buffer value. For example, if checking the pH 4.0 buffer, the result must be in the 3.8 to 4.2 range.

2.3.5. To obtain an accurate reading, align the needle of the pH meter with its image in the mirror on the gauge. For a digital meter, round the result to one decimal figure (e.g., 7.6 instead of 7.57 units).

2.3.6. Rinse the probe with de-ionized water (DI) before and between each standard buffer solution.

2.4. Measuring Sample pH: After an acceptable initial calibration or calibration check, follow these procedures to take a pH reading of a freshly collected sample.

2.4.1. Pour enough of the fresh sample into a clean cup to take the reading.

2.4.2. Place the pH electrode in the sample (in the cup) and swirl the electrode.

2.4.3. Wait for stabilization, and read the pH value.

2.4.3.1. In the case of low specific conductance and meter drift, add 1 mL of 1M KCl (potassium chloride) solution to each 100 mL of sample, swirl and read pH.

2.4.3.2. Note: to make 1M KCl solution, take 74.55 g of primary standard grade KCl and add it to a 1-liter volumetric flask. Add DI to the 1-liter line on the flask and mix. Solutions of the appropriate strength may be purchased from commercial laboratory suppliers.

2.4.4. Turn the meter off after the last sample reading, rinse the electrode thoroughly with de-ionized water and replace the electrode's cap.

2.4.5. In-Situ pH of Samples: After calibrating the multi-probe sensors (e.g., in Hydrolab or YSI meters) as outlined in 2.3 above, follow the meter's instructions to select the display for reading the pH of the sample.

2.4.6. Immerse the probe at the desired depth in the water and wait at least thirty seconds for stabilization of the reading (record the value when the difference between two readings taken ten seconds apart is not greater than 0.2 unit).

2.5. Flow-through Cells: When using a flow-through cell, the procedure described above in section 2.4.6 is applicable.

3. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.

4. RECORDS: See FT 1000, section 4 for additional details.

4.1. Calibration: Record all calibration information (initial and continuing) in the field notebook or on a form specifically designed for this purpose (e.g. FD 9000-8). This information must be recorded:

4.1.1. The calibration method (or SOP) and the type of standard(s) (including the concentrations) used.

4.1.2. Record each calibration check (initial, continuing or final) in the permanent field records (or calibration logs). At a minimum, these records must include:

4.1.2.1. Date, time and location (e.g., monitoring well MW-X; laboratory; etc.) of each calibration check;

4.1.2.2. Individual performing the check;

4.1.2.3. Results of each check, including the concentration/type of standard, expected reading, and the actual reading;

4.1.3. Whether the check met or failed acceptance criteria;

4.1.4. Readings associated with a failed check; and

4.1.5. Corrective actions associated with failed check (such as recalibration, removal from use, etc.).

4.1.6. Optionally, enter the meter name, model number, and identification number (if applicable).

4.2. Samples: Record the sample results on the appropriate field parameter sheets (e.g., Form FD 9000-7) or in a field notebook. For each sample record the following information:

- Project Name
- Date and time the measurement was collected
- Location of the sample (description, monitor well number, etc.)
- Analyte Name
- Reporting Units
- Sample Value
- Initials of the person taking the measurements.

4.3. Reagent and Standards Documentation: Maintain documentation on calibration standards (e.g., buffers, KCl) and other reagents.

4.3.1. At a minimum, note the date of receipt, expiration dates (on the bottle label), and date of first use (on the standard container).

4.3.2. Follow expiration dates: If any standard or chemical is used after the expiration date, there must be documentation showing that the reagent is providing an acceptable response.

## FT 1110. REFERENCES

1. U.S. Environmental Protection Agency, EPA 180.1, Methods for the Chemical Analysis of Water and Waste, EPA-600/4-79-020, Revised 1983.

2. American Public Health Association, American Water Works Association, Water Pollution Control Federation, SM 4500-$H^+$, Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1999.

## Appendix FT 1100
## Tables, Figures and Forms

Form FD 9000-7 Field Parameter Data Sheet for Surface Water

Form FD 9000-8 Field Instrument Calibration Records

DEP-SOP-001/01

FT 1100 Field Measurement of Hydrogen Ion Activity (pH)

**Field Parameter Data Sheet for Surface Water**



SURVEY/PROJECT: _____ SAMPLERS: _____ METER # _____

| STATION NUMBER | STATION DESCRIPTION | PARAMETER | DATE | TIME | TOTAL DEPTH | SAMPLE DEPTH | WATER TEMP | DO | %SAT DO | COND | SALINITY | PH | TURBIDITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | UNIT | yy/mm/dd | hr:min | feet | feet | Celsius | mg/L | % | µS/cm | ppt | su | NTU |
| | | STORET CODE | 73672 | | 81903 | 68 | 10 | 299 | 301 | 94 | 480 | 400 | 82078 |
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FIELD CONDITIONS FOR STATION# _____ AT TIME_____:

CLOUD COVER (%): _____ WIND DIRECTION: _____ TIDAL STAGE: _____

PREVIOUS RAINFALL: _____ WIND SPEED (MPH/KNOTS): _____ WAVE CONDITIONS: _____

Note: This Sheet is used for recording Sample Data – Calibration information must also be documented (see FT 1100, section 4)

FT 1100 Field Measurement of Hydrogen Ion Activity (pH)

**Field Instrument Calibration Records**

**INSTRUMENT** (MAKER/MODEL#) _____ **INSTRUMENT #** ____

**PARAMETER:** *[check only one]*

☐ TEMPERATURE ☐ CONDUCTIVITY ☐ SALINITY ☐ pH ☐ ORP

☐ TURBIDITY ☐ RESIDUAL CL ☐ DO ☐ OTHER _____

**STANDARDS:** *[Specify the type(s) of standards used for calibration, the origin of the standards, the standard values, and the date the standards were prepared or purchased]*

*Standard A* _____

Standard B _____

*Standard C* _____

| DATE (yy/mm/dd) | TIME (hr:min) | STD (A, B, C) | STD VALUE | INSTRUMENT RESPONSE | % DEV | CALIBRATED (YES, NO) | TYPE (INIT, CONT) | SAMPLER INITIALS |
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# FT 1200. FIELD MEASUREMENT OF SPECIFIC CONDUCTANCE (CONDUCTIVITY)

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FQ 1000 Field Quality Control Requirements
- FD 1000 Documentation Procedures

1. INTRODUCTION: Specific conductance is a useful method to approximate the total amount of inorganic dissolved solids.

1.1. Conductivity varies with temperature. For example, the conductivity of salt water increases 3%/degree C at 0°C, and only 2 %/degree C at 25°C.

