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RESOURCE CONSERVATION AND RECOVERY ACT CONFIRMATION ASSESSMENT AND RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION WORK PLAN FOR AREA OF CONCERN C NS MAYPORT FL

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RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) CONFIRMATION ASSESSMENT AND RCRA FACILITY INVESTIGATION WORK PLAN FOR AREA OF CONCERN C

U. S. NAVAL STATION MAYPORT MAYPORT, FLORIDA

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:

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Naval Facilities Engineering Command
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1.0 INTRODUCTION

This work plan presents the background, approach, and data-gathering procedures for Resource Conservation and Recovery Act (RCRA) investigations of selected solid waste management units (SWMUs) at U.S. Naval Station (NAVSTA) Mayport, Florida. NAVSTA Mayport is located in northeastern Duval County, Florida, at the confluence of the St. Johns River and the Atlantic Ocean, as shown on Figure 1-1.

1.1 PURPOSE OF THE FIELD SAMPLING PLAN

The work plan incorporates the Sampling and Analysis Plan (SAP) (Sections 1.0 through 8.0 of this work plan), the Health and Safety Plan (HASP) (Appendix A), and the Quality Assurance Project Plan (QAPP) (Appendix B). The FSP portion of the work plan is to serve as a guide for site investigation activities at Area of Concern (AOC) C and documents the procedures for field activities and sample analyses. The FSP was prepared in accordance with the Tetra Tech NUS, Inc. (TtNUS) Quality Assurance Program Manual, dated October 1, 1998. The FSP specifies sampling protocol and procedures for data collection and sample analysis as well as types, locations, frequency of samples to be collected, sample designations, sample handling and analysis, sampling equipment, and handling of investigative derived wastes (IDW).

1.2 FACILITY DISCRIPTION AND BACKGROUND

NAVSTA Mayport is located within the corporate limits of the city of Jacksonville, Duval County, Florida, approximately 12 miles to the northeast of downtown Jacksonville (Figure 1-1). The station complex is located on the northern end of a peninsula bounded by the Atlantic Ocean to the east and the St. Johns River to the north and west. NAVSTA Mayport occupies the entire northern part of the peninsula except for the town of Mayport located to the west between the station and the St. Johns River.

NAVSTA Mayport was commissioned in 1942 on approximately 700 acres of land. The station initially consisted of a harbor and an airfield located near the mouth of the St. Johns River. The airfield and harbor were constructed from the dredging and filling of Ribault Bay. The harbor was initially dredged to a depth of 29 feet below mean sea level (msl), and is referred to as the Mayport Turning Basin. The Mayport Turning Basin is surrounded on three sides by ship piers.

The original mission of the station included use by patrol craft, target boats, and rescue boats. The station was placed in caretaker status from 1946 to 1948. In 1948 the station was reopened, and in 1952

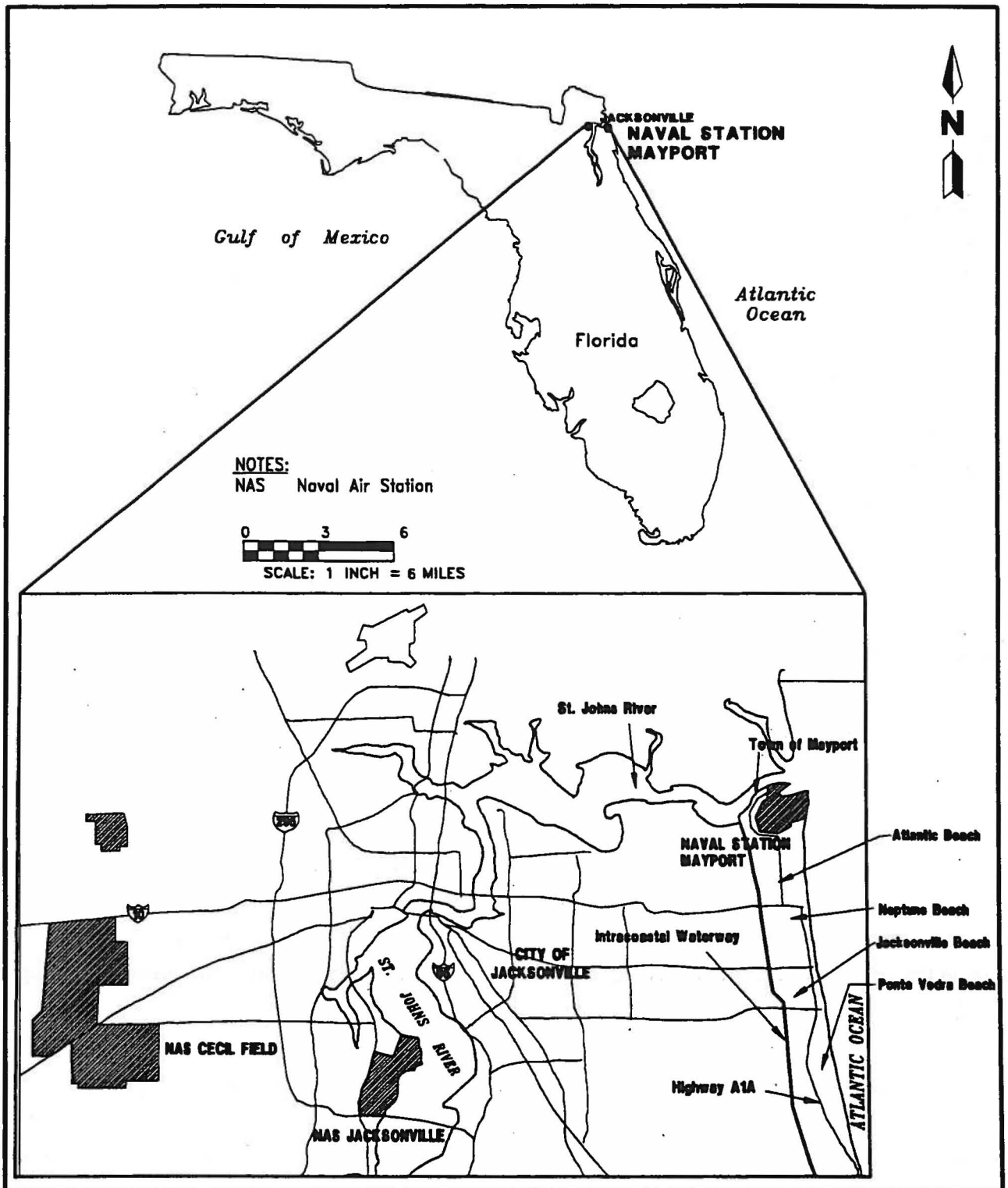

FIGURE 1-1
FACILITY LOCATION MAP
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TECHNICAL MEMORANDUM
GROUNDWATER ASSESSMENT OF TETRACHLOROETHENE RELEASE NEAR BUILDING 191
U.S. NAVAL STATION
MAYPORT, FLORIDA

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an aircraft carrier was assigned to the station. The turning basin was dredged to a depth of 40 feet to allow aircraft carriers and other large ships to berth at NAVSTA Mayport. The amount of uplands at NAVSTA Mayport was increased by using dredge material to fill areas south of the turning basin.

NAVSTA Mayport is the fourth largest Navy homeport in the United States, employing approximately 13,000 active duty personnel and 1,000 civilians, and occupying more than 3,400 acres. Currently, destroyers, frigates, an aircraft carrier, a destroyer tender, and minesweepers are stationed at NAVSTA Mayport. The station is also home to five helicopter squadrons, with approximately 200,000 take-offs and landings per year on the 8,000-foot runway. The ship facilities are located in the northern and eastern areas of the complex near the Mayport Turning Basin, and the air facilities are located in the central and western areas near the runway. The station also maintains housing and recreation facilities for the active duty personnel and their families.

NAVSTA Mayport provides all necessary support services for the surface fleet and aircraft stationed at or visiting Mayport. This support includes a division of the Public Works Center, which is headquartered at Naval Air Station (NAS) Jacksonville, and provides infrastructure support. Other services include personnel support, facilities support, and ship and aircraft repair and maintenance.

Industrial operations conducted at NAVSTA Mayport involve intermediate level maintenance for both ships and aircraft, and vehicle maintenance and repair. Any maintenance activities that can be conducted without putting a ship into dry-dock are considered intermediate. Aircraft maintenance is performed in the hangar buildings by squadron personnel.

Maintenance and repair operations for ships are carried out by three organizations on the station: Shore Intermediate Maintenance Activity (SIMA), Supervisor of Shipbuilding (SUPSHIP), and Naval Aviation Depot (NADEP). SIMA conducts repair and maintenance operations onboard ships at the piers and in the SIMA operations building. SUPSHIP is a contracting organization that contracts out maintenance and repair work. NADEP conducts maintenance operations on aircraft launching and arresting systems in its own building on the station.

Wastes generated by the station are those normally associated with ship, on-shore maintenance, and flight operation activities. Wastes generated and disposed of at the station include waste oils, fuels, lubricants, solvents, paints, and general refuse associated with ship, aircraft, vehicle, and building maintenance activities. From 1942 to 1979, all wastes were disposed of in landfills on the station. Some of the landfilled wastes were burned at the site to reduce their volume. Additionally, some waste oils were used for mosquito control around the station. From 1979 to 1994, all burnable wastes were

incinerated in a carbonaceous fuel boiler. Incinerator ash, unburnable debris, construction rubble, and large scrap materials were landfilled on the base until early 1985, when all onsite landfills were closed.

1.3 AOC C DESCRIPTION

AOC C is located southeast of the NAVSTA Mayport Turning Basin and includes buildings and facilities around the southern portion of Echo Pier, Building 191, and the SIMA Building (Building 1488) (Figure 1-2). Storage areas at Building 191 are used to support ship and shore services at NAVSTA Mayport by providing areas to receive, temporarily store, and distribute supplies. The outlying buildings are used to warehouse hazardous materials such as solvents and compressed gasses. These buildings or structures include one Quonset building (Buildings 2023), an open-sided covered structure with concrete floor (Building 191-A), and an aluminum constructed structure (Building 191-C). Quonset Building 264 that was previously located on site has been demolished. Activities pertaining to the SIMA Building were not available at the time this work plan was being prepared.

1.4 REGULATORY SETTING (RESOURCE CONSERVATION AND RECOVERY ACT CORRECTIVE ACTION PROGRAM)

Environmental Protection Agency (USEPA) issued RCRA permit No. H016-118598 and Hazardous and Solid Waste Amendments (HSWA) permit FL9 170 024 260 to NAVSTA Mayport on March 25, 1988. The HSWA permit was revised and reissued on June 15, 1993. A RCRA facility assessment (RFA) visual site inspection (VSI) for NAVSTA Mayport was conducted on behalf of the USEPA Region IV by their contractor, A.T. Kearney, Inc. (A.T. Kearney, 1989). The RFA identified 56 SWMUs and 2 areas of concern (AOCs) at NAVSTA Mayport. Eighteen SWMUs were determined to require a RCRA Facility Investigation (RFI) because hazardous substance releases to the environment were confirmed and required further characterization to determine the nature and extent of contamination. Fifteen SWMUs were determined not to require further action because no release of hazardous substances to the environment had occurred. Twenty-three SWMUs were determined to require further investigation because hazardous substance releases to the environment were suspected but not confirmed. RFA sampling visits (SVs) were conducted at 7 of these 23 sites to confirm the presence or absence of a release(s) to the environment (Table 1-1). SWMU 51 consists of petroleum underground storage tanks and appurtenances and is being managed under a different program of RCRA (i.e., 40 Code of Federal Regulations [CFR], Part 280, Subtitle C, Regulation of Underground Storage Tanks). The other 15 SWMUs will be investigated during subsequent RFA SVs.

The USEPA recommended that a phased approach be used to implement RFI, RFA SV, and other corrective action activities. This approach was recommended to account for the number of SWMUs at

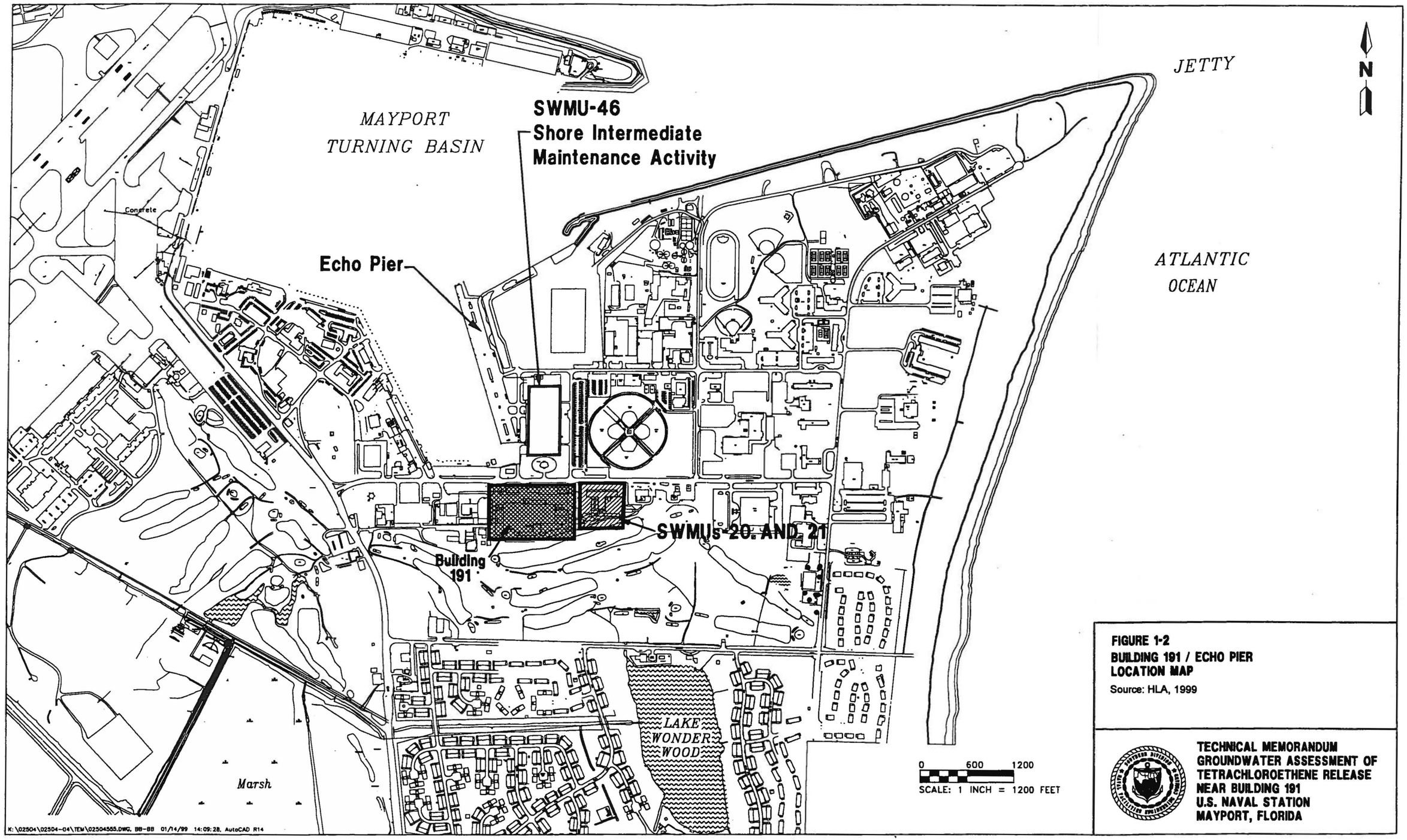

FIGURE 1-2
BUILDING 191 / ECHO PIER
LOCATION MAP
Source: HLA, 1999

TECHNICAL MEMORANDUM
GROUNDWATER ASSESSMENT OF
TETRACHLOROETHENE RELEASE
NEAR BUILDING 191
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NAVSTA Mayport, the diversity of their past and/or present operations, and the magnitude of permit requirements. A Corrective Action Management Plan (CAMP) is revisited every year to incorporate the latest descriptions of the phased approach, proposed schedule, and strategy to implement the RCRA Corrective Action Program at NAVSTA Mayport. The original CAMP is located in Appendix F of Volume I of the USEPA-approved RFI work plan (ABB Environmental Services, Inc. [ABB-ES], 1991). The CAMP identifies the operational groups of SWMUs, ranks them by their perceived relative risks to human health and the environment, and contains the proposed schedule for the field investigations and report submittals. The latest CAMP including AOC C was released in August 1999.

Previous investigations under the RCRA Corrective Action Program at NAVSTA Mayport include RFI and RFA SV activities at Groups I and II SWMUs (Figure 1-2). Current activities under the RCRA Corrective Action Program address the SWMUs located in the Group III SWMU area and include field investigative activities for both the RFI site characterizations and RFA SVs. AOC C will be addressed in a subsequent investigation as described in this work plan in accordance with the CAMP (ABB-ES, 1995a).

The RCRA Facility Investigation General Information Report (GIR) for NAVSTA Mayport (ABB-ES, 1995b) provides information relevant to AOC C, including background sampling information and analytical methodology, risk assessment approach, and the ecological characterization of NAVSTA Mayport. The NAVSTA Mayport GIR includes a summary of published information including: geography, physiography, demographics, climate, regional geology, and hydrogeology; methods and procedures used to conduct the field activities; methodology used to validate analytical data and conduct risk assessments; and characterization of station-wide background conditions, including surface soil, subsurface soil, and groundwater. This information will be used for comparison purposes during the confirmation assessment (CA) and RFI data evaluation. The information contained in the GIR (ABB-ES, 1995b) is common to all of the NAVSTA Mayport SWMUs, and it will not be repeated in this investigation work plan.

1.5 SAMPLING AND ANALYSIS PLAN ORGANIZATION

The organization for the SAP portion of the work plan is as follows:

- Chapter 1.0 presents the purpose, site description, and regulatory setting for the CA and RFI at AOC C, NAVSTA Mayport.
- Chapter 2.0 summarizes previous investigations.
- Chapter 3.0 presents the investigative methodology for conducting the assessment.
- Chapter 4.0 presents the site-specific data quality assessment.
- Chapter 5.0 describes the human health risk process.
- Chapter 6.0 addresses the waste resulting from investigation activities.

- Chapter 7.0 presents the field sampling plan schedule of operations for the field investigation work plan.

2.0 PREVIOUS INVESTIGATIONS

This chapter summarizes previous investigations applicable to AOC C at NAVSTA Mayport. Previous investigations included UST investigations south of Building 191 and west of the SIMA Building, and investigation of the soil and groundwater quality north of Building 191 and along the southern portion of Echo Pier for a tetrachloroethene release.