1.2. Record the sample temperature or adjust the temperature of the samples prior to measuring specific conductance if the conductivity instrument does not employ automatic temperature compensation and correction of the instrument display value.

2. EQUIPMENT AND SUPPLIES

2.1. Field Instrument: Any self-contained conductivity instrument suitable for field work, accurate and reproducible to 5% or better over the operational range of the instrument, and preferably equipped with temperature-compensation adjustment. See references in FT 1210 below for additional information about instruments.

2.2. Standards: Purchased or laboratory-prepared standard potassium chloride (KCl) solutions with conductivity values that bracket the expected samples' range. In the laboratory, prepare standards of appropriate conductivities per SM2510. See FT 1210, section 2 below.

2.3. Recordkeeping and Documentation Supplies:

- Field notebook or,
- Field record forms (e.g., forms FD 9000-7, FD 9000-8 and FD 9000-9)

3. CALIBRATION AND USE

3.1. General Concerns

3.1.1. For instruments without automatic temperature compensation, attempt to adjust the temperature of the samples to 25°C. If the temperature cannot be adjusted, record the temperature, correct for temperature (per section 3.4 below) and report the results corrected to 25°C. See references in FT 1210 below for further information about temperature correction.

**3.1.2. Temperature measurement devices used to manually or automatically correct conductivity measurements must be calibrated per FT 1400.**

3.2. Calibration

3.2.1. Initial Calibration: Calibrate the meter prior to use according to the following steps:

3.2.1.1. Follow the instrument manufacturer's calibration instructions.

3.2.1.2. Use two standard potassium chloride solutions that bracket the range of expected sample conductivities.

3.2.1.3. Calibrate the instrument with the first standard.

3.2.1.4. Check the calibration of the instrument with the second standard, bracketing the range of expected sample values.

3.2.1.5. If the instrument can be calibrated with more than one standard, choose additional calibration standards within the range of expected sample values. The second standard in section 3.2.1.4 above may be used as an additional calibration standard.

3.2.2. Acceptability: Accept the calibration if the meter reads within +/- 5% of the value of any calibration standard used to check the calibration. For example, the acceptance range for a 100 µmhos/cm standard is 95 to 105 µmhos/cm. If the meter does not read within +/- 5% of each calibration check standard, determine the cause of the problem and correct before proceeding.

3.2.3. Temperature Correction: Most field instruments read conductivity directly. If the meter does not automatically correct values to 25°C, calculate correction factors using the procedure in section 3.4 below. Record all readings and calculations in the calibration records.

3.2.4. Continuing calibration: Check the meter with at least one KCl standard with a specific conductance within the range of conductivity measured in environmental samples. The reading for the calibration check must also be within +/- 5% of the standard value (see 3.2.2 above).

3.2.4.1. If new environmental samples are encountered outside the range of the initial calibration in 3.2.1 above, check the instrument calibration with 2 standards bracketing the expected range of sample values. If these calibration checks fail, recalibrate the instrument as in 3.2.1.

3.2.5. Quality Control: Follow the calibration quality control procedures and frequency of calibrations specified in FT 1000, section 2.2.

3.2.5.1. **More frequent calibration checks may be required for discharge permit compliance measurements or other regulatory requirements.**

3.3. Measuring Specific Conductance of Samples:

3.3.1. Follow manufacturer's instructions for sample measurement.

3.3.2. Immerse or place the conductivity probe or sensor in situ at a measuring location representative of the sampling source.

3.3.3. Allow the conductivity instrument to stabilize.

3.3.4. Measure the water temperature (if necessary for manual temperature compensation) and record the temperature. See FT 1400 for temperature measurement procedures.

3.3.5. If the meter is equipped with manual temperature compensation, adjust the conductivity meter to the water temperature per manufacturer's instructions.

3.3.6. If the conductivity meter has a set of positions that multiply the reading by powers of ten in order to measure the full range of potential conductivities, set this dial to the correct range in order to take a reading.

3.3.7. Record the sample conductivity measurement reading.

3.3.8. Rinse off the probe with de-ionized water. Follow manufacturer's instructions for probe storage between use.

3.4 Calculations for Temperature Compensation

If the meter does not automatically correct for temperature (manual or automatic adjustment), or if a probe with a cell constant other than 1 is used, the following formula must be used to normalize the data to 25°C:

$$K = \frac{(K_m)(C)}{1 + 0.0191(T-25)}$$

Where: K = conductivity in µmhos/cm at 25°C

$K_m$ = measured conductivity in µmhos/cm at T degrees C

C = cell constant

T = measured temperature of the sample in degrees C

If the cell constant is 1, the formula for determining conductivity becomes:

$$K = \frac{(K_m)}{1 + 0.0191(T-25)}$$

Refer to SM2510B, 20th edition, if other calculations (i.e., determining cell constant, etc.) are required. See FT 1210 below.

3.5 In-Situ Measurements at Depth or With Flow-through Cells: After calibrating the instrument as outlined in 3.2 above, follow the manufacturer's instructions to measure the conductivity of the sample.

3.5.1. For in-situ measurements immerse the probe at the desired depth and wait for stabilization of the reading and record its value. Follow a similar procedure when using a flow-through cell.

3.5.1.1 Preferably measure groundwater sample conductivity in-situ with a downhole probe or in a flow-through system.

4. PREVENTATIVE MAINTENANCE: Refer to FT 1000, section 3.

5. RECORDS: See FT 1000, section 4 for additional details.

5.1. Calibration:

Record all calibration information (initial and continuing) in a field notebook, on a form specifically designed for this purpose (e.g., FD 9000-8) or in other records, to include:

- Standard concentrations used
- Results of each calibration check, including expected reading for the calibration standard and actual reading obtained from the instrument
- Date, time and location (e.g., sample site, laboratory; etc.) of each calibration check
- Individual performing the check
- Whether the check met or failed acceptance criteria

- Sample readings associated with a failed check, either by direct listing or link to other records
- Corrective actions associated with failed check (such as recalibration, removal from use, etc.)
- Meter name, model number, and identification number (if applicable)

5.2. Samples:

Record the sample results on the appropriate field parameter sheets (e.g., Form FD 9000-7), field notebook or other records, to include:

- Project name
- Date and time the measurement was collected
- Location of the sample (description, monitor well number, etc.)
- Parameter name
- Reporting units
- Sample measurement value
- Indentification of operator taking the measurements

5.3. Reagent and Standards Documentation

Maintain documentation on calibration standards.

5.3.1. Note the standard value, vendor, lot number, date of receipt, expiration date and date of first use.

5.3.2. Observe and follow the expiration dates. If any standard is used after the expiration date, there must be documentation showing independent verification that the standard is providing an acceptable response.

## FT 1210. REFERENCES

1. U.S. Environmental Protection Agency, EPA120.1, Methods for the Chemical Analysis of Water and Waste, EPA-600/4-79-020, Revised 1983.

2. American Public Health Association, American Water Works Association, Water Pollution Control Federation, SM2510, Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1999.

3. American Society for Testing and Materials, ASTM, D1125-95 (Reapproved 1999), Standard Test Methods for Electrical Conductivity and Resistivity of Water

4. U.S. Geological Survey, National Field Manual for the Collection of Water-Quality Data, Book 9, Chapter A6, Field Measurements, Section 6.3, Specific Electrical Conductance, Techniques of Water-Resources Investigations, 4/98

## Appendix FT 1200
## Tables, Figures and Forms

Form FD 9000-7 Field Parameter Data Sheet for Surface Water

Form FD 9000-8 Field Instrument Calibration Records

SURVEY/PROJECT: _____ SAMPLERS: _____ METER # _____

| STATION NUMBER | STATION DESCRIPTION | PARAMETER | DATE | TIME | TOTAL DEPTH | SAMPLE DEPTH | WATER TEMP | DO | %SAT DO | COND | SALINITY | PH | TURBIDITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | UNIT | yy/mm/dd | hr:min | feet | feet | Celsius | mg/L | % | µS/cm | ppt | su | NTU |
| | | STORET CODE | 73672 | | 81903 | 68 | 10 | 299 | 301 | 94 | 480 | 400 | 82078 |
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FIELD CONDITIONS FOR STATION# _____ AT TIME_____:

CLOUD COVER (%): _____ WIND DIRECTION: _____ TIDAL STAGE: _____

PREVIOUS RAINFALL: _____ WIND SPEED (MPH/KNOTS): _____ WAVE CONDITIONS: _____

Note: This Sheet is used for recording Sample Data – Calibration information must also be documented (see FT 1100, section 4)

FT 1200 Field Measurement of Specific Conductance

**Field Instrument Calibration Records**

**INSTRUMENT** (MAKER/MODEL#) _____ **INSTRUMENT #** ____

**PARAMETER:** *[check only one]*

☐ TEMPERATURE ☐ CONDUCTIVITY ☐ SALINITY ☐ pH ☐ ORP

☐ TURBIDITY ☐ RESIDUAL CL ☐ DO ☐ OTHER _____

**STANDARDS:** *[Specify the type(s) of standards used for calibration, the origin of the standards, the standard values, and the date the standards were prepared or purchased]*

*Standard A* _____

Standard B _____

*Standard C* _____

| DATE (yy/mm/dd) | TIME (hr:min) | STD (A, B, C) | STD VALUE | INSTRUMENT RESPONSE | % DEV | CALIBRATED (YES, NO) | TYPE (INIT, CONT) | SAMPLER INITIALS |
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# FT 1400. FIELD MEASUREMENT OF TEMPERATURE

Use this SOP in conjunction with the following DEP SOPs:

- FT 1000 General Field Testing and Measurement
- FQ 1000 Field Quality Control Requirements
- FD 1000 Documentation Procedures

## 1. EQUIPMENT AND SUPPLIES

1.1. Field Instruments: Use any of the following instrument types for performing field measurements:

- Digital thermistor (thermocouple type) and meter typical of field instruments
- Glass bulb, mercury-filled thermometer (not recommended for field ruggedness)
- Glass bulb, alcohol-filled thermometer with protective case
- Bi-metal strip/dial-type thermometer
- Advanced silicon chip temperature sensor and digital meter

1.1.1. Field instruments must be capable of measuring temperature in 0.1°C increments.

1.2. Standard Thermometer: NIST-traceable Celsius certified thermometer with scale marks for every 0.1°C increment, a range of 0°C to 100°C (or a range bracketing expected sample temperatures) and correction chart supplied with certification.

1.3. Recordkeeping and Documentation Supplies:

- Field notebook or forms (e.g., forms FD 9000-7, FD 9000-8 and FD 9000-9)

## 2. CALIBRATION AND USE

2.1. General Concerns

2.1.1. Select a temperature measuring device meeting the requirements of section 1.1 above.

2.1.2. Dial-type and thermocouple-type devices with meters are preferred over the glass thermometers for fieldwork because of their durability and ease of reading.

2.1.2.1. Transport glass thermometers in protective cases.

2.1.2.2. Inspect glass thermometers for liquid separation. Do not use a thermometer if the liquid has separated.

2.1.2.3. Most instruments with digital display will provide more decimal figures than are significant. Record the temperature reading with only one rounded decimal figure (e.g., 25.9 instead of 25.86°C).

2.2. Calibration

2.2.1. See FT 1000 for required frequency of initial calibration and calibration checks.

**2.2.1.1. Other field-testing measurements requiring temperature compensation necessitate calibration of the temperature field measurement device according to this SOP.**

2.2.2. Check all thermistor (meter) devices and field thermometers against the NIST-traceable standard thermometer at several temperatures in the expected sample measurement range, using any correction factor indicated by the certificate supplied with the NIST-traceable thermometer.

2.2.2.1. See the reference in FT 1410, section 3 below for additional guidance about making temperature comparisons with the standard thermometer.

2.2.2.2. Make note of the calibration in the calibration records. See section 4, below.

2.2.2.3. The field measurement device may be used with a linear correction factor provided that the observed temperature difference with the standard thermometer is documented at incremental temperatures over the range of expected sample temperatures. See the reference in FT 1410, section 3 below for further guidance about correction factors.

2.2.2.4 Use the resulting correction factor when making temperature measurements of samples with the field measurement device.