2.1 UST INVESTIGATIONS

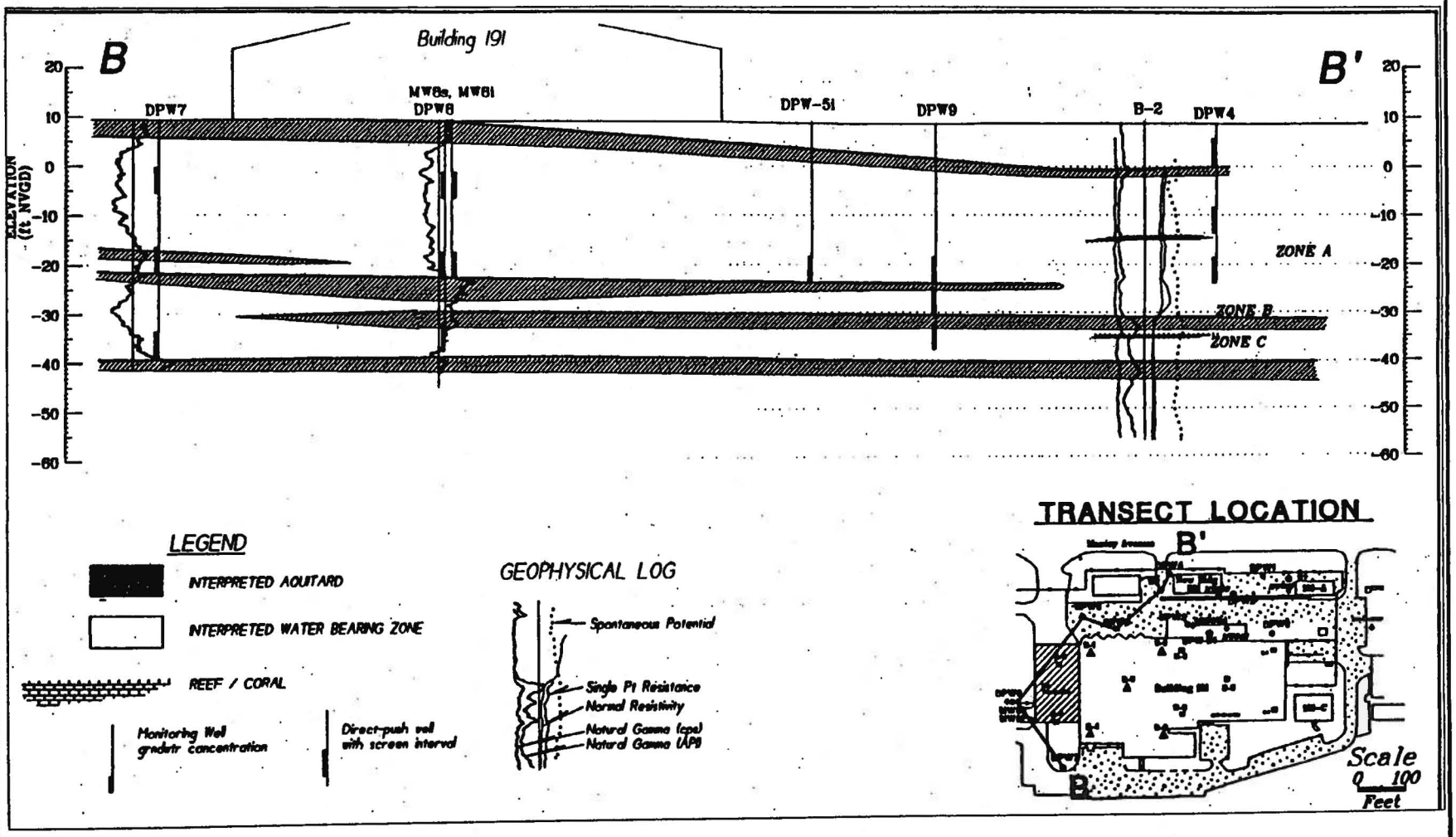
Two UST investigations have been performed within AOC C that resulted in the installation of four groundwater monitoring wells in the vicinity of Building 191, and six monitoring wells west of the SIMA Building. Activities and information regarding the wells installed west of the SIMA Building were not available during the preparation of this work plan. Limited information regarding the UST investigation and monitoring wells installed in the vicinity of Building 191 are taken from the technical memorandum (HLA, 1999) and are presented in Section 3.2.2 of this work plan.

2.2 RESOURCE CONSERVATION AND RECOVERY ACT INVESTIGATION ACTIVITIES

The Navy Comprehensive Long-Term Environmental Action Navy (CLEAN) I contractor (Harding Lawson Associates [HLA]) was contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) to conduct an RFI for SWMUs at NAVSTA Mayport. The RFI activities were conducted in accordance with the Hazardous and Solid Waste Amendment permit No. FL9 170 024 260, issued by the USEPA on March 25, 1988, and revised and reissued on June 15, 1993. A Technical Memorandum (HLA 1999) was issued as a result of this investigation.

The RFI consisted of installing additional conventional monitoring and direct-push wells, and the collection of groundwater samples under the Navy Environmental Leadership Program (NELP) to delineate the horizontal and vertical extent of volatile organic compounds detected at the site.

Lithologic sampling and borehole geophysical surveys performed at the site identified that the surficial aquifer beneath Building 191 has three aquifer zones underlain by other permeable zones and discontinuous clay layers (Figure 2-1). Direct-push and conventional monitoring wells have been installed in the three upper zones but not in the other underlying permeable zones.



SOURCES:
Direct-Push Well (DPW) Innovative Technology Evaluation Report, Additional Assessment Using Innovative Technology/Methodology at the SWMU 15 and Building 191 Area, NAVSTA, Mayport, Florida. (ICON, 1998a)

Draft Contamination Assessment Report, Additional Assessment Using Innovative Technology/Methodology at the SWMU 15 and Building 191 Area, NAVSTA, Mayport, Florida. (ICON, 1998b)

FIGURE 2-1
NORTH-SOUTH CROSS-SECTION DIAGRAM DEPICTING SUBSURFACE GEOLOGY
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TECHNICAL MEMORANDUM
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The shallow or water table zone (Zone A), consists of the interval from the water table, which occurred from approximately 3 to 5 feet below land surface (bls), to a depth of approximately 33 feet bls where a 3-foot-thick gray silty clay layer was usually encountered. This clay layer was not apparent in the northern part of the site near Massey Avenue. The shallow aquifer consists of well graded (poorly sorted) quartz sand with some shell fragments. At a depth of approximately 24 feet bls, a 3-inch-thick limestone seam was sporadically encountered.

The intermediate aquifer zone (Zone B) consists of a permeable zone of gray silty sand between 36 to 39 feet bls. A greenish-gray sandy clay layer approximately 4-feet thick is encountered at approximately 39 feet bls forming the lower boundary of Zone B. This aquitard was discontinuous or missing in the southern portion of AOC C.

The deep permeable zone (Zone C) consists of a permeable dark gray silty sand with some shell fragments from approximately 43 to 47 feet bls. At 47 feet bls, a 2-foot thick dark gray silty clay was encountered as the lower boundary of Zone C. This aquitard appears to be continuous across the AOC C area.

Potentiometric surface maps of the three aquifer zones of the surficial aquifer were constructed for water level measurements collected on September 3, 1997 (Figure 2-2). Groundwater flow in each layer is generally toward the south or southeast. Seepage velocities calculated from data collected at direct-push monitoring wells installed at three depths within Zone A, resulted in the following:

- 3.9 ft per day (ft/day) for the upper portion of Zone A
- 19.2 to 51.6 ft/day for the middle portion of Zone A
- 12.5 to 153.1 ft/day for the bottom portion of Zone A

Seepage velocities calculated using data from a direct-push monitoring well located in Zone B and C resulted in 2.2 ft/day and 23.2 ft/day respectively. Seepage velocities calculated using data from a conventional monitoring well installed within Zone A resulted in 66.8 ft/day. Seepage velocities for two conventional monitoring wells installed in Zone C resulted in 77.1 and 109.6 ft/day. Differences in the seepage velocities for different wells and different types of wells may be due to differences in the construction and installation method, filter pack materials, aquifer hydraulic properties, or aquifer test methods.

Eleven volatile organic target analytes (1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethene (total), cis-1,2-dichloroethene, bromodichloromethane, dibromochloromethane, chloroform, methylene chloride,

tetrachloroethene, trichloroethene, and vinyl chloride) were detected in the groundwater samples collected in 1995, 1997, and 1998 in the vicinity of Building 191 and Echo Pier.

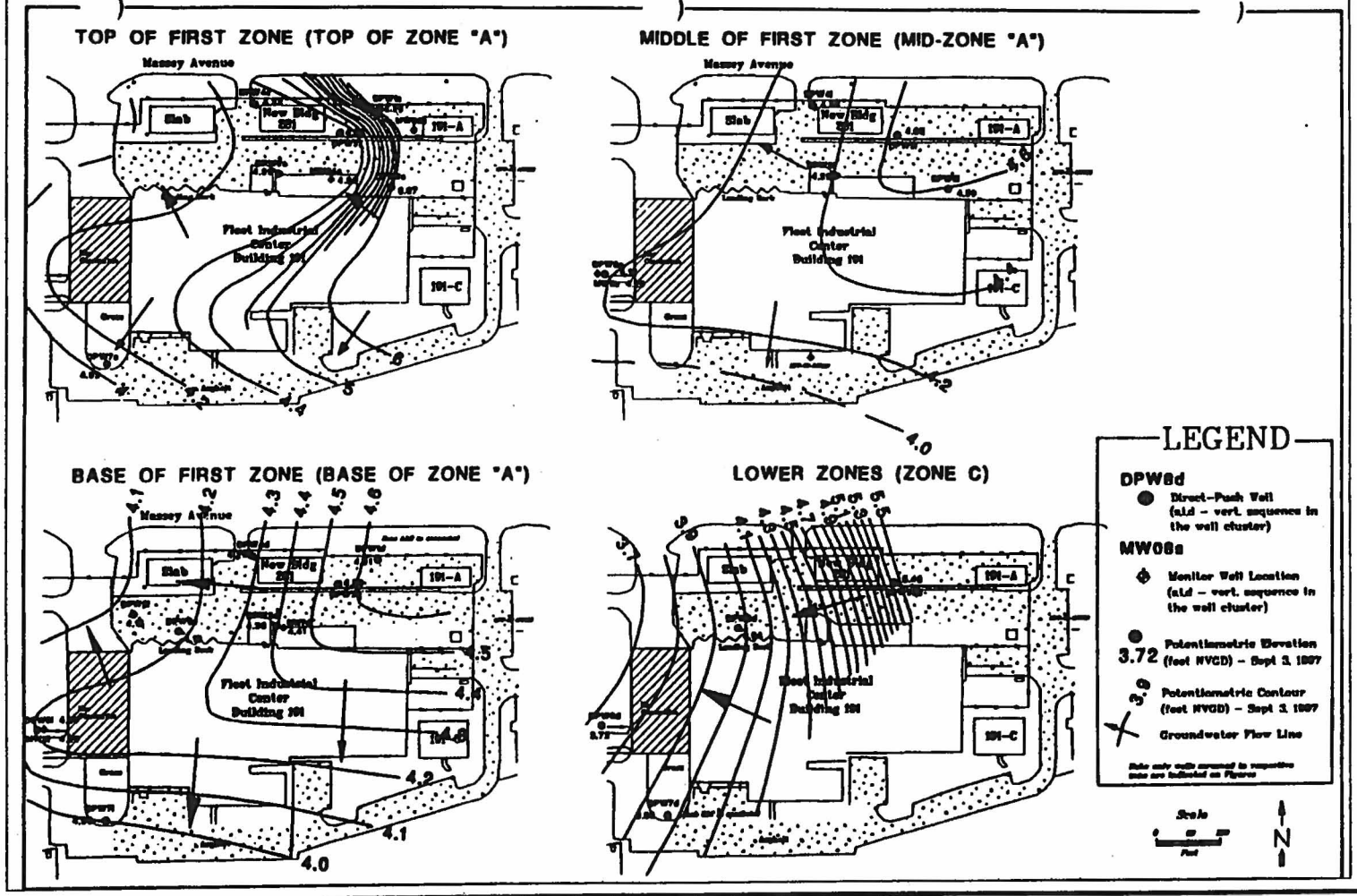
Groundwater collected from monitoring wells installed in the water table zone contained concentrations of chloroform, dibromochloromethane, tetrachloroethene, trichloroethene, vinyl chloride, arsenic, iron and manganese that exceed Florida groundwater guidance concentrations.

Methylene chloride, 1,1-dichloroethane, cis-1,2-dichloroethene, trichloroethene, and vinyl chloride were detected in groundwater samples collected from the intermediate zone at concentrations that are at or slightly below Florida groundwater guidance concentrations.

Methylene chloride, tetrachloroethene, and trichloroethene were detected at concentrations exceeding Florida groundwater guidance concentrations in groundwater samples collected from monitoring wells installed in the deep aquifer zone.

Conclusions given in the Technical Memorandum (HLA 1999) indicate that natural attenuation data collected in the water table (Echo Pier) and intermediate aquifer zones provide evidence in support of anaerobic biodegradation of chlorinated organics. The evaluation of the deep aquifer zone suggests that limited anaerobic biodegradation will occur. However, degradation products of tetrachloroethene and trichloroethene have been detected in groundwater samples from the deep zone.

These conclusions also state that under current land use there is no exposure to the VOCs detected in the groundwater samples. Lifetime cancer risk associated with ingestion of groundwater as drinking water containing these chemicals is exceeded by a reasonable maximum exposure (RME) of $5x10^{-4}$ for the aggregate resident (hypothetical future adult and child resident). The RME exceeds the USEPA acceptable risk range of $1x10^{-6}$ to $1x10^{-4}$ and the Florida Department of Environmental Protection (FDEP) target of $1x10^{-6}$. The hazard indices (His) calculated for groundwater ingestion exceeds the USEPA and FDEP target HI of 1 (HLA, 1999).



SOURCES:
Direct-Push Well (DPW) Innovative Technology Evaluation Report, Additional Assessment Using Innovative Technology/Methodology at the SWMU 15 and Building 191 Area, NAVSTA, Mayport, Florida. (ICON, 1998a)

Draft Contamination Assessment Report, Additional Assessment Using Innovative Technology/Methodology at the SWMU 15 and Building 191 Area, NAVSTA, Mayport, Florida. (ICON, 1998b)

FIGURE 2-2
POTENTIOMETRIC CONTOURS, SEPTEMBER 3, 1997
Source: HLA, 1999

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TECHNICAL MEMORANDUM
GROUNDWATER ASSESSMENT OF TETRACHLOROETHENE RELEASE NEAR BUILDING 191
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MAYPORT, FLORIDA

3.0 TECHNICAL APPROACH

The planned investigation work at AOC C focuses on two activities. The planned Confirmation Assessment (CA) will consist of the identification of existing data gaps, site reconnaissance for potential additional source areas, surveying elevations of existing monitoring wells, measuring groundwater elevations, and selecting monitoring well sampling locations. The focus of the CA is to confirm the presence of groundwater contamination and determine the direction of groundwater flow. The CA will provide the necessary data to support the RFI in an efficient manner. The second activity will be an RFI. The RFI will evaluate the full extent of groundwater contamination and conduct a human health and ecological risk assessment of AOC C.

Analysis of the previous investigation data suggests that additional data are needed to define the concentrations of constituents in soil and groundwater to regulatory-defined or risk-based concentrations and to improve the certainty of data interpretation. Adjustments to this work plan may be necessary, as new data become available. If new field investigation methods or changes to existing methods become necessary as a result of adjustments to the SOW, then the proposed revisions will be presented by TtNUS to the Southern Division's Remedial Project Manager, FDEP and USEPA Region 4 regulatory representatives, and NAVSTA Mayport's Environmental Coordinator for review and approval.

3.1 FIELD INVESTIGATION METHODS

3.1.1 Standard Operating Procedures

A variety of field investigation activities will be conducted at NAVSTA Mayport to meet the objectives of the CA and RFI. Data collection during the field investigation will follow the Standard Operating Procedures (SOPs) issued in the QA Section of the FDEP *Comprehensive Quality Assurance Plan (COMPQAP)* #980038 (Tetra Tech NUS, 1998) and by USEPA in *Environmental Investigations Standard Operating Procedures Quality Assurance Manual* (1996b). These will be followed to ensure the data is consistent with regulatory requirements and meet the data quality objectives (DQOs).

In some instances the planned investigation activities (e.g., well construction) may not be specifically addressed in the Comprehensive Quality Assurance Plan (COMPQAP); in other cases a methodology presented in the COMPQAP, or a specific step thereof, may be deemed inconsistent with site-specific conditions or previous investigation methods used at NAVSTA Mayport. In these cases the USEPA

Region 4 Environmental Investigations SOPs (USEPA, 1996b), Navy technical guidance, or project-specific SOPs adopted by or prepared by TtNUS will be followed.

A copy of all above-referenced guidance documents along with this work plan will be maintained in the TtNUS field office at NAVSTA Mayport and will be reviewed with the field team before work begins. Project-specific SOPs that are adopted by or prepared by TtNUS for the CA or RFI at NAVSTA Mayport are presented in this work plan and are discussed in the following sections.

3.1.2 General Site Operations

3.1.2.1 Field Team Organization

The TtNUS CA and RFI field teams will consist of staff members who will be assigned temporary duty at NAVSTA Mayport and who will 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 NAVSTA Mayport 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 Project Safety Officer 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 Project Safety Officer may be assigned to the FOL or another member of the field team. The Project Safety Officer or designee will report directly to the TtNUS Corporate Director of Health and Safety.

- The Field Geologist will oversee soil boring and monitoring well installation activities and may conduct various environmental sampling activities. Duties will include logging and documentation of drilling and well construction, environmental sample collection and handling, and ensuring that the approved methods are implemented. The field geologist may also conduct tests for identifying subsurface conditions and characterizing the groundwater flow regime.

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

3.1.2.2 Mobilization

TtNUS must perform several internal tasks before field mobilizations. 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; and
- Arrangement of transportation and lodging for field personnel.

In addition to internal efforts, external mobilization efforts will be coordinated with the NAVSTA Mayport 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);
- Set up the investigation field office and coordinate utilities hookup;
- Select staging areas for equipment and IDW;
- Select decontamination area(s) with electrical hookup, potable water, and drainage to an oil/water separator;
- Complete security procedures for project and subcontractor personnel to gain access to the Base;
- Ensure supplies of potable water are accessible; and
- Coordinate with Base personnel to locate buried utilities.

A location will be assigned by the Base POC to be used as a personnel/communication field office. Multiple decontamination facilities may be selected or constructed by the drilling subcontractor before the beginning of field activities at locations deemed appropriate by the Base POC and TtNUS. Site reconnaissance will be performed before initiation of field activities. Some of these activities will be performed with the assistance of NAVSTA Mayport personnel. These activities are listed below:

- Locating and setting up of 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 suites, 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; and
- Erecting any necessary barricades and/or temporary fencing.

3.1.3 Field Investigation Activities

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

- Location survey;
- Measurement of groundwater potentiometric levels;
- Collection of groundwater samples;
- Field measurement of physical and chemical properties of soil and groundwater samples;
- Collection of surface soil samples;
- Installation of soil borings and collection of subsurface soil samples using direct-push techniques;
- Installation of groundwater monitoring wells in the shallow, intermediate, and deep zones of the aquifer;
- Decontamination of investigation equipment;
- Sample management;
- Field QC, documentation, and record keeping;
- IDW management.

Project-specific SOPs will be given priority, followed by the FDEP COMPQAP and then USEPA Region 4 SOPs when SOPs for the same task differ. Copies of all guidance documents will be located in the TtNUS field office at NAVSTA Mayport. Table 3-1 presents a cross-reference guide to the applicable SOPs for the general field activities listed above. Table 3-1 focuses on the SOPs deemed most likely to be used by the field investigation team. If activities arise that are not referenced in Table 3-1, then the project-specific SOPs, COMPQAP, the USEPA Region 4 SOPs, or Navy guidance will be followed (in that order) with approval by USEPA, FDEP, and Navy personnel. Project-specific SOPs referenced in Table 3-1 are discussed in the following sections.

3.1.3.1 Direct-Push Sampling

A direct-push technology (DPT) soil sampling device (e.g., Geoprobe® system) may be used to obtain subsurface soil samples at NAVSTA Mayport. DPT allows investigators to push a sampler to depth and obtain a continuous core that is relatively undisturbed. For this project a DPT sampler may be used for collecting shallow (0-2 foot below land surface [bls]) soil samples for use in the risk assessment.

The soil samples may be collected from any discrete depth interval, but will typically be collected from above the zone of perched groundwater saturation. The DPT sampler typically has an inner diameter 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 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 removed for examination.