2.2.2.5 Prominently display the correction factor on the field measurement device, with the date last checked. A calibration correction curve or plot may also be used.

2.2.2.6 Properly dispose of glass-bulb thermometers that do not meet the above calibration acceptance criteria.

2.2.3. Continuing Calibration Checks: See FT 1000 for required frequency of continuing calibration checks.

2.2.3.1. The maximum time between continuing calibration checks (continuing calibration verifcation) can be extended beyond one month if verified by historical data for calibration checks for the specific field temperature measurement device.

2.2.3.2. Check the field measurement device against the standard NIST-traceable thermometer as in section 2.2.2 – 2.2.2.6 above.

2.2.4. Refer to additional calibration requirements in FT 1000, section 2.2.

2.2.5. **More frequent calibration checks may be required for discharge permit compliance measurements or other regulatory requirements.**

2.3. Measuring Sample Temperature

2.3.1. Insert or place the thermometer or sensor in situ at a measuring location representative of the sampling source.

2.3.2. Allow the thermometer or temperature sensor to equilibrate to ambient in-situ temperature.

2.3.2.1. Groundwater samples must be measured in-situ with a downhole probe or in a flow-through system. Do not measure bailed or pumped samples in an intermediate container containing static sample.

2.3.3. Record the temperature to the nearest 0.1°C when the reading stabilizes and remains constant.

3. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.

4. RECORDS: See FT 1000, section 4 for additional details.

4.1. Calibration records

Document all calibration information (initial and continuing), to include the following:

- Details of the method used to compare the field measurement device to the NIST-traceable standard thermometer (see guidance in the reference listed in FT 1410, section 3 below)
- Temperature values at which calibrations were checked
- Date, time and location of each calibration check
- Analyst or operator performing the check
- Results of each calibration check, including the expected reading (per the NIST – traceable standard thermometer) and the actual reading of the field measurement device, using any established correction factors
- Whether the check met or failed acceptance criteria
- Corrective actions associated with failed check (such as new correction factor, removal from use, etc.)
- Field measurement meter or thermometer name, model number, and identification number (if applicable)

4.2. Sample measurement records

Document sample measurement results as follows:

- Project name
- Date and time the measurement was performed
- Location of the sample (description, monitor well number, etc.)
- Parameter name
- Reporting units
- Sample measurement temperature value
- Identification of the operator taking the measurements

## FT 1410. REFERENCES

1. U.S. Environmental Protection Agency, EPA170.1, Methods for the Chemical Analysis of Water and Waste, EPA-600/4-79-020, Revised 1983.

2. American Public Health Association, American Water Works Association, Water Pollution Control Federation, SM2550, Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1999.

3. U.S. Geological Survey, National Field Manual for the Collection of Water-Quality Data, Book 9, Chapter A6, Field Measurements, Section 6.1, Temperature, Techniques of Water-Resources Investigations, 4/98

## Appendix FT 1400
## Tables, Figures and Forms

| | |
|---|---|
| Form FD 9000-7 | Field Parameter Data Sheet for Surface Water |
| Form FD 9000-8 | Field Instrument Calibration Records |

FT 1400 Field Measurement of Temperature

**Field Parameter Data Sheet for Surface Water**

SURVEY/PROJECT: _____ SAMPLERS: _____

METER # _____

| STATION NUMBER | STATION DESCRIPTION | PARAMETER | DATE | TIME | TOTAL DEPTH | SAMPLE DEPTH | WATER TEMP | DO | %SAT DO | COND | SALINITY | PH | TURBIDITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | UNIT | yy/mm/dd | hr:min | feet | feet | Celsius | mg/L | % | µS/cm | ppt | su | NTU |
| | | STORET CODE | 73672 | | 81903 | 68 | 10 | 299 | 301 | 94 | 480 | 400 | 82078 |
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FIELD CONDITIONS FOR STATION# _____ AT TIME_____:

CLOUD COVER (%): _____ WIND DIRECTION: _____

_____ TIDAL STAGE: _____

PREVIOUS RAINFALL: _____ WIND SPEED (MPH/KNOTS): _____

_____ WAVE CONDITIONS: _____

Note: This Sheet is used for recording Sample Data – Calibration information must also be documented (see FT 1100, section 4)

DEP-SOP-001/01
FT 1400 Field Measurement of Temperature
**Field Instrument Calibration Records**

**INSTRUMENT** (MAKER/MODEL#) _____ **INSTRUMENT #** _____

**PARAMETER:** *[check only one]*

☐ TEMPERATURE ☐ CONDUCTIVITY ☐ SALINITY ☐ pH ☐ ORP
☐ TURBIDITY ☐ RESIDUAL CL ☐ DO ☐ OTHER _____

**STANDARDS:** *[Specify the type(s) of standards used for calibration, the origin of the standards, the standard values, and the date the standards were prepared or purchased]*

*Standard A* _____

Standard B _____

*Standard C* _____

| DATE (yy/mm/dd) | TIME (hr:min) | STD (A, B, C) | STD VALUE | INSTRUMENT RESPONSE | % DEV | CALIBRATED (YES, NO) | TYPE (INIT, CONT) | SAMPLER INITIALS |
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# FT 1500. FIELD MEASUREMENT OF DISSOLVED OXYGEN (DO)

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FD 1000 Documentation Procedures

1. EQUIPMENT AND SUPPLIES

1.1. Field Instrument: a membrane/electrode DO meter, with polarographic or galvanic electrode, and a sensitivity that results in a precision of +/- 0.2 mg DO/L and an accuracy of +/- 0.2 mg DO/L. Temperature compensation must be done either automatically by the DO probe, or manually in accordance with SM 4500-O G. Temperature must also be calibrated in accordance with FT 1400.

1.2. Standards

1.2.1. NIST-traceable Celsius thermometer with a scale marked for every 0.1°C and a range of 0 to 100°C.

1.2.2. Access to an organization with capability to perform the Winkler titration procedure is recommended but not mandatory.

1.2.3. A "zero-DO standard", prepared on-site with an aliquot of the sample water, is optional. Prepare by adding excess sodium sulfite and a trace of cobalt chloride to bring the DO to zero.

1.3. Recordkeeping and Documentation Supplies:

- Field notebook (w/ waterproof paper is recommended)
- Field record forms (e.g., forms FD 9000-7, FD 9000-8 and FD 9000-9)
- Indelible pens

2. CALIBRATION AND USE: the electrode method is predominantly used in-situ for dissolved oxygen determinations.

2.1. General Concerns

2.1.1. Turbulence is necessary to keep a constant flow of water across the membrane-sample interface. Make sure the appropriate mechanism is working before using the probe.

2.1.2. Store the probe with a cover that creates a saturated atmosphere. A cap, with a wet sponge in it, will suffice for single-parameter probes. If the sensor is in a multi-probe device, keep the protective cap filled with water during storage.

2.1.3. Before mobilizing, check to make sure there are no bubbles beneath the probe membrane, or any wrinkles or tears in the probe membrane. If so, replace the membrane and KCl solution. Check the leads, contacts, etc. for corrosion and/or shorts if meter pointer remains off-scale, does not calibrate, or drifts.

2.1.4. Dissolved inorganic salts interfere with the performance of DO probes. For example, DO readings in salt water are affected by the salinity and must be corrected. The DO meter may adjust automatically based on readings taken from the specific conductivity/salinity probe. If corrections are not automatic the appropriate calculations must be used to correct for salinity. If automatic adjustments are used the specific conductivity/salinity probe calibration must be checked or calibrated in accordance with FT1200.

2.1.5. Reactive gases, which pass through the membrane, may interfere. For example, chlorine will depolarize the cathode and cause a high probe output. Long-term exposures to chlorine will coat the anode with the chloride of the anode metal and eventually desensitize the probe. Sulfide (from $H_2S$) will undergo oxidation if high enough potential (voltage) is applied, creating current flow, yielding faulty readings. If such interferences are suspected, change the membrane electrode more frequently and calibrate at more frequent intervals.

2.2. Calibration

2.2.1. Follow the quality control requirements for calibration (see FT 1000, section 2.2).

2.2.2. Air Calibration and Checks: before use, check the meter in water-saturated air to make sure it is properly calibrated and operating correctly. Make a similar check at the end of the day or sampling event. Follow the manufacturer's instructions for your specific instrument.

2.2.2.1. Allow an appropriate warm up period before initial field calibration.

2.2.2.2. Once the probe/calibration chamber is stable at ambient temperature, check the air temperature and determine, from the DO versus temperature table (See Table 1 Below) what the DO should measure. A stable and accurate temperature is required for a valid calibration.

2.3. Continuous Calibration

2.3.1. Air-Calibration Chamber in Air: DO sensor or instrument is calibrated against air that is saturated with water at a known temperature and ambient atmospheric pressure. Use table 1 to check calibration at specified temperature (*USGS TWRI Book 9 See Table 1)*

2.3.1.1. Wet the inside of the calibration chamber with water-pour out the excess water (leave a few drops) and insert the sensor into the chamber (this ensures 100-percent humidity)

2.3.1.2. Allow adequate time for the DO sensor and the air inside the calibration chamber to equilibrate.

2.3.1.3. Measure the temperature in the calibration chamber and observe the readings until the instrument stabilizes.

2.3.1.4. Use the oxygen solubility table 1 to determine the DO saturation at a measured temperature and atmospheric pressure.

2.3.1.5. Compare DO meter reading with value obtained from table 1 to ensure continuous calibration

**Table 1: Solubility of Oxygen in Water at Atmospheric Pressure[1,2]**

| Temperature °C | Oxygen Solubility mg/L | Temperature °C | Oxygen Solubility mg/L |
|---|---|---|---|
| 0.0 | 14.621 | 26.0 | 8.113 |
| 1.0 | 14.216 | 27.0 | 7.968 |
| 2.0 | 13.829 | 28.0 | 7.827 |
| 3.0 | 13.460 | 29.0 | 7.691 |
| 4.0 | 13.107 | 30.0 | 7.559 |
| 5.0 | 12.770 | 31.0 | 7.430 |
| 6.0 | 12.447 | 32.0 | 7.305 |
| 7.0 | 12.139 | 33.0 | 7.183 |
| 8.0 | 11.843 | 34.0 | 7.065 |
| 9.0 | 11.559 | 35.0 | 6.950 |
| 10.0 | 11.288 | 36.0 | 6.837 |
| 11.0 | 11.027 | 37.0 | 6.727 |
| 12.0 | 10.777 | 38.0 | 6.620 |
| 13.0 | 10.537 | 39.0 | 6.515 |
| 14.0 | 10.306 | 40.0 | 6.412 |
| 15.0 | 10.084 | 41.0 | 6.312 |
| 16.0 | 9.870 | 42.0 | 6.213 |
| 17.0 | 9.665 | 43.0 | 6.116 |
| 18.0 | 9.467 | 44.0 | 6.021 |
| 19.0 | 9.267 | 45.0 | 5.927 |
| 20.0 | 9.092 | 46.0 | 5.835 |
| 21.0 | 8.915 | 47.0 | 5.744 |
| 22.0 | 9.743 | 48.0 | 5.654 |
| 23.0 | 8.578 | 49.0 | 5.565 |
| 24.0 | 8.418 | 50.0 | 5.477 |
| 25.0 | 8.263 | | |

1. The table provides three decimal places to aid interpolation
2. Under equilibrium conditions, the partial pressure of oxygen in air-saturated water is equal to that of the oxygen in water-saturated air

2.4. Additional Checks: The following methods may be used as additional checks to verify calibration. These additional checks may be required as part of a specific permit.

2.4.1. Winkler method (e.g. SM4500-0 C): this check is useful to assess the condition of the DO sensor (i.e., its degradation with time/use) and that the instrument can still maintain a valid calibration. (EPA Method# 360.2, and SM4500-O B)

2.4.1.1. Following EPA Method# 360.2 or SM4500-O C when using the Winkler method is necessary for an accurate calibration check.

2.4.1.2. Fill a clean bucket with uncontaminated or de-ionized water and place the probe into the bucket (with stirrer or equivalent mechanism turned off). Fill at least two biological oxygen demand (BOD) bottles without entraining atmospheric oxygen into the bottles. Carefully submerge the bottom of the bottle (one at a time) into the water and allow the water to fill the bottle. Place the bottle on the bottom of the

bucket and carefully place stopper into it without adding atmospheric oxygen. Retrieve the bottles and determine their DO by the Winkler method (see SM4500-O-B for more details). Turn the stirrer or equivalent mechanism on and read the DO of the water in the bucket.