After removal from the sampler barrel, the sample is extracted and placed on a fresh, clean surface. If a liner is used, it will be opened and screened with a flame ionization detector (FID) or photoionization detector (PID). Samples selected for laboratory analyses will be immediately placed into laboratory-supplied containers. 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 each use using standard decontamination procedures (see Table 3-1).

3.1.3.2 Well Casing and Screen Materials

All permanent and temporary monitoring wells will be constructed of Schedule 40 polyvinyl chloride (PVC) casing and screen manufactured for environmental applications (i.e., no inked markings, shipped clean in individual, sealed wrappings) and meeting the requirements of the American Society for Testing and

TABLE 3-1

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STANDARD OPERATING PROCEDURES CROSS REFERENCE[a]
CA AND RFI WORK PLAN FOR
AREA OF CONCERN C
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ACTIVITY	FDEP[b]		EPA-4[c]		Tetra Tech NUS, Inc.[d]	
SOIL SAMPLING						
General	A	4.0 / 4.3.1-4.3.2	A	12.3		
Manual Sampling	A	4.3.4	A	12.3.1		
Power-Driven Sampling	A	4.3.4.5	A	12.3.2		3.1.3.1
VOC Samples	A	4.3.2	A	5.13.9 / 12.4.1		
Sample Mixing	A	4.3.2	A	5.13.8		
DRILLING						
Safety			A	6.7		
Direct-Push					A*	3.1.3.1
Augering			A	6.3.1		
Rotary			A	6.3.3		
Abandonment			A	6.9		
WELL CONSTRUCTION						
Overdrilling			A	6.4.2		
Annular Space			A	6..4.1		3.1.3.3
Casing and Screen			M	6.6.2	A*	3.1.3.3
Installing the Well			M	6.5.1 / 6.5.2		3.1.3.3
Filter Pack			A	6.4.3 / 6.6.3		3.1.3.3
Filter Pack and Screen Design			M	6.6.4	A*	3.1.3.4
Well Seal and Grouting			A	6.4.4 / 6.4.5		3.1.3.3
Surface Completion			A	6.4.6 / 6.4.7 / 6.4.8		3.1.3.3.3
Development			A	6.8		3.1.3.3.5
Temporary Wells			A	6.1		
GROUNDWATER SAMPLING						
General	A	4.0 / 4.2.1 / 4.2.5.2				
Purging		4.2.5.3-4.2.5.5	A	7.2.1 / 7.2.2 / 7.2.4		
Sample Methods		4.2.5.6	A	7.3.1 / 7.3.3		
Sample Containers / Preservation	A	4.2.2	A	7.3.4		
Trace Organic and Metals	A	4.2.5.6 (g)	M	5.13.9 / 7.3.5	A*	3.1.3.5
Temporary Wells	A	4.2.9				
Auxillary Data			A	7.3.7		
FIELD MEASUREMENTS						
Groundwater Levels	A	4.2.5.4	M	15.8	A*	3.1.3.6
pH, Temperature, Conductivity	A	7.5.2 / 7.5.3 / 7.5.5	A	16.2-16.4		
Dissolved Oxygen	A	7.5.4	A	16.7		3.1.3.8
Turbidity			A	16.5		
Redox Potential					A*	3.1.3.7
Ferrous Iron (Fe++)					A*	3.1.3.9
Air Monitoring / Head Space	A	7.5.7			A*	3.1.3.12
Residual Product Detection					A*	3.1.3.6

TABLE 3-1

STANDARD OPERATING PROCEDURES CROSS REFERENCE[a]
CA AND RFI WORK PLAN FOR
AREA OF CONCERN C
NAVSTA MAYPORT
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PAGE 2 OF 2

ACTIVITY	FDEP[b]		EPA-4[c]		Tetra Tech NUS, Inc.[d]	
DECONTAMINATION						
General	A	4.1.1 / 4.1.3				3.1.3.3
Reagents	A	4.1.2				3.1.3.3
Sampling Equipment	A	4.1.4			A*	3.1.3.3
Filters	A	4.1.6				
Tubing	A	4.1.7.1-4.1.7.5				
Pumps	A	4.1.8				
Field Equipment	A	4.1.9.1 / 4.1.9.2			A*	3.1.3.3
Analyte-Free Water Containers	A	4.1.10				
Ice Chests / Shipping Containers	A	4.1.11				
SAMPLE HANDLING						
General			A	5.13.3 / 5.13.7		
Sample Containers	A	4.4.1				
Preservation and Holding Times	A	4.4.2	A	5.13.6		
Documentation	A	5.0 / 5.3	A	3.3		
Sample Identification	A	5.3.2	A	3.2.1	A*	3.1.3.13
Packing and Transportation	A	4.4.3.2				
FIELD QUALITY ASSURANCE/QUALITY CONTROL						
Field Calibration	A	7.5				
Field Equipment Decontamination		7.5..1				
Quality Control Samples	A	9.1				
Control Limits	A	7.5			A*	3.1.3.14
Corrective Action	A	11			A*	3.1.3.15
INVESTIGATION-DERIVED WASTE						
Investigation Waste Disposal	A	4.4.5			A*	3.1.3.16
Nonhazardous Waste			A	5.15 / 5.15.1		
Hazardous Waste			A	5.15 / 5.15.2		
RECORDKEEPING						
Field Logbooks and Forms			A	3.5	A*	3.1.3.17
Manufacturer's Specifications					A*	3.1.3.18
Chain-of-Custody Forms	A	5.3				
Field Calibration Records	A	7.8				
SURVEYING						
GPS Surveys					A*	3.1.3.19
NGVD Surveys					A*	3.1.3.19

[a] Annotations found in this reference table indicate the following:

A – Standard Operating Procedure (SOP) that is fully adopted.

A* – Standard Operating Procedure (SOP) that is under review.

M – Modification of existing Florida Department of Environmental Protection (FDEP) or U.S. Environmental Protection Agency (EPA) SOP documented in project-specific SOP.

[b] Denotes FDEP SOPs adopted by Brown & Root Environmental, source:
FDEP Comprehensive Quality Assurance Plan #870055G, March 1996.
Number shown indicates the chapter and section in the FDEP SOPs.

[c] Denotes EPA Region 4 Environmental Investigations SOPs and Quality Assurance Manual, May 1996. Number shown indicates the section in the EPA SOPs.

[d] Denotes project-specific SOPs adopted by or prepared by Brown & Root Environmental for the conduct of work at Naval Air Station Whiting Field.
Number shown indicates the text section in which the SOP may be found.
GPS – Global Postioning System
NGVD – Natural Geodetic Vertical Datum
VOC – volatile organic compound

Materials (ASTM) F 480 and D 1785. This variance from the USEPA Region 4 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 wells previously installed at NAVSTA Mayport. If conditions are encountered where the use of PVC in well construction is inappropriate, then stainless steel or another suitable material will be selected and presented to USEPA, FDEP, and Navy personnel for approval before being used.

3.1.3.3 Filter Pack and Screen Design

The USEPA Region 4 SOPs (USEPA 1996b) 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 where previous investigations have analyzed the formation intervals of interest and for which the grain size data are available. When this information is not available, RFI well construction will follow the previous investigation practice of using a 20/30-size gradation filter material coupled with a 0.010-inch, factory-slotted well screen. This filter pack size and screen slot size combination has previously been used at NAVSTA Mayport, 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), then an alternate filter pack and screen slot size combination will be recommended in accordance with the USEPA Region 4 SOPs (USEPA 1996b).

3.1.3.4 Monitoring Well Installation

3.1.3.4.1 Shallow Well Installation

The shallow monitoring wells will be installed using both direct push technology (DPT) and conventional hollow stem auger (HSA) rotary drilling. The shallow wells will be completed to depths from 15 to 30 feet bls, as determined from the water and lithological data gathered during the CA, using 2-inch-diameter, Schedule 40 PVC, flush-threaded casing with 10 feet of 0.01-in. factory-slotted PVC screen. The well screens will be placed such that the screens bracket the water table. If HSA drilling is used, the wells will be constructed inside the auger. Once the screen and riser pipe are in place, the annulus of the boring

will be backfilled with clean, 20/30, silica sand from the bottom of the borehole to 2 feet above the top of the screen. If the well is constructed inside augers, the sand will be maintained at a depth of several inches inside the augers to ensure an adequate sand pack around the well. A bentonite seal at least 2 feet thick will be installed on top of the 20/30 silica sand. The remainder of the annulus of the borehole will be grouted by pumping a cement/bentonite slurry through a tremie pipe up to 2 feet bls.

3.1.3.4.2 Intermediate and Deep Well Installation

The intermediate and deep wells will installed using DPT and conventional HSA drilling. The intermediate wells will be targeted for the intermediate zone of the aquifer between 36 and 39 feet bls. The bottom of each intermediate borehole is expected to be approximately 40 feet bls. The wells will be constructed of 2-inch-diameter, Schedule 40 PVC, flush-threaded casing with 5-feet of 0.01-inch factory-slotted, PVC screen. Centralizers will be placed at approximately 25-foot intervals above the top of the screen and at the bottom of the screen to center the well in the borehole. The annulus between the well and the borehole wall will be backfilled using a tremie pipe with 20/30 clean silica sand to at least 2 feet above the top of the screen. A minimum 2-foot-thick bentonite seal will be installed above the sand pack. The remainder of the annulus will be backfilled with cement/bentonite grout.

The deep wells are anticipated to be completed between 43 and 47 feet bls. The wells will be constructed of Schedule 40 PVC, flush-threaded casing with 5 feet of 0.01-in factory-slotted PVC screen. Centralizers will be placed at approximately 25-foot intervals above the top of the screen and at the bottom of the screen to ensure that the well is centered in the borehole. The annulus between the well and the borehole wall will be backfilled using a tremie pipe with 20/30 clean silica sand to at least 2 feet above the top of the screen. A minimum 2-foot-thick bentonite seal will be installed above the sand pack. The remaining annulus will be backfilled with cement/bentonite grout.

Lithological data (soil boring logs and monitoring well logs) collected during the investigations conducted by ABB/HLA and the NELP investigation will be evaluated for pertinent geologic information. The need for 6-inch PVC surface casings will be evaluated from this data and data gathered during this RFI. Based on existing groundwater analytical data, surface casings will be installed in the intermediate and deep wells to prevent downward migration of contaminants. The surface casings will be set in confining layers below the shallow wells. The casings will be pressure-grouted in place and allowed to cure for at least 24 hours before the borehole is advanced below the casing.

3.1.3.4.3 Well Surface Completion

Each monitoring well surface completion will be flush mount. The riser pipe will be cut to approximately 3 inches below land surface 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 provided with sealing gasket to reduce the amount of water infiltration. Each well will be fitted with a J-Plug and stainless steel lock. 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 mount monitoring well. The flush mounted casings shall be completed 1-inch above existing grade and the apron tapered to be flush with existing grade at the edges such that water will run off of the apron. The protective casing shall be completed with a metal identification tag.
The tag specifications include:

- 4" x 4" x 0.032" stainless steel or aluminum;
- 3/16" lettering;
- 1/8" diameter mounting holes; and
- Black printed or stamped lettering.

3.1.3.4.4 General Drilling Requirements

The only drilling fluid used will be potable water unless mud rotary drilling becomes necessary. A bentonite based drilling mud will be used if mud rotary drilling is necessary for well installation. 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 the drilling activities will be disposed of in accordance with the methods previously used by the CLEAN I contractor at NAVSTA Mayport.

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-2).
- Each well will be constructed by a driller and drilling company certified by the State of Florida.
- Well locations will be approved by the Base POC before installation.
- Glue will not be used to join screen or casing.
- At each well nest location, the deep well will be installed first to prevent invasion of drilling fluids into the shallower wells.

- At each well nest location, lithologic soil samples will be taken continuously by using 5-foot continuous samplers or at 5-foot intervals using 2-foot split spoons at the deep well location only. Installation of the intermediate and deep surface casing wells will then be based on the lithologic description of the deep boring.
- A notch will be cut into the top of the casing to be used as a reference point for the elevation survey and for measuring water levels.

3.1.3.4.5 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 development equipment will be decontaminated before being placed in the well. Throughout the development procedure, discharge water color and volume shall be documented. 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 2 consecutive readings;
- At minimum of 3 well volumes is removed from the monitoring well;
- 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 a well. Following development and after the water levels have been allowed to stabilize 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 C) or in the field logbook. All development water will be drummed and disposed of according to the investigation-derived waste (IDW) Waste Management Plan (Appendix F).

3.1.3.5 Decontamination Procedures

The decontamination of major equipment (e.g., drilling rigs, dump trucks, backhoes) 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 the NAVSTA Mayport equipment decontamination area that was established by the CLEAN I contractor. 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 the sampling location.

Disposable material (e.g., gloves, Tyvek suits) generated during decontamination will be bagged and stored in drums for proper disposal at an off-base location.

3.1.3.5.1 Soil Sampling Equipment

All stainless steel spoons, bowls, and other soil-sampling equipment will be decontaminated after each use. The decontamination procedure outlined below will be used.

- Wash and scrub the equipment with a solution of Liquinox (or equivalent) and potable water;
- Rinse with potable water;
- Rinse non-steel equipment with 10 to 15 percent reagent-grade nitric acid ($HN0_3$) when sampling for trace metals;
- Rinse with analyte-free water;
- Rinse twice with isopropanol;
- Rinse with analyte-free water;
- Air dry (if possible); and
- Wrap in oil-free aluminum foil (if appropriate).

3.1.3.5.2 Water Sampling Equipment

Submersible and peristaltic pumps will be used to purge and collect water samples. Dedicated Teflon™ discharge lines will be used for each location for each sampling location. The interior and exterior of submersible pumps will be cleaned between each sampling location. The exterior casing of peristaltic

pumps will be cleaned between each sampling location. Pump decontamination procedures are as follows:

- Wash with Liquinox and potable water;
- Run Liquinox and potable water through the pump;
- Rinse with potable water; and
- Rinse with analyte-free water.

Groundwater samples will be collected using low flow quiescent sampling methods or bailers. Bailers will be decontaminated after each use. Stainless steel or Teflon™-coated lines will be dedicated to each well for each sampling event or will be decontaminated between uses. Equipment will be decontaminated in the manner outlined below.

- Wash and scrub equipment with a solution of Liquinox (or equivalent) and potable water.
- Rinse with potable water.
- Rinse non-steel equipment with 10 to 15 percent reagent-grade $HN0_3$ when sampling for trace metals.
- Rinse with analyte-free water.
- Rinse twice with isopropanol.
- Rinse with analyte-free water.
- Air dry (if possible).
- Wrap in oil-free aluminum foil.

Any additional equipment used in sampling will be decontaminated by following the procedure outlined above.

3.1.3.5.3 Major Equipment

Between each well or boring, all major equipment used for sample collection such as drill rigs and backhoes will be decontaminated at the existing NAVSTA Mayport equipment decontamination area formerly used by the CLEAN I contractor. Decontamination will consist of steam-cleaning, washing with Liquinox (or equivalent), and rinsing with potable water. If necessary, surfaces will be scrubbed until all visible soil and possible contaminants have been removed. All dirt, grime, grease, oil, loose paint, and rust flakes shall be removed. The inside surfaces of the casing, drill rods, and auger flights will be

similarly cleaned. The decontamination area will be constructed and operated to contain all solids and liquids produced. Liquids will be directed to an oil/water separator before release to the Base's sanitary sewer system. Solids will be retained and tested to determine appropriate disposal.

3.1.3.6 Trace Metals Sampling in Groundwater

Groundwater samples to be analyzed for trace levels of inorganics will be collected in a manner consistent with the procedure developed during previous investigations at NAVSTA Mayport. The procedure are summarized as follows: purging and sample collection will be performed using low-flow/low-stress techniques, and if turbidity exceeds 10 NTUs, then a second filtered sample will be collected for analysis. This procedure may be at variance with USEPA Region 4 SOP guidance, which states that filtered groundwater sampling and analyses should be used only in support of geochemical speciation studies unless certain criteria are met. The data collected at NAVSTA Mayport will be used to support RA evaluations.

3.1.3.7 Groundwater Level Measurements

Measurement of the depth to water in monitoring wells will be performed according to the COMPQAP and USEPA Region 4 SOPs, with the exception that measuring devices will not be calibrated against an Invar steel surveyor's chain. The devices will be calibrated against each other to ensure that accurate relative measurements are made during the data collection event. The results of the calibration will be recorded in the field logbook.

A minimum of one complete round of water level measurements will be obtained from existing Site 191 and Echo Pier monitoring wells existing within AOC C and the monitoring wells installed during the RFI. All measurements will be collected within a 8-hour workday. This workday will also fall within a 48-hour period of consistent weather conditions to minimize atmospheric/precipitation effects on groundwater conditions. Previous tidal information collected by ABB/HLA will be used to minimize the potential impact of tidal influences. Measurements will be collected at least 24 hours after well development using an electrical 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 the monitoring wells, the thickness of the free product will be measured with an electronic interface probe and an adjusted water level will be calculated for the monitoring well.

3.1.3.8 Oxidation-Reduction Potential of Groundwater

The oxidation-reduction (redox) potential of groundwater is the measurement of the relative tendency of the groundwater solution to accept or donate electrons. The redox potential depends upon the influences the rates and types of biodegradation processes. Therefore, the measurement of redox potential (in millivolts [mV]) can provide evidence of the type of biodegradation processes that are active in a particular plume or even within different portions of the same plume. Great care must we taken during the evaluation of redox potential since most natural waters contain mixed potentials which cannot be related to a single electron couple. Therefore, redox potential should only be used as a qualitative indicator of the overall reduction/ oxidation state.

Redox potential will be determined in the field using a portable field meter at selected monitoring wells. Because of the sensitivity of redox potential to oxygenation and disturbance of the groundwater sample, care will be used to obtain the sample, and the analysis will be performed at the well head immediately after sample collection.

Calibration and maintenance of the Redox meter will be performed in accordance with the manufacturer's instructions. These actions will be documented in the field logbook and/or on an equipment calibration log as presented in Appendix C.

3.1.3.9 Dissolved Oxygen in Groundwater

The dissolved oxygen (DO) concentration in groundwater acts a primary substrate or cosubstrate during the initial stages of metabolism. During respiration, oxygen is utilized as an electron acceptor to mineralize hydrocarbons, such as benzene, toluene, ethylbenzene and xylenes (BTEX), into carbon dioxide and water. Every 3.5 mg/L of oxygen has the potential to biodegrade 1 mg/L of BTEX.

DO will be measured using a high resolution, low-range digital titrator (HACH model OX-DT). This can be used to measure high levels of DO (high range from 1 to 10 mg/l). DO analyses will be performed in accordance with the manufacturers' instructions.

Care will be exercised to avoid entrainment of atmospheric oxygen or loss of DO in groundwater samples. Shallow water table elevations (<12 feet) allow the use of an AccuVac® sampler to collect the water samples directly from the well. Water samples collected from water tables at depths greater than 12 feet bls will be collected using a Kemmerer-type sampler or low-flow peristaltic or bladder pump.

3.1.3.10 Ferrous Iron in Groundwater

Under anaerobic conditions, dissolved ferrous iron (Fe^{++}) can be used as an electron acceptor. Ferric iron is reduced under anaerobic conditions to dissolve ferrous iron and carbon dioxide. Every 21.8 mg/L of dissolved ferrous iron has the potential to biodegrade 1 mg/L of BTEX.
Ferrous iron will be determined in the field at selected monitoring wells using a field test kit (HACH Model IR-18C). Because of the sensitivity of the iron valence state to oxygenation and disturbance of the groundwater sample, care will be used to obtain the sample. The analysis will be performed at the well head immediately after sample collection to reduce the disturbance of the groundwater sample.

Use of the field test kit will be performed in accordance with the manufacturer's instructions. These actions will be documented in the field logbook and/or on the appropriate field forms as required by the SOPs (see Table 3-1).