2.4.1.3. Adjust the DO meter according to manufacturer's instructions. Be sure to adjust the meter to the temperature of water in the bucket, and then calibrate the DO meter to read the average DO concentration of the two samples determined by the Winkler test.

2.4.2. Zero-DO Check: The air calibration and the interfering effects of the sample can be further checked in the field by means of a "zero-DO standard"(SM 4500-O G.).

2.4.2.1. Prepare this standard on-site with an aliquot of the sample by adding excess sodium sulfite and a trace of cobalt chloride to bring the DO to zero. Prepare this zero-DO standard in a beaker or a large-mouth sample container of appropriate size to insert the DO probe.

2.4.2.2. After adding the chemicals, gently swirl the water and let it sit for about 30 seconds before inserting the probe.

2.4.2.3. Read the DO of the sample. If the reading is outside the acceptance interval, the instrument must be recalibrated and/or zero-adjusted if the meter allows for this adjustment.

2.4.3. Air-Saturated Water: The DO sensor or instrument system is calibrated against water that is saturated with oxygen at a known temperature and ambient atmospheric pressure. (*USGS TWRI Book 9 See Table 1 above)*

2.4.3.1. The temperature and Conductivity of water used for calibration should be about the same as the temperature and conductivity of the water to be measured.

2.4.3.2. Place DO sensor and calibration water in a large beaker or open-mouth container.

2.4.3.3. Aerate the water for an adequate amount of time.

2.4.3.4. Determine if the water is 100 percent saturated with oxygen, and take a temperature reading (Temperature must be calibrated or check for accuracy before DO calibration check)

2.4.3.5. Use table 1 above to determine the DO saturation value at the measured water temperature. Compare DO meter reading with value obtained from table 1 to ensure continuous calibration

2.5. Measuring DO in Samples:

2.5.1. Place the DO probe at the depth and location appropriate to what you are measuring.

2.5.1.1. For example, take the DO of an effluent just before it enters the receiving water. If the effluent aerated prior to entering the surface water, take the DO reading in the receiving water right where it enters.

2.5.1.2. For well mixed surface waters, e.g., fast flowing streams, take the DO reading at approximately 1-2 feet below the surface or at mid-depth.

2.5.1.3. For still or sluggish surface waters, take a reading at one foot below the surface, one foot above the bottom, and at mid-depth.

2.5.1.4. If it is shallow, say less than two feet, take the reading at mid-depth.

2.5.1.5. Do not take a reading in frothy/aerated water since you may get a false reading.

2.5.1.6. For groundwater, if it is impractical to place the probe in the well, collect a sample with minimal aeration and measure the DO immediately upon collection. Use a low-flow pumping system with a flow-through cell for best results.

2.5.2. Rinse probe with de-ionized water and keep the probe in the saturated atmosphere (see 2.1.2 above) between sites and events.

2.5.3. If the readings show distinct, unexplainable changes in DO levels, or when the probe has been in waters with high sulfides, recalibrate using the Winkler method or perform maintenance per manufacturer's instructions. While taking a reading, if it is very low (e.g., below 1.0 mg/L), allow it to stabilize, record it and then, remove and rinse the probe, as the environment is very likely anoxic and may contain hydrogen sulfide, which can damage the probe.

2.5.4. Salinity and Temperature corrections may be necessary. Follow manufacturer instructions for automatic corrections or perform manual calculations (SM 4500-O G.).

3. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.

4. RECORDS: See FT 1000, section 4 for additional details.

4.1. Calibration: Record all calibration information (initial and continuing) in the field notebook or on a form specifically designed for this purpose (e.g. FD 9000-8). This information must be recorded:

4.1.1. The calibration method (or SOP) and the type of standard(s) (including the concentrations) used.

4.1.2. Record each calibration check (initial, continuing or final) in the permanent field records (or calibration logs). At a minimum, these records must include:

4.1.2.1. Date, time and location (e.g., monitoring well MW-X; laboratory; etc.) of each calibration check;

4.1.2.2. Individual performing the check;

4.1.2.3. Results of each check, including the concentration/type of standard, expected reading, and the actual reading;

4.1.3. Whether the check met or failed acceptance criteria;

4.1.4. Readings associated with a failed check; and

4.1.5. Corrective actions associated with failed check (such as recalibration, removal from use, etc.).

4.1.6. Optionally, enter the meter name, model number, and identification number (if applicable).

4.2. Samples: Record the sample results on the appropriate field parameter sheets (e.g., form FD 9000-7) or in a field notebook. For each sample record the following information:

- Project Name
- Date and time the measurement was collected
- Location of the sample (description, monitor well number, etc.)+
- Analyte Name
- Reporting Units
- Sample Value
- Initials of the person taking the measurements.

4.3. Reagent and Standards Documentation: Maintain documentation on calibration standards and other reagents.

4.3.1. At a minimum, note the date of receipt, expiration dates (on the bottle label), and date of first use (on the standard container).

4.3.2. Follow expiration dates: If any standard or chemical is used after the expiration date, there must be documentation showing that the reagent is providing an acceptable response.

## FT 1510. REFERENCES

1. U.S. Environmental Protection Agency, EPA360.1 and 360.2, Methods for the Chemical Analysis of Water and Waste, EPA-600/4-79-020, Revised 1983.

2. American Public Health Association, American Water Works Association, Water Pollution Control Federation, SM4500-O-G, Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1999.