3.1.3.11 Carbon Dioxide in Groundwater

Carbon dioxide (CO_2) is both produced and utilized during the biodegradation of hydrocarbons. Carbon dioxide is produced during anaerobic respiration as well as during anaerobic processes of denitrification, iron reduction, and sulfate reduction. However, carbon dioxide is utilized as an electron receptor during the anaerobic process of methanogenesis.

CO_2 will be determined in the field at selected monitoring wells using a digital titrator (HACH model CA-DT). To obtain an accurate field analysis of the dissolved carbon dioxide in the groundwater, care will be use in obtaining the sample and performing the analysis directly at the well head.

Use of the field test kit will be performed in accordance with the manufacturer's instructions. These actions will be documented in the field logbook and/or on appropriate field forms as required by the SOPs.

3.1.3.12 Other Field Natural Attenuation Analytes

Hydrogen sulfide, manganese, methane, nitrate, nitrite, sulfide, sulfate, and alkalinity will be collected in support of an evaluation of the potential for natural attenuation of organic contaminants in groundwater. These analytes will be determined in the field as selected monitoring wells using field test kits and meters. To obtain accurate field analysis of these selected analytes, care will be use in obtaining the sample and performing the analysis.

Use of the field test kit will be performed in accordance with the manufacturers instructions. These actions will be documented in the field logbook and/or on appropriate field forms as required by the SOPs.

3.1.3.13 Sample Head Space Analysis

Soil vapor head space analyses will be performed according to the method prescribed in FDEP Rule 62-770.200(8) of the Florida Administrative Code (FAC). Soil samples will be analyzed for their total hydrocarbon content using an organic vapor analyzer (OVA) equipped with a FID. Charcoal filters will be used to differentiate between methane (a naturally occurring gas) and petroleum hydrocarbon vapors. A photoionization detector (PID) may be used only after a determination of the instrument's equivalent response to a FID has been made. The following steps will be used to prepare soil samples for head space analysis:

- Each soil sample to be analyzed will be equally split and placed into 2 clean, 16-ounce glass jars;
- Each sample jar will filled to approximately one-half of 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;
- The sample jars will be allowed to equilibrate under a temperature range of 20–30°C for approximately 5 minutes;
- The head space will be measured by piercing the aluminum foil with the FID probe and recording the highest sustained reading;
- The FID will be calibrated daily and calibration will be confirmed every 20 samples; and
- If FID readings above background 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.

3.1.3.14 Laboratory Sample Identification

The sample identification system to be used in the field to identify each sample taken during the CA or RFI field efforts will be in accordance with TtNUS SOP CT-O4, contained in Appendix D. The coding system provides a tracking record to allow the 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., MPT-AC), 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.

3.1.3.15 Field Instrument Control Limits

QA/QC specifications for field measurements are summarized in Table 3-2. This table shows the control parameters to be assessed, control limits, and corrective actions to be implemented.

The TtNUS representative on site at each well and boring will confirm measurements of total depth of holes, dimensions and placement of well screens and casings, and volume and placement of filter pack and grout materials by independent observation or measurement. The FOL will review field forms and field logbook entries for indications of measurement data outside of the control range.

3.1.3.16 Corrective Actions

Comprehensive QA activities will be conducted by TtNUS to ensure 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 for forwarding a report to the Task Order Manager and QA Manager for investigation and corrective action. The QA Manager has the responsibility for assuring the overall adequacy of corrective actions and summarizing this information in a status report to TtNUS management.

Before its use in the field, each instrument will be calibrated prior to field use to ensure it's capable of producing usable data indicative of site conditions. QC data, such as duplicate field measurements or QC check standards, will be collected for field instruments and used to evaluate the continued acceptable performance of each instrument. Table 3-2 lists the corrective actions to be implemented whenever field instruments fail to meet the established control limit criteria.

Field data will be reviewed by the site geologist while in the field. Extreme readings (i.e., readings that appear significantly different from other readings at the same site) will be accepted only after the instrument has been checked for malfunction and the readings have been verified by retesting (with an alternate instrument, if possible).

QC data obtained from field duplicates, field blanks, trip blanks, or equipment blanks will be collected and assessed by the QA Manager or the cognitive Task Order Manager to evaluate the overall quality of the

sample collected. Whenever the results of the field QC samples fail to meet the acceptance criteria, as identified in Table 3-2, 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 Task Order Manager 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; and
- 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.

3.1.3.17 Investigation-Derived Waste

All IDW generated during CA and RFI field activities will be stored on site until analysis of the media has been reviewed and appropriate decisions for the disposal of the waste can be made by the base environmental coordinator. Section 6.0, includes a discussion of the IDW management process followed by the CLEAN I contractor that will be continued during the field activities for the CA and RFI.

3.1.3.18 Field Logbooks and Forms

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

TABLE 3-2

**FIELD QA/QC SPECIFICATIONS
CA AND RFI WORK PLAN FOR
AREA OF CONCERN C
NAVSTA MAYPORT
MAYPORT, FLORIDA**

Analysis	Control Parameter	Control Limit	Corrective Action
Air monitoring using an organic vapor analyzer (FID)	Daily check of calibration of FID	Calibration to manufacturer's specifications	Recalibrate. If unable to calibrate, replace.
pH of water	Continuing calibration check of pH 7.0 buffer	pH = 7.0 ± 0.1	Recalibrate. If unable to calibrate, replace electrode.
Specific conductance of water	Continuing calibration check of standard solution	± 1% of standard	Recalibrate.
Temperature of water	Check against NIST precision thermometer	± 0.1°C at two different temperatures	Reset thermistors in accordance with manufacturer's specifications; dispose of inaccurate thermometer.

FID – flame ionization detector
NIST – National Institute of Standards and Technology

A bound, weatherproof field logbook shall be maintained by each sampling event leader. 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 D. This book will contain a summary of the day's activities and will reference the 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 D.

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

3.1.3.19 Manufacturers' Specifications

The FOL shall collect a copy of the available manufacturers' specifications for all supplies and equipment that are used in the collection of environmental samples. This shall apply to, 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 the field mobilization.

3.1.3.20 Surveying

3.1.3.20.1 Global Positioning Survey Locations

The locations of sample points, soil borings, and wells may initially be determined during the field investigation using a portable Global Positioning Survey (GPS) instrument with sub-meter accuracy. This information may be helpful in plotting results and analyzing the data coverage in real-time to make data acquisition decisions during the CA or RFI field activities. The GPS instrument will be used in accordance with the manufacturer's instructions, and the results will be recorded in the field records. Monitoring wells and other selected points will be permanently located using a NGVD survey at the close of the field mobilization.

3.1.3.20.2 National Geodetic Vertical Datum Survey Locations

The locations of monitoring wells installed during the RFI field activities will be measured by a certified land surveyor. Each point will be measured from a reference location that is tied to the Florida State Plane Coordinate System. An X–Y coordinate system shall be used to identify locations. The X coordinate will be the east–west axis; the Y coordinate will be the north–south axis. The reference location will be the origin.

All surveyed locations will be reported using the Florida State Plane Coordinate System. Existing installation benchmarks will serve as the horizontal and vertical datum for the survey. Elevations and horizontal locations will be recorded to the nearest hundredth of a foot. The elevations of all monitoring wells will be surveyed at the water level measuring reference point on the top of the well casing and on the undisturbed ground surface adjacent to the well pad.

3.2 SITE HISTORY AND DESCRIPTION

3.2.1 AOC C Location and Description

AOC C is located southeast of the NAVSTA Mayport Turning Basin and includes buildings and facilities around the southern portion of Echo Pier, Building 191, and the SIMA Building (Figure 3-1). Storage areas at Building 191 are used to support ship and shore services at NAVSTA Mayport by providing areas to receive, temporarily store, and distribute supplies. The outlying buildings are used to warehouse hazardous materials such as solvents and compressed gasses. These buildings or structures include one Quonset building (Buildings 2023), an open-sided covered structure with concrete floor (Building 191-A),

and an aluminum constructed structure (Building 191-C). Quonset Building 264 that was previously located on site has been demolished. (HLA, 1999) The SIMA conducts repair an maintenance operations onboard ships at the piers and in the SIMA operations building (ABB-ES, 1995). Additional information pertaining to SIMA activities were not available at the time this work plan was being prepared.

3.2.2 History

An accident report dated May 4, 1993 identified that approximately 25 to 30 gallons of tetrachlorethene (a solvent used for dry cleaning) were released from a punctured 55-gallon drum on to asphalt pavement. The release was reported to have been contained before it could enter a nearby storm water inlet located approximately 130 feet from the release. Analytical results from samples consisting of asphalt, limerock, and soil were collected from within the release area (department of the Navy, 1994). A copy of the release report is included in Appendix E. The release was located north of Building 191 between Buildings 281 and 191-A. The approximate areal extent of the release near building 191-A is shown on Figure 3-1.

A Contamination Assessment Report (CAR) was prepared by Environmental Science and Engineering, Inc. (ESE) (HLA, 1999), to evaluate the potential release(s) of diesel fuel from underground fuel lines that extended from an aboveground 300-gallon storage tank located on the south side of Building 191. The assessment consisted of installing three piezometers and four monitoring wells, collecting information on water levels in the vicinity of building 191, determining groundwater flow directions, and collecting groundwater samples for chemical analysis from the monitoring wells.

Tetrachloroethene and trichloroethene were detected in a groundwater sample from MPT-TC-MW04S located on the northern side of Building 191. Following the investigation, ESE abandoned the wells they installed by plugging them with grout. Subsequent to the ESE report, HLA was requested to determine whether or not hazardous materials had been released to the environment. Based on the data collected during the HLA assessment, it was determined that a release of tetrachloroethene and/or trichloroethene had occurred in the vicinity Building 191. Following this determination, additional assessment was conducted by ICON Environmental Services (ICON) and HLA using both direct-push technology and conventional monitoring wells under the NELP.

Results of the additional assessment completed at Building 191 were presented in a technical memorandum that concluded with recommendations to complete a site characterization and assessment of remedial alternatives at the Building 191 and Echo Pier areas. Included in the recommendations were requests for additional groundwater sampling from monitoring wells MPT-TC-MW04S and MPT-TC-MW05S, a comprehensive survey of the locations and elevations of the existing monitoring wells, and a

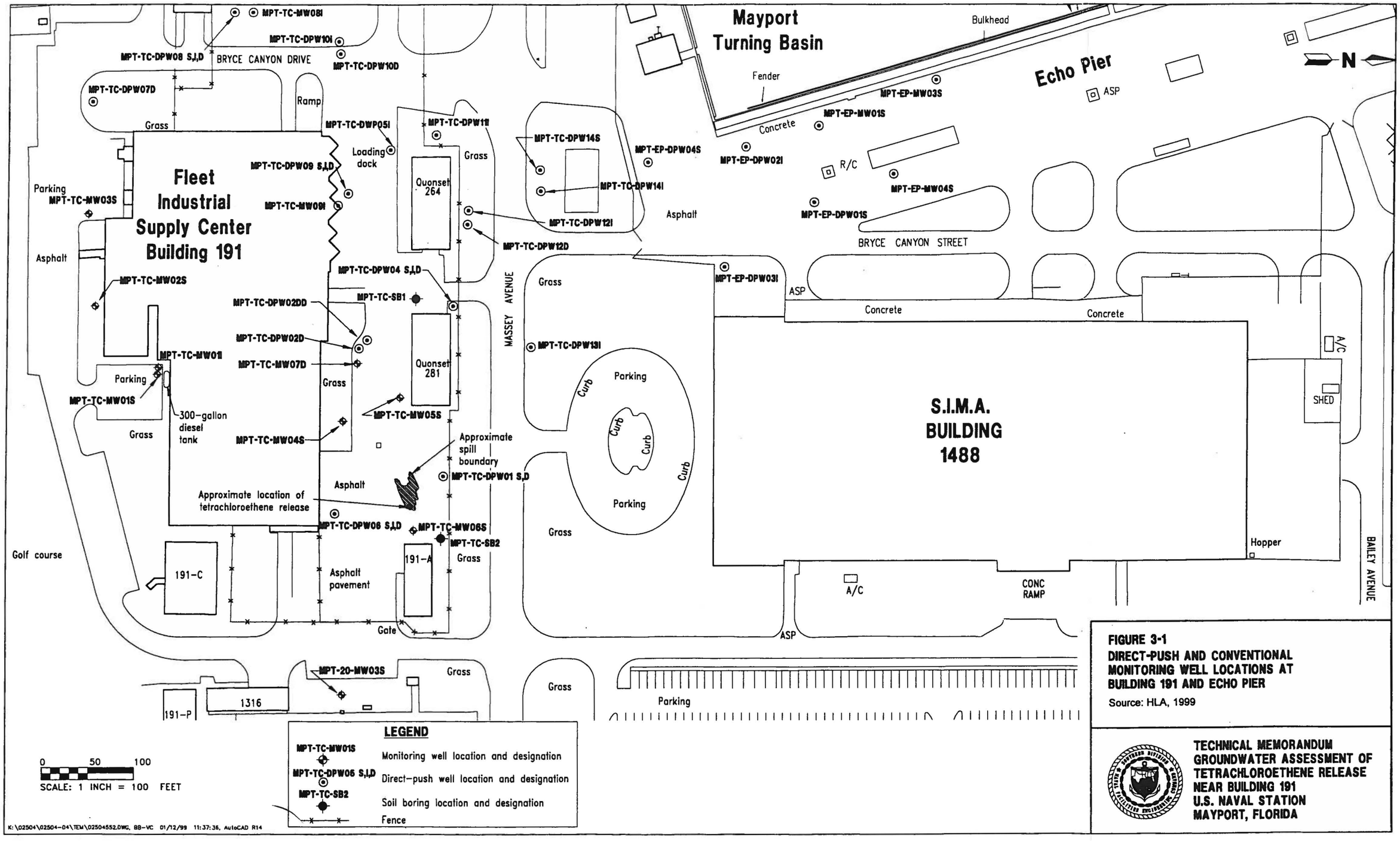


FIGURE 3-1
DIRECT-PUSH AND CONVENTIONAL MONITORING WELL LOCATIONS AT BUILDING 191 AND ECHO PIER

Source: HLA, 1999

TECHNICAL MEMORANDUM
GROUNDWATER ASSESSMENT OF TETRACHLOROETHENE RELEASE
NEAR BUILDING 191
U.S. NAVAL STATION
MAYPORT, FLORIDA

groundwater elevation survey for all previously investigated zones of the aquifer. The Technical Memorandum suggests the source of the vinyl chloride detected in groundwater samples along Echo Pier has not been determined. The technical memorandum proposed that the present well locations and well screen placements be evaluated to determine if the location and extent of the halogenated VOC plume was fully delineated.

Information on the most recent previous assessment activities are available in the *Technical Memorandum, Groundwater Assessment of Tetrachloroethene Release Near Building 191, Naval Station Mayport* (HLA 1999). The direction of additional activities during the RFI to satisfy the Technical Memorandum recommendations will be guided by the Mayport Partnering Team. Figures 3-2, 3-3, and 3-4 summarize the available data for the areal extent of VOC-impacted groundwater.

3.3 SITE-SPECIFIC ACTIVITIES

The technical approaches for the individual tasks constituting the field investigation are described in the following sections.

3.3.1 Proposed CA Activities

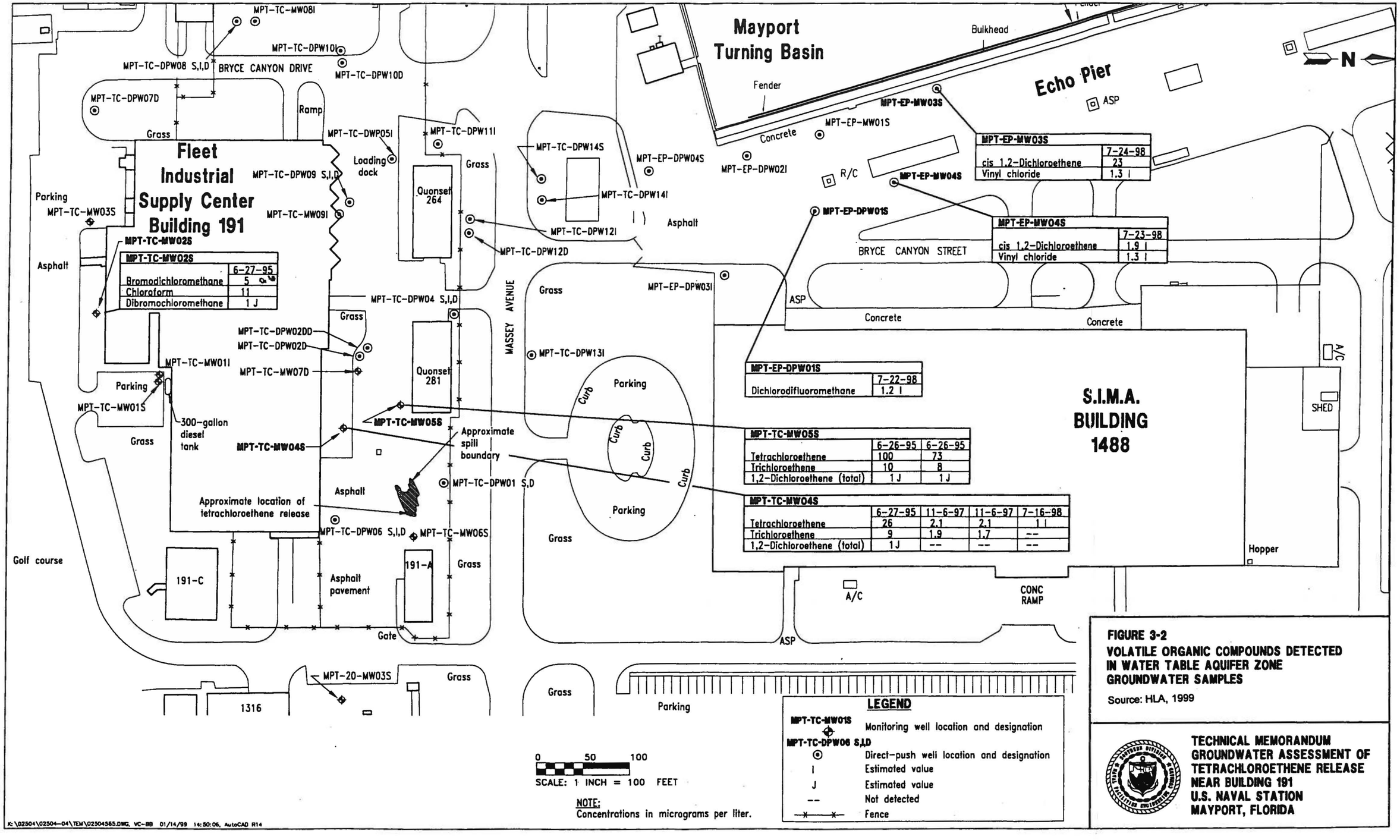
The CA activities proposed for AOC C are described in the following sections.

3.3.1.1 Groundwater Investigation Scope

The groundwater investigation tasks to be performed during the CA at AOC C are described below.

- Identify existing data gaps.
- Identify potential additional source areas.
- Measure the locations and elevations of existing monitoring wells.
- Determine the direction of groundwater flow.

Select RFI monitoring well locations.