3. U.S. Geological Survey, TWRI, Book 9, 04/98.

4. American Society for Testing and Materials, Annual book of ASTM Standards 2001, Section 11 Water and Environmental Technology, Vol. 11.01

## Appendix FT 1500
## Tables, Figures and Forms

| | |
|---|---|
| Form FD 9000-7 | Field Parameter Data Sheet for Surface Water |
| Form FD 9000-8 | Field Instrument Calibration Records |

DEP-SOP-001/01

FT 1500 Field Measurement of Dissolved Oxygen

**Field Parameter Data Sheet for Surface Water**



SURVEY/PROJECT: _____ SAMPLERS: _____

METER # _____

| STATION NUMBER | STATION DESCRIPTION | PARAMETER | DATE | TIME | TOTAL DEPTH | SAMPLE DEPTH | WATER TEMP | DO | %SAT DO | COND | SALINITY | PH | TURBIDITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | UNIT | yy/mm/dd | hr:min | feet | feet | Celsius | mg/L | % | µS/cm | ppt | su | NTU |
| | | STORET CODE | 73672 | | 81903 | 68 | 10 | 299 | 301 | 94 | 480 | 400 | 82078 |
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FIELD CONDITIONS FOR STATION# _____ AT TIME_____:

CLOUD COVER (%): _____ WIND DIRECTION: _____

TIDAL STAGE: _____

PREVIOUS RAINFALL: _____ WIND SPEED (MPH/KNOTS): _____

WAVE CONDITIONS: _____

Note: This Sheet is used for recording Sample Data – Calibration information must also be documented (see FT 1100, section 4)

**Field Instrument Calibration Records**

**INSTRUMENT** (MAKER/MODEL#) _____ **INSTRUMENT #** _____

**PARAMETER:** *[check only one]*

☐ TEMPERATURE ☐ CONDUCTIVITY ☐ SALINITY ☐ pH ☐ ORP

☐ TURBIDITY ☐ RESIDUAL CL ☐ DO ☐ OTHER _____

**STANDARDS:** *[Specify the type(s) of standards used for calibration, the origin of the standards, the standard values, and the date the standards were prepared or purchased]*

*Standard A* _____

Standard B _____

*Standard C* _____

| DATE (yy/mm/dd) | TIME (hr:min) | STD (A, B, C) | STD VALUE | INSTRUMENT RESPONSE | % DEV | CALIBRATED (YES, NO) | TYPE (INIT, CONT) | SAMPLER INITIALS |
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# FT 1600. FIELD MEASUREMENT OF TURBIDITY

Use in conjunction with:

- FT 1000 General Field Testing and Measurement
- FQ 1000 Field Quality Control Requirements
- FS 1000 General Sampling Procedures
- FD 1000 Documentation Procedures

1. INTRODUCTION: Turbidity measures the scattering effect that suspended solids have on the propagation of light through a body of water (surface or ground waters). The higher the effect (i.e., intensity of scattered light), the higher the turbidity value. Suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter, and plankton and other microscopic organisms cause turbidity in water.

This SOP describes the use of true nephelometric measurement using instruments meeting the specifications of the cited methods (see references). The use of in-situ probes with turbidity sensors may be used for screening purposes only. Do not report their results for regulatory purposes.

2. EQUIPMENT AND SUPPLIES

2.1. Field Instrument: Use a turbidimeter (aka nephelometer) or a spectrophotometer consisting of a light source and one or more photoelectric detectors with a readout device to indicate the intensity of light. The instrument must meet these specifications:

2.1.1. The light source must have a tungsten-filament lamp operated at a color temperature between 2000 and 3000°K.

2.1.2. The distance traversed by the incident light and scattered light within the sample tube must not exceed 10 cm.

2.1.3. The light detector, positioned at 90° to the incident light, must have an acceptance angle that does not exceed ± 30° from 90°.

2.1.4. The detector and any filter system must have a spectral peak response between 400 and 600 nanometers.

2.1.5. The instrument sensitivity must permit detection of a turbidity difference of 0.02 NTU at the 0 – 1.0 NTU scale.

2.1.6. Note: using the appropriate equipment and following the procedures in this SOP, the field accuracy of this measurement is close to %R= 100 ± 10% for turbidities in the range of 1 to 100 NTU.

2.2. Sample Cells (cuvettes): Use sample cells or tubes of clear, colorless glass or plastic.

2.2.1. Keep cells scrupulously clean, both inside and out, and discard if scratched or etched.

2.2.1.1. Never handle them where the light beam strikes the sample.

2.2.1.2. Clean sample cells by thorough washing with laboratory soap (inside and out) followed by multiple rinses with distilled or de-ionized water, and let air-dry.

2.2.2. Use a very thin layer of silicone oil on the outside surfaces to mask minor imperfections or scratches in the cells.

2.2.2.1. Use silicone oil with the same refractive index of the glass; making sure the cell appear to be nearly dry with little or no visible signs of oil.

2.2.3. Because small differences between cells significantly impact measurement, use either matched pairs or the same cell for standardization and sample measurement.

2.3. Standards: Formazin stock suspension of 4,000 NTU, either prepared according to method SM 2130B, section 3.b, or of commercial origin. Use daily or working standards as outlined below. Do not use standards past their expiration dates.

2.3.1. Working formazin standards: in the turbidity ranges of interest, prepare by diluting the 4,000 NTU stock standard with "high-quality dilution water" (nominal value of 0.02 NTU).

2.3.1.1. Prepare this water by passing laboratory reagent-grade water through a filter with pore size of 0.1 µm (rinse the collection flask at least twice with filtrate and discard the next 200 mL).

2.3.2. Secondary commercial standards: use only those certified by the manufacturer to give equivalent calibrations to the primary standards and retain their certificates.

2.3.3. Primary or secondary Gel-type standards: suspensions of microspheres of styrene-divinylbenzene (SDVB) copolymer that are as stable as the concentrated formazin and more stable than diluted formazin. These standards, available commercially, are also known as "gel-type" standards. They are recommended for field use.

2.4. Recordkeeping and Documentation Supplies:

- Field notebook (w/ waterproof paper is recommended)
- Field record forms (e.g., forms FD 9000-7, FD 9000-8 and FD 9000-9)
- Indelible pens

## 3. Calibration and Use

### 3.1. General Concerns

3.1.1. Light absorption by dissolved and suspended matter may cause a negative bias on the turbidity measurement. When present in significant concentrations, particles of light-absorbing materials such as activated carbon will cause a negative interference. Likewise, the presence of dissolved, color-causing substances that absorb light may also cause a negative interference. Some commercial instruments may have the capability of either correcting for slight color interference or optically blanking out the color effect.

3.1.2. Handle samples with natural effervescence as described in 3.3.5 below.

### 3.2. Calibration

3.2.1. Follow the quality control requirements for calibration (see FT 1000, section 2.2).

3.2.2. Calibrate the field instrument before use either at the base of operations or in the field. The acceptance criterion for the initial calibration or a calibration check depend on the range of turbidity of the standard value:

- S= 0.1 - 10 NTU: the response must be within 10% of the standard;

- S= 11 - 40 NTU: the response must be within 8% of the standard;
- S= 41 – 100 NTU: the response must be within 6.5% of the standard; and
- S > 100 NTU: the response must be within 5% of the standard.