MPT-EP-MW03S	7-24-98
cis 1,2-Dichloroethene	23
Vinyl chloride	1.3 I

MPT-EP-MW04S	7-23-98
cis 1,2-Dichloroethene	1.9 I
Vinyl chloride	1.3 I

MPT-TC-MW02S	6-27-95
Bromodichloromethane	5
Chloroform	11
Dibromochloromethane	1 J

MPT-EP-DPW01S	7-22-98
Dichlorodifluoromethane	1.2 I

MPT-TC-MW05S	6-26-95	6-26-95
Tetrachloroethene	100	73
Trichloroethene	10	8
1,2-Dichloroethene (total)	1 J	1 J

MPT-TC-MW04S	6-27-95	11-6-97	11-6-97	7-16-98
Tetrachloroethene	26	2.1	2.1	1 I
Trichloroethene	9	1.9	1.7	--
1,2-Dichloroethene (total)	1 J	--	--	--

LEGEND

- MPT-TC-MW01S — Monitoring well location and designation
- MPT-TC-DPW06 S,I,D — Direct-push well location and designation
- I — Estimated value
- J — Estimated value
- -- — Not detected
- Fence

NOTE:
Concentrations in micrograms per liter.

FIGURE 3-2
VOLATILE ORGANIC COMPOUNDS DETECTED IN WATER TABLE AQUIFER ZONE GROUNDWATER SAMPLES

Source: HLA, 1999

TECHNICAL MEMORANDUM GROUNDWATER ASSESSMENT OF TETRACHLOROETHENE RELEASE NEAR BUILDING 191 U.S. NAVAL STATION MAYPORT, FLORIDA

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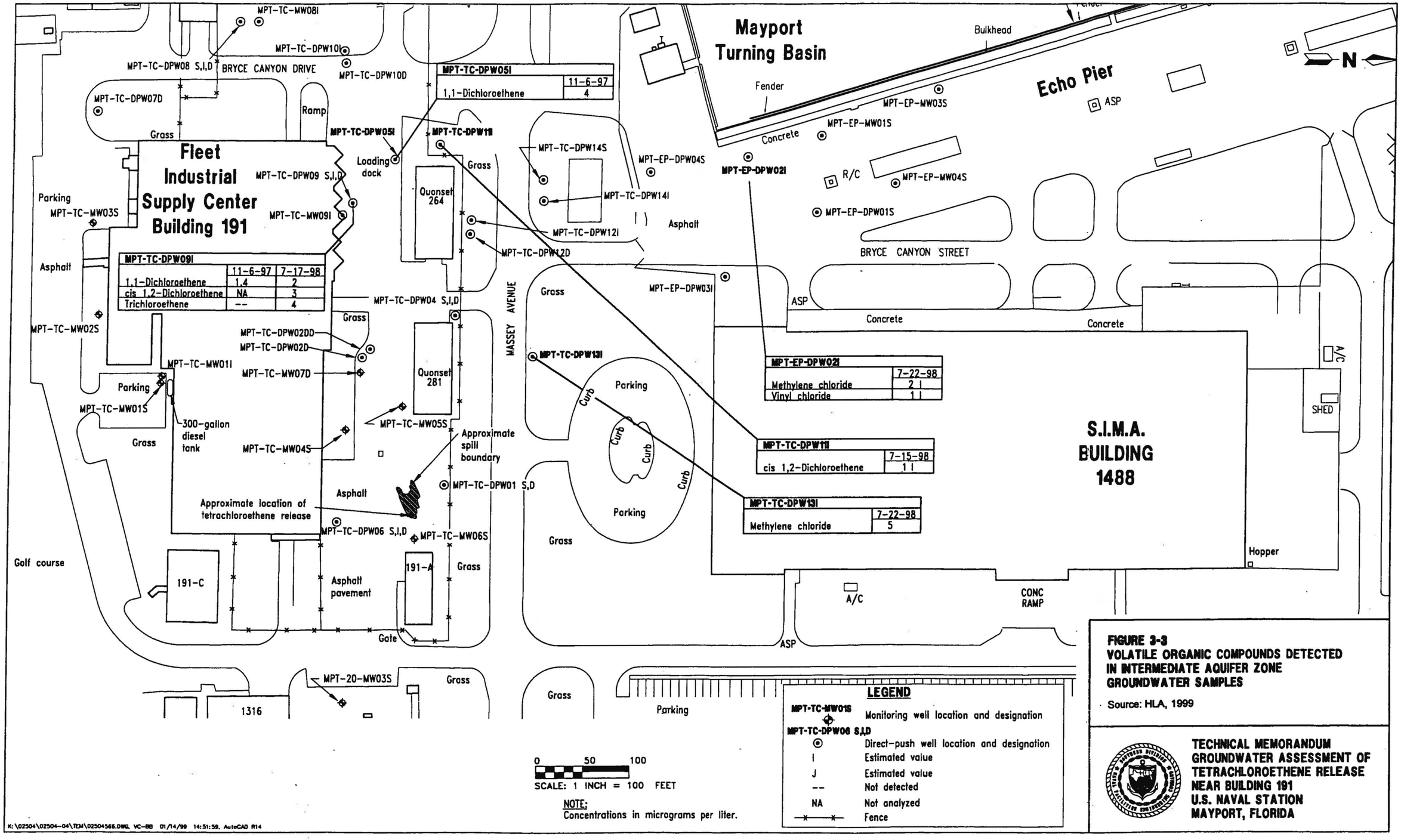

FIGURE 3-3
VOLATILE ORGANIC COMPOUNDS DETECTED IN INTERMEDIATE AQUIFER ZONE GROUNDWATER SAMPLES

Source: HLA, 1999

TECHNICAL MEMORANDUM
GROUNDWATER ASSESSMENT OF TETRACHLOROETHENE RELEASE
NEAR BUILDING 191
U.S. NAVAL STATION
MAYPORT, FLORIDA

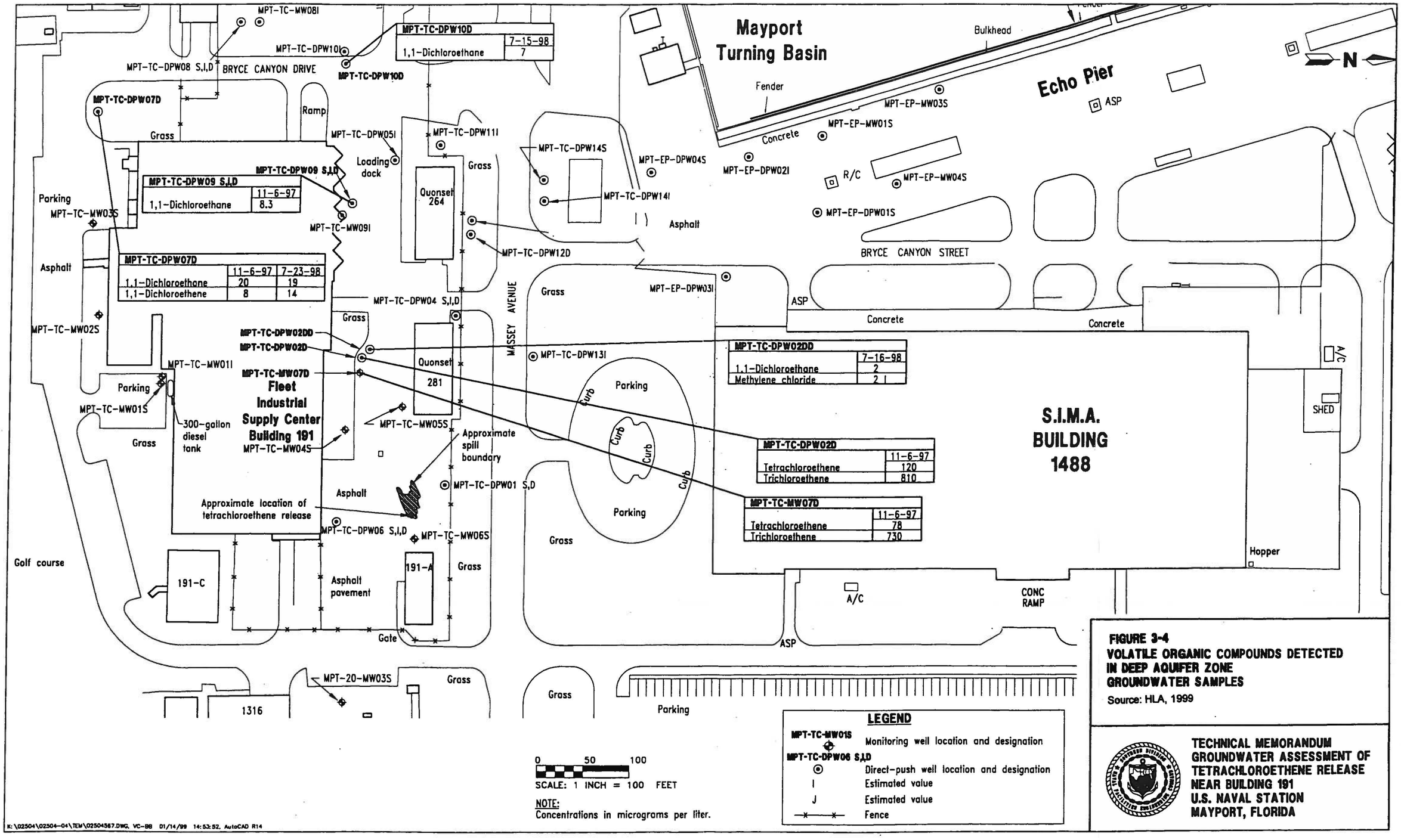

FIGURE 3-4
VOLATILE ORGANIC COMPOUNDS DETECTED IN DEEP AQUIFER ZONE GROUNDWATER SAMPLES
Source: HLA, 1999

TECHNICAL MEMORANDUM
GROUNDWATER ASSESSMENT OF TETRACHLOROETHENE RELEASE
NEAR BUILDING 191
U.S. NAVAL STATION
MAYPORT, FLORIDA

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3.3.1.2 CA Focus Areas

The CA Focus areas include the following Tasks:

- Visual identification of a potential source for detected 1,1-dichloroethane during the site walkover inspection.
- Identification of additional wells from previous investigations at the SIMA Building during a site walkover inspection and records search.
- Inspection of the storm sewer inlet located west of the former tetrachloroethene spill area and identification of the storm sewer piping at AOC C.
- Performance of a comprehensive location and elevation survey for available AOC C monitoring wells.
- Collection of a complete round of groundwater levels.

3.3.1.3 Proposed Groundwater Sampling Investigation and Criteria

Based on previous analytical results, groundwater from the three wells indicated above will be analyzed for Appendix IX VOCs and natural attenuation parameters. The natural attenuation indicator parameters will be used to confirm existing conditions within the AOC area around Building 191. Natural attenuation and water quality parameters to be analyzed, other than Appendix IX VOCs, are summarized in Table 3-3.

3.3.2 Proposed RFI Activities

The technical approaches to all of the individual tasks constituting the field investigation are described in the following sections.

3.3.2.1 Soil Investigation Scope

The soil investigation scope for RFI activities include:

- Identify and define the extent of contaminated soils or identified potential source areas within AOC C that exceeds applicable FDEP regulation (e.g., Florida Soil Cleanup Goals (1999), Chapter 62.777 F.A.C. and Soil Cleanup Target Levels from Revised Chapter 62-770 F.A.C.); and
- Determine the extent of soil contamination that exceeds applicable "risk benchmarks" defined by USEPA [e.g., USEPA Region VI RBCs and SSLs (USEPA 1996)].

3.3.2.2 Proposed Soil Investigation

The RFI at AOC C will consist of approximately twelve surface soil samples (0 to 2 ft bls) and twelve subsurface soil samples (>2 ft bls) collected using a DPT rig. The sampling locations will be selected based on previous sampling data, and potential source areas identified during the CA. The supporting rationale for these borings is presented in the box below. The location and rationale for these borings are subject to change based on data collected during the CA and guidance given by the NAVSTA Mayport Partnering Team.

RFI Rationale for Soil Borings at AOC C

Soil Boring Location	Rationale
ACSB01, ACSB02, ACSB03	Identification and delineation of contaminated soil or suspected source areas north of the SIMA Building.
ACSB04, ACSB05, ACSB06	Identification and delineation of contaminated soil or suspected source areas west of the SIMA Building.
ACSB07, ACSB08, ACSB09	Identification and delineation of contaminated soil or suspected source areas south of the SIMA Building.
ACSB10	Identification and delineation of contaminated soil or suspected source areas east of the SIMA Building.

3.3.2.3 Soil Sampling Criteria

Soil samples will be collected in all borings using a drilling rig with nominal 2-inch-diameter split spoons or a DPT rig using either two- or four-foot samplers with plastic liners, or by hand auger for surface soils. These soil samples will be screened by Tetra Tech NUS using a Flame Ionization Detector (FID). In general, one subsurface soil sample will be collected from above the water table at each soil boring.

The water table at the site is expected to be relatively high (within 5 feet of the surface). All soil borings will be advanced to a maximum depth of 20 feet bls or to the water table, whichever occurs first. If OVA readings in the vadose are greater than 50 ppm, then the boring will be continued to a depth 5 feet below the depth when OVA readings decrease to < 50 ppm or to the water table, whichever occurs first. Soil samples will not be collected below the water table. A surface soil sample will not be collected from borings in paved areas. Soil sample quantities are based on 10 soil borings being advanced to 20 feet bls. Soil samples will be analyzed for TCL VOCs, TCL SVOCs, TCL Pesticides, TCL PCBs, and TAL Metals, and cyanide.

TABLE 3-3

**NATURAL ATTENUATION AND WATER QUALITY PARAMETER ANALYSIS
CA AND RFI WORK PLAN FOR
AREA OF CONCERN C
NAVSTA MAYPORT
MAYPORT, FLORIDA**

Parameter	Test Method	Test Location
Dissolved Oxygen (DO)	HACH 8215	Field
Hydrogen Sulfide	HACH HS-C	Field
Nitrite	HACH 8507	Field
Nitrate	HACH 8192	Field
Iron II (Fe^{+2})	HACH 8146	Field
Manganese	HACH MN-5	Field
Sulfate	NA	Laboratory
Sulfide	HACH 8131	Field
Methane	SW3810, Modified	Laboratory
Oxidation-Reduction Potential (Redox)	Redox Meter	Field
PH	pH Meter	Field
Temperature	Meter	Field
Specific Conductance	Meter	Field
Alkalinity	HACH 8203	Field
Carbon Dioxide	Hach 8250	Field

Groundwater Investigation Scope

The RFI activities proposed for groundwater at AOC C are described below.

- Characterize extent of groundwater contamination that exceeds regulatory criteria (e.g., USEPA and Florida MCLs) for groundwater contamination or potential source areas identified during the CA.
- Investigate the extent of the vinyl chloride identified in existing monitoring wells along the southern portion of Echo Pier.
- Collect supporting data to evaluate risk and remedial alternatives at the site, including, natural attenuation of the groundwater plume.

3.3.2.4 Proposed Groundwater Investigation

The RFI investigation at AOC C will include the installation of 38 additional monitoring wells to help characterize the nature and extent of groundwater contamination within AOC C. These new sampling locations will be selected based on previous sampling data and potential source areas to help characterize the nature and extent of soil contamination. The location and rationale for these borings are subject to change based on data collected during the CA and guidance given by the NAVSTA Mayport Partnering Team.

The supporting rationale for these wells is presented below.

RFI Rationale for Additional Monitoring Wells at AOC C	
Monitoring Well Location	**Rationale**
MPT-AC-DPW01S,I,D MPT-AC-DPW02S,I,D MPT-AC-DPW03S,I,D MPT-AC-DPW04S,I,D	Twelve (4 clusters of 3) wells will be installed north of the SIMA Building to identify and investigate the vertical and horizontal extent of contamination in the shallow, intermediate, and deep aquifer zones (presently identified aquifer zones A, B, and C respectively).
MPT-AC-DPW05S,I,D MPT-AC-DPW06S,I,D MPT-AC-DPW07S,I,D MPT-AC-DPW08S,I,D	Twelve (4 clusters of 3) wells will be installed east of the SIMA Building to identify and investigate the vertical and horizontal extent of contamination in the shallow, intermediate, and deep aquifer zones.
MPT-AC-MW09D,D2 MPT-AC-MW10D,D2 MPT-AC-MW11D MPT-AC-MW12D	Six wells will be installed west of the SIMA Building to identify and investigate the vertical extent of contamination in the deep and second deep aquifer zone.
MPT-AC-DPW13D MPT-AC-DPW14D MPT-AC-DPW15D MPT-AC-DPW16D	Three wells will be installed west of Building 191 to identify and investigate the vertical extent of contamination in the deep aquifer zone, and one well will be installed adjacent to monitoring well MPT-TC-MW01S and MPT-TC-MW01I to help identify up-gradient constituents in the deep aquifer zone.
MPT-AC-MW13D2 MPT-AC-MW14D2 MPT-AC-MW15D2	Three wells will be installed west of Building 191 to identify and investigate the vertical extent of contamination in the second deep aquifer zone.
MPT-AC-DPW17S	One well will be installed between the tetrachloroethene release area near Building 191, and the storm sewer inlet to identify constituents up-gradient of the storm sewer for comparison with constituent concentrations detected in groundwater monitoring wells down-gradient of the storm sewer inlet.

3.3.2.5 Groundwater Sampling Criteria

Groundwater samples from all newly installed monitoring wells north, east, and west of the SIMA Building will be analyzed for: VOA (Appendix IX), SVOA (Appendix IX), nonhalogenated (Appendix IX), pesticides (Appendix IX), PCBs (Appendix IX), TAL Metals and tin, cyanide, organochlorine Herbicides (Appendix IX), and organophosorous pesticides (Appendix IX). Eight monitoring wells installed in the vicinity of Building 191 will only be sampled for VOCs and natural attenuation parameters. The analyses, shown in Table 3-4, will be performed on groundwater samples from the proposed new wells.

Selected wells will be sampled for natural attenuation parameters. Natural attenuation and water quality parameters to be analyzed are shown in Table 3-3.

TABLE 3-4

GROUNDWATER ANALYSES
RFI WORK PLAN FOR
AREA OF CONCERN C
NAVSTA MAYPORT
JACKSONVILLE, FLORIDA
PAGE 1 OF 2

Well Number	APPENDIX IX							TAL Metals + Tin	Cyanide	Natural Attenuation Parameters
	VOA	SVOA	Nonhalogenated	Pesticides	PCBs	Organochlorine Herbicides	Organophosorous Pesticides			
	SW-846 8260B	SW-846 8270C	SW-846 8015Mod	SW-846 8081A	SW-846 8082	SW-846 8151A	SW-846 8141A	SW-846 6010B/7000A	SW-846 9010B/9012A/9013	
MPT-AC-DPW-1S	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-1I	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-1D	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-2S	X	X	X	X	X	X	X	X	X	
MPT-AC-DPW-2I	X	X	X	X	X	X	X	X	X	
MPT-AC-DPW-2D	X	X	X	X	X	X	X	X	X	
MPT-AC-DPW-3S	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-3I	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-3D	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-4S	X	X	X	X	X	X	X	X	X	
MPT-AC-DPW-4I	X	X	X	X	X	X	X	X	X	
MPT-AC-DPW-4D	X	X	X	X	X	X	X	X	X	
MPT-AC-DPW-5S	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-5I	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-5D	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-6S	X	X	X	X	X	X	X	X	X	
MPT-AC-DPW-6I	X	X	X	X	X	X	X	X	X	
MPT-AC-DPW-6D	X	X	X	X	X	X	X	X	X	
MPT-AC-DPW-7S	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-7I	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-7D	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-8S	X	X	X	X	X	X	X	X	X	
MPT-AC-DPW-8I	X	X	X	X	X	X	X	X	X	
MPT-AC-DPW-8D	X	X	X	X	X	X	X	X	X	
MPT-AC-DPW-9D	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-9D2	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-10D	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-10D2	X	X	X	X	X	X	X	X	X	X

TABLE 3-4

GROUNDWATER ANALYSES
RFI WORK PLAN FOR
AREA OF CONCERN C
NAVSTA MAYPORT
JACKSONVILLE, FLORIDA
PAGE 2 OF 2

Well Number	APPENDIX IX							TAL Metals + Tin	Cyanide	Natural Attenuation Parameters
	VOA	SVOA	Nonhalogenated	Pesticides	PCBs	Organochlorine Herbicides	Organophosorous Pesticides			
	SW-846 8260B	SW-846 8270C	SW-846 8015Mod	SW-846 8081A	SW-846 8082	SW-846 8151A	SW-846 8141A	SW-846 010B/7000AB/9012A/9013		
MPT-AC-DPW-11D	X	X	X	X	X	X	X	X	X	
MPT-AC-DPW-12D	X	X	X	X	X	X	X	X	X	X
MPT-AC-DPW-13D	X									X
MPT-AC-DPW-13D2	X									X
MPT-AC-DPW-14D	X									
MPT-AC-DPW-14D2	X									
MPT-AC-DPW-15D	X									X
MPT-AC-DPW-15D2	X									X
MPT-AC-DPW-16D	X									X
MPT-AC-DPW-17S	X									

All environmental sampling will be performed in accordance with procedures outlined in the COMPQAP. QC samples including equipment blanks, trip blanks, and field duplicates will be collected as outlined in Section 9.1 of the COMPQAP. The frequencies with which these QC samples will be collected are summarized below. At least one field blank will be collected during each field sampling event.

Number of Samples	Precleaned Equipment Blank	Field-Cleaned Equipment Blank	Trip Blank (VOCs)	Duplicate
10+	Minimum of one, then 5%	Minimum of one, then 5%	one per cooler	minimum of one, then 10%
5-9	One*	one*	one per cooler	one
<5	One*	one*	one per cooler	one

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

3.3.3 Sampling Summary

Waste characterization samples will be collected from the investigation-derived soil and water. An estimated 30 soil samples will be collected and analyzed for TCLP parameters to determine the appropriate method of disposal for investigative derived waste soils produced from soil borings and monitoring well installation around the SIMA Building. Investigative derived waste soils produced from the Building 191 area of the AOC will be disposed of based on previous characterization samples, field measurements, and observations, and samples collected during the investigation.

Investigative derived waste development and purge water will be characterized based on the groundwater analytical sample results from each well. If groundwater sample results indicate that disposal is required, samples will be collected and analyzed for TCLP from one drum for each identified monitoring well.

Investigative derived waste will be containerized and segregated in the following categories: decontamination fluids, development and purge water from wells with low probabilities of highly impacted groundwater, and development and purge water from wells with high probabilities of highly impacted groundwater.

A summary of the CA and RFI sampling and analysis program is summarized in Tables 3-4 through 3-7.

TABLE 3-5

SOIL ANALYTICAL PROGRAM SUMMARY
CONFIRMATION ASSESSMENT AND RCRA FACILITY INVESTIGATION WORK PLAN
FOR
AREA OF CONCERN C
NAVSTA MAYPORT
MAYPORT, FLORIDA

Sample Identification	CLP/TCL VOCs	CLP/TCL SVOCs	CLP/TAL Metals and CN	CLP/TCL Pesticides/ PCBs
Analysis Method	**SW-846 8260**	**SW-846 8270**	**(A)**	**SW-846 8081/8082**
SURFACE SOIL				
Area of Concern C	2	2	2	2
SUBSURFACE SOIL				
Area of Concern C	10	10	10	10
TOTAL SOIL SAMPLES	**12**	**12**	**12**	**12**

(A)CLP/TAL Inorganics analyses by Methods SW6010, SW7471 or SW7470, SW9010, and SW9065.

Notes:
TCL – Target compound list
CLP – Contract Laboratory Program
PCB – Polychlorinated biphenyls
TPH – Total petroleum hydrocarbons
SVOC – Semivolatile organic compound
VOCs – Volatile organic compound
TAL – Target analyte list

TABLE 3-6

GROUNDWATER ANALYTICAL PROGRAM SUMMARY
CONFIRMATION ASSESSMENT AND RCRA FACILITY INVESTIGATION WORK PLAN
FOR
AREA OF CONCERN C
NAVSTA MAYPORT
MAYPORT, FLORIDA

Sample Identification	APPENDIX IX							TAL Metals + Tin	CN	NA Parameters
	VOCs	SVOCS	Nonhalo-genated	Pesticides	PCBs	O-Herbicides	O-Pesticides			
Analysis Method	SW-846 8260	SW-846 8270C	SW-846 8015Mod	Sw-846 8081A	SW-846 8082	SW-846 8151A	SW-846 8141A	(A)	(B)	(C)
GROUNDWATER SAMPLES										
AREA OF CONCERN C										
RFI	38	30	30	30	30	30	30	30	30	22
TOTAL WATER SAMPLES	**41**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**25**

(A)CLP/TAL Inorganics analyses by Methods SW6010B or SW7000A.
(B)Cyanide analyses by Methods SW9010B, SW9012A, or SW9013.
(C)See Table 3-3 for Natural Attenuation Parameters.

Notes:
- CA – Confirmation Assessment
- RFI – RCRA Facility Investigation
- CN – Cyanide
- O-Herbicides – Organochlorine Herbicides
- O-Pesticides – Organophosorous Pesticides
- TCLP – Toxicity Characteristic Leaching Procedure
- PCB – Polychlorinated biphenyls
- QC – Quality control
- SVOC – Semivolatile organic compound
- VOCs – Volatile organic compound
- TAL – Target analyte list

TABLE 3-7

ANALYTICAL QC PROGRAM SUMMARY
CONFIRMATION ASSESSMENT AND RCRA FACILITY INVESTIGATION WORK PLAN
FOR
AREA OF CONCERN C
NAVSTA MAYPORT
MAYPORT, FLORIDA

Sample Identification	Surface Soil Samples	Subsurface Soil Samples	Groundwater Samples	
			CA	RFI
QC SAMPLES				
Duplicate	1	1	0	5
Matrix Spike	0	0	0	2
Matrix Spike Duplicate	0	0	0	2
Trip Blanks	1	2	0	7
Equipment Blanks	1	1	0	3
Field Banks	0	1	0	1
TOTAL QC SAMPLES	**3**	**5**	**0**	**20**

Notes:

CA – Confirmation Assessment
RFI – RCRA Facility Investigation
QC – Quality Control

4.0 SAMPLE ANALYSES AND VALIDATION

4.1 DATA VALIDATION

The approach to providing reliable data that meet the DQOs will include QA/QC requirements for each type of analytical data generated during the field investigation. The QA/QC efforts for laboratory analyses will include collection and submittal of QC samples and the assessment and validation of data from the subcontract laboratories. Analytical data will be subjected to independent data validation in accordance with the following guidelines:

- *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA 1994d).
- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA 1994e).
- *Navy Installation Restoration Laboratory Quality Assurance Guide* (NFESC 1996).

4.1.1 Sample Analysis

Samples collected during the CA and RFI field activities will be analyzed in accordance with the DQOs established in the Quality Assurance Program Plan (QAPP) found in Appendix B. The number of samples (including QA/QC samples) and analyses planned for the NAVSTA Mayport CA and RFI are summarized in Section 3.0.

Data quality indicators include the precision, accuracy, representativeness, comparability, and completeness parameters. These parameters will be used within the data validation process to evaluate data quality. The achievable limits for these parameters vary with the DQO level of the data. The limits used for laboratory analytical data in this program will be those set by the CLP for Level D DQOs.

4.2 DATA EVALUATION

The purpose of this task is to assess the usability of validated data results based upon data comparisons to non-site-related conditions. Results that meet the DQO requirements and are considered usable will be

compared to background sampling results. Results of the data evaluation will be documented in the RI report. The following data evaluations and comparisons will be made:

- Evaluation of detection limits.
- Evaluation of counting errors.
- Evaluation of equilibrium data.
- Evaluation of qualified data.
- Comparison of laboratory and field blanks to sample results.
- Comparison of laboratory and field duplicate results.

Contaminants of potential concern (COPCs) will be identified through evaluation of the following criteria:

- Background sampling results.
- Frequency of detection.
- Extent of contamination.

COPCs will be addressed throughout the data evaluation and risk assessment.

Site data will be compared to two times the background mean as well as the background maximum and other descriptive statistics. If necessary, statistical testing will be performed using the *t* test, Mann-Whitney test, or both. Results of the *t* test will be used when the data have a normal distribution or can be made to approximate the normal through transformation (taking the logarithm of each datum transforms a lognormal distribution to the normal). Results of the Mann-Whitney test will be used when at least one of the distributions being compared cannot be classified. Although not required to draw conclusions about the difference between background and site data, performing both tests simultaneously can provide a better understanding of the distributional patterns affecting test results.

4.3 DATA MANAGEMENT

The purpose of this task is to track and manage environmental and QC data collected during the field investigation from the time the data are obtained through data analysis and report evaluation. Coordination and management of environmental and QC sample analysis by the contracted laboratories is also part of this task. CA and RFI activities generate data including sample locations, measurements of field parameters, and the results of laboratory analyses. Reports regarding the collection and analyses of sample data will also be generated. Management of data collected during CA and RFI activities will ensure accessibility of

data to support environmental data analysis, risk assessments, and the evaluation of remedial action alternatives.

Samples will be tracked from field collection activities to analytical laboratories following standard chain-of-custody procedures. Sample information recorded on the chain-of-custody forms will be transferred (electronically or manually) into the sample tracking portion of the database management system (DMS), thereby enabling the samples to be tracked through final disposition.

Analytical results, applicable QA/QC data, validation flags, chain-of-custody information, and any other applicable information will be incorporated into the DMS. All data will be verified after uploading to ensure completeness and accuracy.

5.0 BASELINE RISK ASSESSMENT

5.1 HUMAN HEALTH RISK ASSESSMENT

The human health risk assessment (HHRA) for AOC C at NAVSTA Mayport will be performed to characterize the risks (current and future) associated with potential human exposures to site-related contaminants. The process consists of six basic components: (1) data evaluation and summarization, (2) selection of COPCs, (3) exposure assessment, (4) toxicity assessment, (5) risk characterization, and (6) uncertainty analysis. A brief description of each component is presented in the following subsections.

The HHRA will be conducted according to CERCLA methodology. The following federal and USEPA Region IV guidelines are some of the primary references used to direct and support the HHRA:

- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (USEPA 1989a).
- *Supplemental Guidance to RAGS: USEPA Region IV Bulletins, Human Health Risk Assessment* (USEPA 1995a).
- *Exposure Factors Handbook* (USEPA 1997a).
- *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance "Standard Default Exposure Factors", Interim Final* (USEPA 1991b).
- *Dermal Exposure Assessment: Principles and Applications, Interim Report* (USEPA 1992b).
- *Guidance for Data Usability in Risk Assessment* (Part A) (USEPA 1992a).
- *Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)*. (USEPA 1998a).

The HHRA also considers the following FDEP standard:

- *Florida Administrative Code, Chapter 62-785* (this Chapter will be replaced by Chapter 62-777, when adopted).

Preliminary screening evaluations will be conducted to indicate the nature and extent of chemical contamination at AOC C. The findings will be used to determine whether a full baseline risk assessment is needed, or whether the modified version of the process described below is more appropriate.

5.1.1 Data Evaluation and Summary

The data used in the risk assessment are the results from analyses conducted under the CLP protocol with documented QA/QC procedures. Before analytical results are released by the laboratory, both the sample and QC data are carefully reviewed to verify sample identity, instrument calibration, detection limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. The QC data are reduced, spike recoveries are included in control charts, and the resulting data are reviewed to ascertain whether they are within the laboratory-defined limits for accuracy and precision. Any nonconforming data are discussed in the data package cover letter and case narrative.

The data will then be reviewed and validated in accordance with *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program* (NEESA 1988) and *Navy Installation Restoration Laboratory Quality Assurance Guide* (NFESC 1996). The data review and validation process is independent of the laboratory's checks.

5.1.1.1 Evaluation of Quantitation Limits

Sample quantitation limits (SQLs) are compared to corresponding standards and criteria. For soil, SQLs will be compared to the USEPA Region III RBCs and FDEP Soil Cleanup Target Levels (Chapter 62.785 F.A.C.). The groundwater SQLs will be compared to federal and state MCLs and Florida guidance concentrations. SQLs in excess of the appropriate screening value represent an area of uncertainty in the analytical results. The effect of this uncertainty will be noted in the risk assessment.

5.1.1.2 Evaluation of Qualified and Coded Data

The laboratories and data validators may attach qualifiers and codes to the analytical data. The qualifiers may pertain to QA/QC variances in identification or quantitation of an analyte. When data have both

laboratory and validation qualifiers, the validation qualifiers supersede the laboratory qualifiers. All unqualified positive detections and "J" qualified detections (estimated values) are considered as detected concentrations for the HHRA. All nondetects (indicated with a "U" qualifier) are retained in the HHRA data set; this includes samples with a "UJ" qualifier. If an analyte has all nondetect results for all samples in a given medium, it is not considered in the risk assessment for that medium. Any samples with a "UR" qualifier (indicating a rejected nondetection) or "R" qualifier (indicating a rejected positive detection) are not included in the HHRA data set because these values have been rejected and are unusable.

5.1.1.3 Evaluation of Tentatively Identified Compounds

Tentatively identified compounds (i.e., both identity and concentration are uncertain) will be reviewed. The uncertainty in the identities and concentrations of these analytes will be discussed in the uncertainty analysis.

5.1.1.4 Data Used in the Risk Assessment

The product of the data evaluation is a summary of usable data for each medium. This summary includes the frequency of detection, the arithmetic mean (using only samples with detected concentrations), the range of detected concentrations, the arithmetic mean of background concentrations, and the range of the quantitation limits. The summary information is used to select human health chemicals of potential concern (COPCs) as described in Section 5.1.2. The exposure point concentrations (EPCs) of COPCs are determined as described in Section 5.1.3.3.

5.1.2 Identification of Human Health Chemicals of Potential Concern

COPCs are selected from all analytes detected at a site. The selection of COPCs from all detected analytes in each medium is based on the analyte concentrations, frequency of detection, comparison to background (inorganics only), and comparison to USEPA and Florida medium-specific screening criteria. COPCs include contaminants that are

- Positively identified in at least one sample.
- Detected at levels significantly above blank concentrations.

Chemicals that do not contribute significantly to human health risks are removed or "screened" from further consideration as COPCs, as recommended by USEPA (USEPA 1989a). Analytes are excluded as COPCs if they meet any of the criteria below.

- The maximum detected concentration of an analyte in a medium is less than twice the arithmetic mean of the background concentration (inorganics only) (USEPA 1995a).

- The maximum analyte concentration in a medium is less than the USEPA Region III RBC and less than the State of Florida criteria and guidance values.

- USEPA Region III RBCs corresponding to an excess lifetime cancer risk (ELCR) of 1×10^{-6} or hazard quotient (HQ) of 0.1 for each analyte detected are used in the screening process. For noncarcinogenic chemicals the USEPA Region III RBC values (October 1,1998) will be divided by 10 to represent an HQ of 0.1.

- For surface and subsurface soil, the residential soil RBCs are used. No RBC is available for lead in soil due to a lack of toxicity data. Based on the USEPA recommendation, a residential screening level of 400 mg/kg is used as the RBC for lead in soil (USEPA 1994a).

- For groundwater, tap water RBCs are used. No RBC is available for lead in groundwater; therefore, the treatment technology action level for drinking water of 15 µg/L (Safe Drinking Water Act action level) is used (USEPA 1994b; FDEP 1994).

- FDEP Soil Cleanup Target Levels based on the aggregate resident are used to screen surface soil (Chapter 62-785 F.A.C.). For subsurface soil, State of Florida Soil Cleanup Target Levels based on leachability are used for screening. The target HQ for noncarcinogenic substances is 1.0, while the target cancer risk is 1×10^{-6} in the soil cleanup criteria. For groundwater, Florida guidance concentrations are used for screening.

- The average concentration of an essential nutrient (e.g., sodium, potassium, magnesium, and calcium) in a medium is below a toxic screening level and consistent with or only slightly above the background concentration for that essential nutrient.

- The frequency of detection (i.e., the number of samples in which the analyte is detected divided by the number of samples analyzed for that analyte) is sufficiently low and professional judgment is used to ensure that the analyte is probably an anomaly. A chemical is considered a candidate for exclusion if (1) it had a low frequency of detection (e.g., less than 5 percent), (2) is not detected in other sampled media or at high concentrations (i.e., contaminated "hot spots" do not exist), and (3) there is no reason to believe that the chemical may be present (USEPA 1989b).

Tentatively identified compounds are screened based on their suspected presence at AOC, the contaminant concentration, the migration potential via each of the identified exposure pathways, and the chemical's toxicity. The tentatively identified compounds of concern are evaluated qualitatively in the HHRA.

5.1.3 Exposure Assessment

The exposure assessment estimates the types and magnitudes of potential human exposure to COPCs. This process involves three steps:

- Characterization of the exposure setting in terms of physical characteristics and the populations that may potentially be exposed to site-related chemicals.
- Identification of exposure pathways and receptors.
- Quantification of exposures for each population in terms of the amount of chemical that is either ingested, inhaled, or absorbed through the skin from all potentially complete exposure pathways.

5.1.3.1 Characterization of Exposure Setting

The physical characteristics of the site and the nature of the surrounding populations are evaluated to provide a basis for assessing potential exposures. The HHRA summarizes important site characteristics that may influence human contact with site contaminants including surface conditions, soil type, degree of vegetative cover, climate, geology, and conditions that affect the migration of contaminants, such as speed and direction of groundwater flow.

The evaluation of population characteristics includes the location of current populations relative to the site and the daily activities of these populations. The presence and location of potentially sensitive subpopulations, such as children or the elderly, are also evaluated. Potential future populations are also considered.

5.1.3.2 Identification of Exposure Pathways and Receptors

This step involves the identification of all relevant exposure pathways through which specific populations may be exposed (currently or in the future) to contaminants at the site. An exposure pathway consists of four necessary elements: (1) a source or mechanism of chemical release, (2) a transport or retention medium, (3) a point of human contact, and (4) a route of exposure at the point of contact (USEPA 1989a).

The first step in defining potential exposure pathways is to identify all sources of contamination (e.g., groundwater and soil). Once sources are identified, relevant fate and transport mechanisms are

evaluated to predict current and potential future exposures. Population characteristics are then used to identify where people may come into contact with contaminated media and the possible routes of exposure (i.e., inhalation, ingestion, or dermal absorption). The receptors to be evaluated are selected based on the current and realistic future use of the AOC and surrounding areas. The human receptors that will be considered during the baseline HHRA of AOC C are (1) military residents, both a young child (age 1-6) and an adult; (2) future residents, both a young child (age 1–6) and an adult; (3) trespassers, both an older child (age 7–16) and an adult; (4) a construction worker; (5) site occupational workers, and (6) a recreational user, both a young child (age 1-6) and an adult. These receptors are described below.

- **Military residents** are individuals who live on base with their families during their tour of duty at NAVSTA Mayport. Typically, a tour of duty is three years. These residents use groundwater extracted from NAVSTA Mayport's on-base water supply wells; however, NAVSTA Mayport treats the groundwater using activated carbon at the well head. Even though the groundwater is treated, to be conservative, exposure to groundwater COPCs will be evaluated in the HHRA.

- **Future residents** are individuals who may currently reside near AOC C or may do so in the future. These residents may come into direct contact with contaminants in surface soils and may rely on the groundwater aquifer as a domestic water supply.

- **Trespassers** are individuals who may from time to time enter a contaminated site without proper authorization and come into contact with contaminated soil.

- **Construction workers** are individuals who may come into contact with surface soils, subsurface soils, or groundwater while excavating or performing construction activities near contaminated sites. Construction workers may also come into contact with surface water or sediment while performing construction.