3.2.3. Nephelometer Calibration: Follow the manufacturer's operating instructions. Run at least one standard in each instrument range to be used in the field. Make certain that the instrument gives stable readings in all sensitivity ranges used.

3.2.4. Secondary standards (see 2.3.3 above) may be used to calibrate and/or check calibrations. Check secondary standards against a primary standard at least once per quarter.

3.3. Measuring Turbidity in Samples:

3.3.1. Gently agitate the sample and wait until air bubbles disappear.

3.3.2. Double-rinse the sample cell or cuvette with a small amount of the sample. Discard, and pour an aliquot into the sample cell or cuvette.

3.3.3. Gently dry out its external surface with lint-free paper.

3.3.4. Insert the cell in the instrument and read the turbidity directly from the meter display. Report turbidity measurements as follows:

| Turbidity Range (NTU) | Report to Nearest (NTU) |
|---|---|
| 0 – 0.1 | 0.05 |
| 1 – 10 | 0.1 |
| 10 – 40 | 1 |
| 40 – 100 | 5 |
| 100 – 400 | 10 |
| 400 – 1000 | 50 |
| > 1000 | 100 |

3.3.5. Do not use vacuum degassing, ultrasonic bath or other devices to remove bubbles from the sample. If the sample contains visible bubbles or if it effervesces (as in groundwater, with changes in pressure and temperature), make a note of this in the field records and collect a sample for laboratory measurement.

3.3.5.1. If effervescing samples are collected for laboratory analysis collect the sample without leaving headspace in the container and ship it as soon as possible to the laboratory (the holding time for this measurement is only 48 hrs). Ship this sample in wet ice at 4°C.

3.3.6. Pour out the sample, double-rinse the cuvette with de-ionized water in preparation for the next sample.

4. PREVENTIVE MAINTENANCE: Refer to FT 1000, section 3.

5. RECORDS: See FT 1000, section 4 for additional details.

5.1. Calibration: Record all calibration information (initial and continuing) in the field notebook or on a form specifically designed for this purpose (e.g. FD 9000-8). This information must be recorded:

5.1.1. The calibration method (or SOP) and the type of standard(s) (including the concentrations) used.

5.1.2. Record each calibration check (initial, continuing or final) in the permanent field records (or calibration logs). At a minimum, these records must include:

5.1.2.1. Date, time and location (e.g., monitoring well MW-X; laboratory; etc.) of each calibration check;

5.1.2.2. Individual performing the check;

5.1.2.3. Results of each check, including the concentration/type of standard, expected reading, and the actual reading;

5.1.3. Whether the check met or failed acceptance criteria;

5.1.4. Readings associated with a failed check; and

5.1.5. Corrective actions associated with failed check (such as recalibration, removal from use, etc.).

5.1.6. Optionally, enter the meter name, model number, and identification number (if applicable).

5.2. Samples: Record the sample results on the appropriate field parameter sheets (e.g., Form FD 9000-7) or in a field notebook. For each sample record the following information:

- Project Name
- Date and time the measurement was collected
- Location of the sample (description, monitor well number, etc.)
- Analyte Name
- Reporting Units
- Sample Value
- Initials of the person taking the measurements

5.3. Reagent and Standards Documentation: Maintain documentation on calibration standards (e.g., formazin, gel standards) and other reagents.

5.3.1. At a minimum, note the date of receipt, expiration dates (on the bottle label), and date of first use (on the standard container).

5.3.2. Follow expiration dates: If any standard or chemical is used after the expiration date, there must be documentation showing that the reagent is providing an acceptable response.

## FT 1610. REFERENCES

1. U.S. Environmental Protection Agency, EPA 180.1, Methods for the Chemical Analysis of Water and Waste, EPA-600/4-79-020, Revised 1983.
2. American Public Health Association, American Water Works Association, Water Pollution Control Federation, SM 2130, Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1999.

3. U.S. Geological Survey, National Field Manual for the Collection of Water-Quality Data; Techniques of Water-Resources Investigations, Book 9, Chapter 6.7, 1998.

## Appendix FT 1600
## Tables, Figures and Forms

| | |
|---|---|
| Form FD 9000-7 | Field Parameter Data Sheet for Surface Water |
| Form FD 9000-8 | Field Instrument Calibration Records |

DEP-SOP-001/01

FT 1600 Field Measurement of Turbidity

**Field Parameter Data Sheet for Surface Water**



SURVEY/PROJECT: _____ SAMPLERS: _____

_____ METER # _____

| STATION NUMBER | STATION DESCRIPTION | PARAMETER | DATE | TIME | TOTAL DEPTH | SAMPLE DEPTH | WATER TEMP | DO | %SAT DO | COND | SALINITY | PH | TURBIDITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | UNIT | yy/mm/dd | hr:min | feet | feet | Celsius | mg/L | % | µS/cm | ppt | su | NTU |
| | | STORET CODE | 73672 | | 81903 | 68 | 10 | 299 | 301 | 94 | 480 | 400 | 82078 |
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FIELD CONDITIONS FOR STATION# _____ AT TIME_____:

CLOUD COVER (%): _____ WIND DIRECTION: _____

_____ TIDAL STAGE: _____

PREVIOUS RAINFALL: _____ WIND SPEED (MPH/KNOTS): _____

_____ WAVE CONDITIONS: _____

Note: This Sheet is used for recording Sample Data – Calibration information must also be documented (see FT 1100, section 4)

**Field Instrument Calibration Records**

**INSTRUMENT** (MAKER/MODEL#) _____ **INSTRUMENT #** _____

**PARAMETER:** *[check only one]*

☐ TEMPERATURE ☐ CONDUCTIVITY ☐ SALINITY ☐ pH ☐ ORP

☐ TURBIDITY ☐ RESIDUAL CL ☐ DO ☐ OTHER _____

**STANDARDS:** *[Specify the type(s) of standards used for calibration, the origin of the standards, the standard values, and the date the standards were prepared or purchased]*

*Standard A* _____

Standard B _____

*Standard C* _____

| DATE (yy/mm/dd) | TIME (hr:min) | STD (A, B, C) | STD VALUE | INSTRUMENT RESPONSE | % DEV | CALIBRATED (YES, NO) | TYPE (INIT, CONT) | SAMPLER INITIALS |
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