- **Site occupational workers** are individuals who, during their 8-hour work shifts, may come into contact with contaminated surface soils or may use groundwater as a domestic-type water supply. Exposure of site occupational workers is very task-dependent. For example, the exposure of office workers to site-related contaminants may be much lower than the exposure of landscapers to such contaminants.

- **Recreational users** are individuals who may come in contact with contaminated surface water or sediment during recreational activities, such as swimming or wading.

Table 5-1 identifies the exposure pathways to be evaluated for the current land use population scenarios at AOC C, whereas Table 5-2 identifies the exposure pathways to be evaluated for the future land use population scenarios at the AOC. Currently, AOC C is largely covered with asphalt and concrete, but has some small grassy areas, therefore, soil exposure will be considered for a trespasser (older child and adult), site occupational worker, and construction worker under current conditions. For future conditions, it is assumed that the concrete and asphalt will not necessarily remain in place; therefore, additional receptors will be considered for soil exposure. An on-site resident will be evaluated under future conditions for comparison purposes, although it is expected that the land will continue to be used as a naval base.

The source of contamination or the initial receiving medium is usually the soil. Migration of contaminants from soil occurs through several different mechanisms including leaching to groundwater and water or wind erosion to other media. Mechanisms for migration into air include volatilization (primarily of VOCs) and wind erosion of contaminated soil (all types of contaminants). This process can also lead to relocation of the contaminants to other surface soil. Infiltration can result in migration into subsurface soil and into groundwater. Dissolved analytes (primarily soluble VOCs, SVOCs, and inorganics) are very mobile and may be transported to wells or discharged to surface water.

5.1.3.3 Quantification of Exposures

The next step is to calculate COPC intakes, via each exposure pathway, for each of the potentially exposed populations. An alternative term for intake is dose. Population-related variables are selected that describe the characteristics associated with individual receptors in that population. Intake is dependent upon exposure factors such as contact rate, age, body weight, body surface area, exposure frequency, exposure duration, and averaging time. When possible, exposure factors are selected from the following USEPA guidance documents: *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance "Standard Default Exposure Factors" Interim Final* (USEPA 1991b), *Dermal Exposure Assessment: Principles and Applications* (USEPA 1992b), and the *Exposure Factors Handbook* (USEPA 1997a).

Exposure Point Concentration

Because contaminant concentrations may vary over a site, an EPC is used to express the exposure concentration as a reasonable maximum exposure (RME) for each exposure pathway.

TABLE 5-1

**PROPOSED HUMAN HEALTH RECEPTORS
TO BE EVALUATED FOR CURRENT LAND USE AT AOC C
CA AND RFI WORK PLAN FOR
AREA OF CONCERN C
NAVSTA MAYPORT
MAYPORT, FLORIDA**

Current Land Use Receptors[a]	Exposure Media	Exposure Routes
Trespasser (older child and adult) Site Occupational Worker Construction Worker	Soil	Ingestion Dermal Inhalation
Site Occupational Worker Construction Worker Military Resident (child and adult)	Groundwater (includes leaching from soil to groundwater)	Ingestion Dermal Inhalation

[a]This preliminary list of human health receptors will be refined following the human health characterization phase of the Investigations.

TABLE 5-2

**PROPOSED HUMAN HEALTH RECEPTORS
TO BE EVALUATED FOR FUTURE LAND USE AT AOC C
CA AND RFI WORK PLAN FOR
AREA OF CONCERN C
NAVSTA MAYPORT
MAYPORT, FLORIDA**

Future Land Use Receptors[a]	Exposure Media	Exposure Routes
Future Resident (child and adult) Trespasser (older child and adult) Site Occupational Worker Construction Worker	Soil	Ingestion Dermal Inhalation
Future Resident (adult and child) Site Occupational Worker Construction Worker	Groundwater (includes leaching from soil to groundwater)	Ingestion Dermal Inhalation

[a]This preliminary list of human health receptors will be refined following the human health characterization phase of the investigations.

The Shapiro-Wilk W test is used to evaluate each data set to determine if it fits a normal or lognormal distribution. If neither distribution fit, the maximum concentration is used for the exposure point concentration (EPC). If there are less than 10 samples, the maximum concentration is chosen as the EPC. Otherwise, the normal or lognormal 95 % UCL is calculated for each analyte in each medium using one-half the reporting limit for all nondetects and the average for samples with duplicates. The normal 95% UCL (UCL-N) is used if the Shapiro-Wilk W test indicated a normal distribution, and the lognormal 95% UCL (UCL-L) is used if the

Shapiro-Wilk W (Gilbert, 1987) test indicated a lognormal distribution. The lesser of the maximum concentration and the appropriate UCL is used for the EPC.

If the Shapiro-Wilk test indicates normally distributed data, the calculation of the UCL-N is a two-step process. First the standard deviation of the sample set must be determined, as follows:

$$S = \left[\frac{\Sigma(X_i - \bar{X})^2}{(n-1)}\right]^{1/2}$$

where: S = standard deviation
X_i = individual sample value
n = number of samples
$\bar{x}$ = mean sample value

The one-sided UCL on the mean is then calculated as follows:

$$UCL = \bar{X} + t\left(\frac{S}{n^{1/2}}\right)$$

where: UCL = 95 percent Upper confidence limit of the mean
$\bar{X}$ = Arithmetic average
t = One-sided t distribution factor ($t_{0.95}$)
s = standard deviation
n = number of samples

If the Shapiro-Wilk test indicates log-normally distributed data sets, the UCL-L is calculated using the following equation:

$$UCL = \exp\left(\bar{X} + 0.5s^2 + \frac{Hs}{(n-1)^{1/2}}\right)$$

where: UCL = 95 percent UCL of the mean
exp = Constant (base of the natural log, e)

$\bar{X}$	=	Mean of the transformed data
s	=	Standard deviation of the transformed data
H	=	H-statistic (from Gilbert, 1987; $H_{0.95}$)
n	=	Number of samples

This equation uses individual sample results that have been transformed by taking the natural logarithm of the results.

Chemical Intake

The general equation for calculating chemical intake from the various media is shown below.

$$Intake(mg / kg - day) = \frac{[CxCRxEFxEDxCF]}{[BWxAT]}$$

where

C	=	EPC of the chemical, medium-specific;
CR	=	contact rate, medium-specific;
EF	=	exposure frequency, population-specific;
ED	=	exposure duration, population-specific;
CF	=	conversion factor, medium-specific;
BW	=	body weight of hypothetically exposed individual; and
AT	=	averaging time (for carcinogens, AT=70 years x 365 days/year; for noncarcinogens, AT=ED x 365 days/year).

The specific equations used to calculate intakes from the different exposure pathways and the values used in the risk calculation spreadsheets for each site will be provided in an appendix to the RFI report. Equations and parameters for intake calculations will be presented in formats required by *Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)* (USEPA 1998a).

Some exposure pathways require additional calculations before intake values can be calculated. The following are brief explanations of the additional calculations required for the inhalation of soil vapors and particulates, inhalation of vapors while showering, and dermal absorption from water.

Inhalation of Soil Vapors and Particulates

The chemical concentration in air from soil vapors and particulates is calculated by the following equation:

$$C_{air} = C_{soil} X (1/PEF + 1/VF)$$

where

C_{air} = chemical concentration in air from soil vapors and particulates

C_{soil} = chemical concentration in soil, chemical-specific

PEF = particulate emission factor

VF = volatilization factor, chemical-specific

For nonvolatile chemicals, the 1/VF term is deleted from the equation.

Inhalation of Vapors while Showering

For this exposure scenario, the contaminant concentrations in air are estimated based on release rates of volatiles from shower water. After reviewing the literature, the model selected to predict indoor (bathroom) concentrations is the Foster and Chrostowski (1987) model.

Dermal Absorption from Water

The dermally absorbed dose (DAD) is calculated in accordance with USEPA's *Dermal Exposure Assessment: Principles and Applications, Interim Report* (USEPA, 1992b). The calculation of the DAD requires the calculation of the absorbed dose per event (DAevent). The permeability constant (K_p) is used to calculate the DAevent. For inorganic compounds, the calculation uses a steady-state approach. For organic compounds, the calculations account for unsteady-state conditions typical of the relatively short exposure associated with bathing. In addition, for organic compounds, the calculations account for the dose that can occur after actual bathing is finished due to absorption of chemicals stored in skin lipids.

For inorganics, K_p is assumed to be equal to that of water and the DAevent is equal to the product of three parameters: K_p, the concentration of the chemical in water (C_w), and the duration of the exposure event (t_{event}). For organic chemicals, the DAevent is calculated from a more complex set of equations, which also use K_p, but involve the calculation of several other intermediate factors. A comparison of t_{event} and one of these factors determine which of two separate equations should be used for DAevent for each organic chemical.

5.1.4 Toxicity Assessment

The toxicity assessment evaluates the evidence available on the potential adverse effects associated with exposure to each analyte. With this information, a relationship between the extent of exposure and the likelihood and severity of adverse human health effects is developed. Two steps are typically associated with toxicity assessment: hazard identification and dose-response assessment.

Hazard identification describes adverse effects that have been associated with exposure to a chemical and, more importantly, whether those effects will occur in humans. Characterizing the nature and strength of causation is also a part of the hazard identification step. The HHRA contains a toxicity profile for each COPC found at the AOC. The toxicity profile describes the physical and toxicological properties of each contaminant.

A dose-response assessment is conducted to characterize and quantify the relationship between intake, or dose, of a COPC and the likelihood or severity of a toxic effect or response. There are two major types of toxic effects evaluated in this risk assessment: carcinogenic and noncarcinogenic.

Following USEPA guidance (USEPA 1989a), these two endpoints are evaluated separately. USEPA's weight-of-evidence classifications and numerical toxicity factors for carcinogens have been developed and have undergone extensive peer review. Toxicity information used in the toxicity profile is primarily from the USEPA Integrated Risk Information System (IRIS), USEPA Health Effects Assessment Summary Tables (HEAST), Agency for Toxic Substances and Disease Registry (ATSDR) Toxicology Profiles, and the USEPA Environmental Criteria and Assessment Office.

A dose-response assessment will be completed to identify the relevant oral, dermal, and inhalation toxicity values for carcinogenic [cancer slope factors (CSFs)] and noncarcinogenic [reference doses (RfDs)] effects of the COPCs. As required by USEPA Region IV guidance (USEPA 1995a, b), risks associated with soil and water dermal contact will be evaluated using RfDs and CSFs that are specific to absorbed doses. It will, therefore, be necessary to adjust oral toxicity values so that they can be used for evaluation of absorbed doses. When appropriate published data are available on oral absorption of a specific chemical, such as the chemical-specific ATSDR Toxicological Profile, they are used to make the administered/absorbed dose adjustment. In the absence of chemical-specific data, the USEPA Region IV Office of Health Assessment (OHA) has adopted the following oral absorption efficiencies as interim default values: 80% for VOCs, 50% for SVOCs, and 20% for inorganic chemicals (USEPA 1995c).

5.1.5 Human Health Risk Characterization

Risk characterization involves the integration of the exposure and toxicity assessments into quantitative expressions of potential human health risks associated with COPC exposure. Quantitative estimates of both carcinogenic and noncarcinogenic risks are made for each COPC and each complete exposure pathway identified in the exposure assessment. A clear distinction will be made between risks associated with current and potential future conditions.

Carcinogenic Risks

Carcinogenic risks associated with exposure to individual chemicals will be estimated by multiplying the estimated chemical intake for each carcinogen (in units of mg/kg-day) by its USEPA CSF [in units of $(mg/kg\text{-}day)^{-1}$]. The result is a chemical-specific ELCR. This value represents the probability of developing cancer over the course of a 70-year lifetime as a result of exposure to a chemical. For each exposure pathway, cancer risks associated with multiple carcinogenic compounds are determined by summing the chemical-specific risks to yield a pathway-specific ELCR. For each receptor, cancer risks are summed for all pathways and media. USEPA's guidelines (40 CFR Part 300) state that the total ELCR for an individual resulting from exposure at a hazardous waste site should not exceed a range of 10^{-6} to 10^{-4}. Carcinogenic COPCs that significantly contribute to a pathway in a use scenario for a receptor are considered chemicals of concern (COCs) (USEPA 1995b). In accordance with FDEP Chapter 62-785 F.A.C., remedial goals will be calculated for any risks greater than 10^{-6}, and risks greater than 10^{-6} for individual compounds in any medium will be identified.

Noncarcinogenic Risks

Noncarcinogenic risk estimates will be determined by dividing estimated chemical intakes (in units of mg/kg-day) by the appropriate RfD (in units of mg/kg-day). The resulting ratio is the HQ. The Hazard Quotient (HQs) for individual COPCs within an exposure pathway are summed, resulting in a hazard index (HI) for that pathway. An HI less than or equal to 1.0 represents concentrations and levels of exposure at which no adverse effects are expected. An HI greater than 1.0 indicates there is a risk of adverse effects and the risk increases as the IH increases. An HI above 1.0 will necessitate additional analyses to determine the likelihood of an adverse effect actually occurring if exposure were to occur. If the HI exceeds 1.0, then more specific HIs should be developed by summing HQs of COPCs with RfDs based on toxic effects on the same target organs. The specific target-organ-based HI should form the basis COC selection (USEPA 1995b). COCs are those chemicals with HQs equal to or greater than 0.1 and which have toxic effects on the same target organs. Remedial goals will be calculated for noncarcinogenic COCs (USEPA 1995b).

Remedial Goal Options

The RGOs for chemicals and media of concern will be developed and will include both ARARs and health-based cleanup goals. The purpose of this information is to provide decision-makers with options upon which to develop the remedial approach.

Consistent with USEPA Region IV guidance (USEPA 1993a), if a given medium has a cumulative cancer risk greater than 10^{-4}, its noncarcinogenic HQ is greater than 1.0, and/or ARARs are exceeded, RGOs will be developed for chemicals in that medium.

In accordance with FDEP, any risks greater than 10^{-6} are worthy of further attention; therefore, risks greater than 10^{-6} for individual chemicals in any medium will also be identified, and RGOs will be developed for those chemicals. Chemicals need not be included if their individual carcinogenic risk contribution to the pathway is less than 10^{-6} or their noncarcinogenic HQ is less than 0.1. If a chemical is detected in groundwater and soil (either surface soil or subsurface soil), then the Florida leachability value will be presented as a separate column in the RGO table.

Media cleanup levels are risk-specific and medium- and exposure-scenario-specific analyte concentrations. They are based on the site-specific exposure parameters (combined ingestion, dermal, and inhalation exposures) and the toxicity information used in the baseline risk assessment.

5.1.6 Uncertainty Analyses

Uncertainties in the quantification of risk associated with the site are identified and their impacts on risk estimates are discussed in a separate section of the HHRA. These uncertainties can arise from several sources. Some common uncertainties include: (1) uncertainties in the analytical procedures to accurately define the contaminant concentrations; (2) uncertainties in obtaining EPCs for use as representative of the exposure concentrations; (3) uncertainties in choosing accurate exposure scenarios and representative exposure factors used to calculate intake; (4) uncertainties associated with the accuracy or absence of toxicity values; and (5) uncertainties associated with the potential for synergistic or antagonistic interaction between COPCs.

The majority of the assumptions made in the risk assessment process are conservative; thus, the estimated risk is probably an overestimate of the actual risk associated with exposure at the site.

The uncertainty section of the HHRA may also include unusual site conditions or extenuating circumstances that may be pertinent to risk management decisions. Other factors such as the inadequacy of toxicity factors

to describe all possible COPC–receptor interactions and individual differences within the human population may be included in this section.

5.2 ECOLOGICAL RISK ASSESSMENT METHODOLOGY

In addition to characterizing the nature and extent of site contamination and assessing potential risks to human health, the RFI process requires an assessment of the potential adverse effects of site contamination on the environment. Accordingly, an ecological risk assessment (ERA) will be performed to characterize the potential risks from AOC C-related chemicals to ecological receptors. Section 5.2.1 of this Work Plan provides an overview of the "screening-level" ERA methodology that will be used. Sections 5.2.2 through 5.2.5 describe these methods in detail. Sections 5.2.6 through 5.2.10 present the "baseline" ERA methods, if a baseline ERA is required. Section 5.2.11 provides a discussion of risk management.

The ERA will be conducted according to the following State, Federal and USEPA Region IV guidance:

- *Ecological Risk Assessment at Military Bases: Process Considerations, Timing of Activities, and Inclusion of Stakeholders (USEPA, 1998X)*
- *Department of the Navy Ecological Risk Assessment Policy Memorandum (DON, 1999)*
- *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA, 1997b).
- *Guidelines for Ecological Risk Assessment* (USEPA, 1998b).
- *Tri-Service proceedural Guidelines for Ecological Risk Assessments* (Wentsel, et al., 1996).

5.2.1 Overview: Screening-Level Ecological Risk Assessment

This section provides an outline of the general screening-level approach that will be taken to assess the impacts of site contamination on ecological receptors at AOC C. This assessment will generally follow a two-step process:

Step 1: Preliminary Problem Formulation (Section 5.2.2) and Ecological Effects Evaluation (Section 5.2.3)

- Preliminary Problem Formulation - This is the first phase of an ERA, which discusses the goals, breadth, and focus of the assessment. It includes general descriptions of the site to be investigated with emphasis on the habitats and ecological receptors present. This phase also involves characterization of chemical sources and migration pathways, evaluation of routes of chemical exposure, and selection of analytes to be assessed. Assessment and measurement endpoints are also selected in this phase. Finally, a conceptual model is developed that describes how chemicals associated with AOC C may come into contact with ecological receptors.

- Preliminary Ecological Effects Evaluation - In this phase, medium-specific ecological screening guidelines for each analyte (i.e., concentrations of each chemical above which adverse effects to ecological receptors may occur) are identified. Chemical doses associated with toxicity to representative ecological receptors are also identified. This step is undertaken concurrently with the exposure assessment described below.

Step 2: Preliminary Exposure Estimate (Section 5.2.4) and Risk Calculation (Section 5.2.5)

- Preliminary Exposure Estimate - This portion of the ERA includes the identification of data sources containing concentrations of chemicals to which ecological receptors may be exposed in various media. It also includes the selection of exposure point chemical concentrations from those data. Chemical doses for representative receptors are also calculated.

- Preliminary Risk Calculation - In this step, exposure point concentrations are compared to guidelines in order to characterize potential risk to ecological receptors. Chemical doses associated with toxicity are compared to calculated doses for representative receptors. Analytes found to pose potential risk after these comparisons are selected as ecological COPCs.

When these two steps are completed, the results can be interpreted and the uncertainties associated with the ERA can be addressed. The above process, described in further detail below, represents the first two steps in the general 8-step ERA approach recommended in the most recent USEPA guidance for performing ERAs, the "Process Document" (USEPA 1997b), which will serve as the basis for the ERA methodology. Furthermore, the ERA will be conducted in accordance with other available ERA guidance documents (USEPA 1998X; USEPA 1998b; Wentsel et al., 1996) and recent Department of the Navy ERA policy (DON, 1999). The methods used in this ERA will be based also, in part, on those used in previous ERAs for NAVSTA Mayport as presented in the base General Information Report (GIR; ABB-ES, 1995b).

Due to the potential complexity of ERAs, they are often conducted using a tiered approach and punctuated with Scientific/Management Decision Points (SMDPs). SMDPs are meetings involving the risk assessors, risk managers, and client to control costs, prevent unnecessary analyses, and ensure that the ERA is proceeding in an efficient, timely manner. Information analyzed in one tier is evaluated to determine whether the objectives of the study have been met, and then it may be used to identify the data required for the next tier, if necessary. This ERA will be considered a "screening-level" assessment since it is based on comparing chemical concentrations against conservative screening values. Again, it comprises steps 1 and 2 of the Superfund ERA process.

A baseline ERA (BERA), Steps 3 through 7 in the 8-step Superfund ERA process, may be conducted if the results of the screening-level ERA indicate that additional study is warranted. The BERA includes more focused studies that incorporate the initial screening, but it may also encompass detailed laboratory and field studies or extensive modeling (USEPA 1997b). Since the details of Steps 3 through 7 will depend on the results of the first two steps they will not be discussed in detail in this Work Plan. However, the basic elements of these steps are discussed briefly below.

5.2.2 Preliminary Problem Formulation

5.2.2.1 Habitat Types and Ecological Receptors

Preliminary problem formulation begins with a description of the site (AOC C), its ecological setting (habitat types), and the ecological receptors that are or could be present. A site visit will be conducted by project ecologists to obtain the necessary information for this step. Maps of the habitats will be generated that characterize the habitats present. Plant communities will be identified and classified according to the Florida Natural Areas Inventory (FNAI) habitat classifications (FNAI, 1990). In addition, information regarding rare, threatened, and endangered species will be obtained from base personnel, FNAI, Florida Fish and Wildlife Conservation Commission (FWC), and the United States Fish and Wildlife Service (USFWS). Project ecologists will document the presence or absence of these species during the site visit. It should be noted, however, that AOC C is comprised mostly of developed areas and mowed turfgrass. Therefore, it is unlikely that the site will contain or provide habitat for rare, threatened, and endangered species.

5.2.2.2 Major Chemical Sources and Migration Pathways

The ERA will investigate and document all possible chemical sources and chemical migration pathways to ecological receptors within the AOC. A migration pathway is the pathway by which a chemical travels from its source (e.g., drums in soil) to potential receptors (USEPA 1997b). In general, the possible chemical

migration pathways include volatilization, wind erosion, overland runoff, infiltration, and groundwater-to-surface water migration of chemicals.

5.2.2.3 Exposure Routes

All relevant chemical exposure routes for all types of receptors identified within the AOC will be investigated during preliminary problem formulation. An exposure route is a point of contact/entry of a chemical from the environment into an organism (USEPA 1997b).

Exposure to chemicals in the soil via dermal contact may occur, but is unlikely to represent a major exposure pathway because fur, feathers, and chitinous exoskeletons probably minimize transfer of chemicals across dermal tissue. In addition, little information is available (e.g., absorption factors) to evaluate dermal exposures to wildlife. Therefore, the dermal exposure pathway will not be quantitatively assessed.

Volatile constituents may be present in some site soils, soil-bound chemical resuspension may occur, and combustion may release chemicals into the air at some sites. However, inhalation does not represent a significant exposure pathway because air chemical concentrations are assumed to be quite low, even for burrowing wildlife, unless after a large spill of a volatile compound. In addition, inhalation ecotoxicity data for chronic exposure are lacking. Hence, the air pathway will not be quantitatively considered for ecological receptors.

Although AOC C is located near the Mayport Turning Basin, this ERA will be terrestrial in nature only. As a result, aquatic and semi-aquatic exposure routes will not be investigated (see Section 5.2.2.4)

5.2.2.4 Selection of Analytes to be Investigated

Analytes initially included in the ERA for quantitative analysis will be all chemicals detected in surface soil and groundwater samples to be collected for this study. Calcium, magnesium, potassium, and sodium will be excluded as analytes to be investigated since they are essential nutrients that are toxic only in extremely high concentrations. Due to the scarcity of data for these essential nutrients, it is not possible to develop ranges of toxicity for them, even at high concentrations. The limited toxicity data available indicate that high dietary intake of these nutrients is well tolerated. The process that will be used to select COPCs from the detected analytes is described in Section 5.2.5.

Inorganics in site media that are detected at maximum concentrations less than two times the average background concentrations are typically excluded from further consideration in Region IV. This has historically been performed as per USEPA Region IV preference since inorganics are naturally occurring chemicals that can be found in locally high concentrations regardless of anthropogenic influences. However, USEPA Region IV and the Department of the Navy (DON) (1999) have indicated that use of background or upgradient data for comparisons to site data should at present be investigated in Step 3A of the 8-step ERA process (see Section 5.2.6.1).

If useable, historical data are available, USEPA (1998X) prefers that the screening assessment be performed as part of the Work Plan, and the Work Plan contain the methods to be followed for a baseline ERA (if necessary). No historical surface soil data are available for AOC C. Thus, no screening can be performed as part of the Work Plan for this medium. Data from two sediment samples collected in 1993 in the nearby Mayport Turning Point Basin are available (ABB-ES, 1994X). Given the large size of the basin and AOC C, it is unlikely that data from these two samples would provide enough information on which to base a baseline ERA. More importantly, although potential chemical migration from AOC C to the Turning Point Basin will be investigated in this study, surface water and sediment risk assessment is beyond the scope of this ERA. This is primarily because the basin is dredged every 2 to 3 years for safe berthing of Navy ships. Dredged sediments are transferred through a slurry pipeline to SWMU 50, the Western Dredge Spoil area. Data from any surface water or sediment samples that would be collected for this study, and subsequent evaluation of ecological risks, would be unusable the next time the basin is dredged.

5.2.2.5 Assessment and Measurement Endpoints

As discussed in USEPA (1997b) and Wentsel et al. (1996), one of the major tasks in preliminary problem formulation is the selection of assessment and measurement endpoints. An assessment endpoint is defined as "an explicit expression of actual environmental values that are to be protected" (USEPA 1997b). Measurement endpoints are "measurable ecological characteristics that are related to the valued characteristic chosen as the assessment endpoint" (USEPA 1997b). Assessment endpoints reflect the resources that are to be protected and, thus, are the underpinning of the entire ERA. The remainder of the ERA will directly and indirectly focus and support the assessment endpoints. Hence, the selection of appropriate assessment endpoints is a crucial step in the ERA process. For this ERA, the assessment endpoints will be protection of one or more of the following groups of receptors from adverse effects of chemicals on their growth, survival, and reproduction:

- Birds that feed on terrestrial invertebrates and plants.
- Carnivorous birds.

- Carnivorous mammals.
- Omnivorous mammals.
- Mammals that feed on soil invertebrates.
- Herbivorous mammals.
- Terrestrial vegetation.
- Terrestrial invertebrates.
- Amphibians and reptiles.

The site visit and other relevant information will be used to determine which assessment endpoints are appropriate for inclusion into the AOC C ERA. As indicated above, measurement endpoints are related to assessment endpoints, but these endpoints are more easily quantified or observed. In essence, measurement endpoints, also known as measures of effects (USEPA 1998b) serve as surrogates for assessment endpoints. While declines in populations and shifts in community structure can be quantified, studies of this nature are generally time-consuming and difficult to interpret. However, measurement endpoints indicative of observed adverse effects on individuals are relatively easy to measure in toxicity studies and can be related to the assessment endpoint. For example, chemical concentrations that lead to decreased reproductive success or increased mortality of individuals in toxicity tests could, if found in the environment, result in shifts in population structure, potentially altering the communities on and near AOC C.

5.2.2.6 Preliminary Conceptual Site Model

The conceptual model is designed to diagrammatically identify potentially exposed receptor populations and applicable exposure pathways, based on the physical nature of the site and the potential chemical source areas. Actual or potential exposures of ecological receptors associated with the AOC assessed in this ERA will be determined by identifying the most likely pathways of chemical release and transport. A complete exposure pathway has three components: a source of chemicals that can be released to the environment; a route of chemical transport through an environmental medium; and an exposure route or contact point for an ecological receptor. A preliminary conceptual model for AOC C will be included in the screening-level ERA. The dermal route (direct contact) and inhalation exposure routes will be included in the conceptual model since they are theoretically possible, but as mentioned earlier, they will not be quantitatively investigated.

5.2.3 Preliminary Ecological Effects Evaluation

For this ERA, exposure point concentrations of detected analytes in groundwater and surface soil will compared to ecologically-based guidelines to determine if they should be selected as COPCs. In addition,

toxic doses of chemicals will be compared to modeled doses for representative receptors. The methods used for screening level selection and toxicity reference value (TRV) selection are discussed in detail below.

5.2.3.1 USEPA Region IV Screening Levels

The first step in the USEPA Region IV ERA process is comparison of maximum concentrations of detected chemicals to ecological screening levels. Surface soil screening levels provided by USEPA Region IV will be used for this ERA (USEPA 1998X). Chemicals whose maximum concentrations do not exceed USEPA Region IV screening levels will be dropped from further consideration, while those that equal or exceed USEPA Region IV screening levels will be considered further.

According to conversations with USEPA Region IV, the screening level for benzo(a)pyrene will be used as a surrogate for high molecular weight polyaromatic hydrocarbons (PAHs) when screening levels are not available for those compounds, and the screening level for diethylhexylphthalate (DEHP) will be used when screening levels are not available for some phthalates. Moreover, when screening levels are available for different species of the same inorganic, the screening level for the most toxic form will be used, including those for hexavalent chromium, trivalent arsenic, methyl mercury, and tributyl-tin. The exception will be if speciated chemical data are available.

5.2.3.2 Toxicity Reference Values (TRVs)

Modeling of chemical exposure via the foodchain will be performed to investigate potential risks to terrestrial wildlife. TRVs for individual receptors will be obtained for comparison to estimated doses that the receptors may receive in the environment. TRVs will be preferentially identified that represent a threshold for sub-lethal effects. Sub-lethal effects are defined as those based on the measurement endpoint, which is impairment of reproduction, growth, or long-term survival. Separate TRVs will be obtained for mammals and birds, as discussed below.

Since toxicity data for the specific receptors chosen are not often available, toxicity data from laboratory species will be extrapolated to receptor species. Most of the toxicity data will be obtained from ORNL wildlife toxicity data (Sample et al., 1996). Other sources of toxicity data will be used, which include the Integrated Risk Information System (IRIS) and the ATSDR toxicity profiles. No-observed-adverse-effects-levels (NOAELs) and lowest-observed-adverse-effects-levels (LOAELs) will be used in the models. As specified in USEPA Region IV guidance, LOAELs will be divided by a factor of 10 to obtain NOAELs if NOAELs are not available for a chemical. Following discussions with USEPA Region IV, VOCs were not

included in foodchain modeling. Analytes with log K_{ow} values less than 3.5 (VOCs) generally do not accumulate in animal tissue (Suter, 1993).

Species used in the foodchain modeling will be chosen to represent the groups of receptors most likely to be exposed to the highest chemical concentrations because of their position in the food web, diet (ingestion rate and food type), home range (contained within the area of contamination), and body size. The species selected will be assumed to be representative of other species within the same trophic group or guild. For each of the representative species, information on life history will be obtained and discussed including diet, average body weight, food ingestion rate, home range, and exposure duration (percent of total time that a receptor may reside at the site). Initially, however, the area use factor and exposure duration will conservatively assumed to be 100 percent. The receptors will be selected to represent the groups of organisms specified in the assessment endpoints.

Amphibians and reptiles will not be used as representative receptors in this ERA since toxicity data are lacking (only a few suitable NOAELs are available), resulting in a small, sporadic toxicity database. Hence, the potential risks to reptiles and amphibians from most chemicals cannot be adequately assessed via the foodchain modeling and, therefore, their inclusion in the modeling adds little value to the assessment. Also, the site itself is terrestrial in nature and does not provide habitat for amphibians. A discussion of the uncertainties associated with the absence of toxicity data for this group of receptors will be provided in the ERA.

5.2.4 Preliminary Exposure Estimate

5.2.4.1 Exposure Point Concentrations

The maximum detected concentrations of chemicals in surface soil will be used as exposure point concentrations and will be compared to ecological screening levels in the risk calculation step. The maximum detected concentrations in groundwater will be used as exposure-point chemicals in that medium, if applicable. Aquatic and semi-aquatic organisms will not be directly exposed to groundwater chemicals but could be exposed via groundwater discharge to Mayport Turning Basin. Comparing groundwater concentrations to USEPA Region Iv surface water screening levels is a very conservative measure of potential impacts to aquatic media from contaminated groundwater discharge. It does not take into account dilution at the discharge point(s), which would probably be substantial; the amount of discharge; location of the point(s) of discharge; direction of groundwater flow; or bioavailability of groundwater chemicals.

5.2.4.2 Chemical Doses for Representative Receptors

A simple model will be used to predict dietary exposures for representative receptor species to be compared to TRVs in the risk calculation step. The actual dose a receptor species receives as the result of indirect or direct exposure is dependent upon the habits of the species and other factors. The equations used to calculate the dose of chemicals ingested for each exposure route for the representative receptors that will be used in this ERA are presented below.

Both the maximum and average detected concentrations of chemicals in surface soils will be used in the model. Average concentrations will be used to provide balance in the ERA.

Incidental Ingestion of Soil

Daily intake of each chemical as a result of ingestion of soil will be determined using the following equation:

$$PD_{ingestion\ of\ soil} = (C_{soil} * FI * F)/(WR)$$

where:
- PD = predicted dose from ingestion of soil (mg/kg/day)
- C_{soil} = concentration in soil (mg/kg)
- FI = fractional intake (% of home range that overlaps impacted area assumed to be 100%)
- F = soil consumed (kg/day)
- WR = body weight (kg)

Ingestion of Food items

The following equation will be used to estimate chemical intake from ingestion of contaminated food items:

$$PD_{ingestion\ of\ food} = (C_{food} * F * FA * FI)/(WR)$$

where:
- PD = predicted dose from ingestion of food items (mg/kg/day)
- C_{food} = chemical concentration (vegetation or prey; mg/kg)
- F = food consumed (kg/day)
- FI = fractional intake (% of home range that overlaps affected area assumed to be 100%)
- FA = percent of diet that equals animals and/or vegetation

WR = weight of receptor (kg)

Preferentially the input parameters (e.g., body weight, ingestion rate) for the representative receptors will be obtained from USEPA's *Wildlife Exposure Factors Handbook: Volumes I and II* (USEPA, 1993b). In general, the values used for the input parameters will be conservative (e.g., lowest body weight) presented in the USEPA publication. It should also be noted that the exposure parameters for the receptors will be those previously used in other ERAs for NAVSTA Mayport, when possible.

For simplicity in the screening-level ERA, bioaccumulation factors (BAFs) may be set equal to 1.0; USEPA Environmental Response Team (ERT) currently recommends this approach. USEPA Region IV (Wellman, 1999) has indicated that this approach is acceptable at Federal Facility sites where a multitude of chemicals are expected to be present. In this instance, the potential over- or underestimation of potential risks from certain classes of chemicals will be discussed in the uncertainties. If USEPA Region IV requires that BAFs be used they will be obtained from commonly cited sources and from previous ERAs performed at NAVSTA Mayport.

5.2.5 Risk Calculation

As identified by USEPA (1997b), the preliminary risk calculation step in the ERA process compares chemical doses for representative receptors to doses associated with toxic effects. Also, the maximum concentrations of chemicals in each medium are compared to USEPA Region IV screening levels. The ratio of the exposure point chemical concentration to the screening level or the estimated dose to the toxic dose is called the hazard quotient (HQ), and is defined as follows:

$$HQ_i = EPC_i/ESG_i \quad \text{or} \quad HQ_i = ID_i/TRV_i$$

where:
- HQ_i = Hazard Quotient for analyte "i" (unitless)
- ID_i = Intake Dose for analyte "i" (mg/kg/day)
- EPC_i = Exposure Point Concentration for analyte "i" (ug/L or ug/kg or mg/kg)
- TRV_i = Toxicity Reference Value for analyte "i" (mg/kg/day)
- ESG_i = Ecological Screening Guideline for analyte "i" (ug/L or ug/kg or mg/kg)

When the ratio of the exposure point concentration to its respective guideline exceeds 1.0, adverse impacts will be considered possible, and the chemical will be selected as a COPC. The HQ value should not be construed as being probabilistic; rather, it is a numerical indicator of the extent to which an exposure point concentration exceeds, or is less than a guideline. When HQ values exceed 1.0, it is an indication that

ecological receptors are potentially at risk. Additional evaluation or data may be necessary to confirm with greater certainty whether ecological receptors are actually at risk, especially since most guidelines are conservatively derived (see Section 5.2.6).

The use of HQs is probably the most common method used for risk characterization in ERAs. Advantages of this method, according to Barnthouse et al. (1986), include the following:

- The HQ method is relatively easy to use, is generally accepted, and can be applied to any data.

- The method is useful when a large number of chemicals must be screened.

This method of risk characterization has some inherent limitations. One primary limitation is that it is a "no/maybe" method for relating toxicity to exposure. That is, it uses single values for exposure concentrations and guidelines. The HQ method does not account for the variability in both these parameters, nor for incremental or cumulative toxicity. To loosely address cumulative toxicity, HQs from comparisons to USEPA Region IV screening levels may summed to obtain a HI when chemicals are determined to have similar modes of action, as recommended by USEPA Region IV. This will be done primarily for organochlorine pesticides and PAHs.

The comparisons described above will be presented in screening tables to select COPCs. Screening tables will include the frequency of detection for each analyte, the background concentration, the minimum and maximum detected concentrations, and the chemical-specific USEPA Region IV screening levels. Using maximum chemical concentrations, tables will also generated that present the HQ values for each representative receptor used in the foodchain modeling. Separate screening tables will be provided for maximum and average concentrations. As a result, two sets of COPCs will be generated for the foodchain modeling: maximum concentration COPCs and average concentration COPCs.

In summary, the COPC selection process is as follows:

1. The maximum concentrations of detected chemicals in the AOC C groundwater and surface soil will be compared to USEPA Region IV screening levels, with the exception of the essential nutrients mentioned earlier. If the maximum concentration is less than the USEPA Region IV screening level, it will be dropped from further consideration; if it equals or exceeds the USEPA Region IV screening level, it will be selected as a COPC. If no USEPA Region IV screening level is available the analyte will be selected as a COPC, as per USEPA guidance (1997b).

2. All detected analytes that are known to bioaccumulate or biomagnify will be used in the foodchain modeling.

3. The maximum and average concentrations of COPCs will be used in the foodchain modeling. Hence, a list of maximum concentration COPCs and a list of average concentration COPCs will be generated.

Since no direct exposure is associated with groundwater, COPCs will not selected for this medium. Nevertheless, groundwater analytes with HQs greater than 1.0 will be presented and discussed, as will be groundwater analytes for which no USEPA Region IV screening levels were available.

An SMDP will be conducted after Step 2 to determine if the process should continue into Step 3.

5.2.6 Step 3: Baseline ERA Problem Formulation

This section describes Step 3 in the 8-step ERA process, baseline ERA problem formulation.

5.2.6.1 Step 3A: Refinement of Preliminary COPCs

The use of conservative guidelines and maximum detected concentrations as a starting point for assessing risks in the screening-level assessment is necessary to ensure that potential risks are not underestimated. However, the use of only a comparison of conservative guidelines to maximum detected concentrations as a tool for determining the need for, nature and magnitude of additional ecological work, and/or a complex baseline ERA has severe limitations.

The undertaking of costly additional ecological analyses must be weighed against benefits, especially in such cases where remedial alternatives are limited or do not exist. Moreover, the environment may suffer as sites of lesser ecological significance are given the same priority as sites of clearly greater ecological concern. For these reasons, the consideration of other relevant factors should be employed after the screening-level assessment, primarily to refine the list of COPCs. USEPA Region IV has historically included these factors as part of the screening-level assessment (at the end of Step 2). USEPA Region IV now considers these factors as part of Step 3 of the 8-step process as they relate to elimination of COPCs. These factors are also part of Step 8 (Section 5.2.11), especially as they relate to ultimate risk management decisions for a site. Most importantly, the Department of the Navy (with national EPA concurrence) has issued a memorandum stating that the evaluations mentioned above should always be undertaken to determine if a baseline ERA is necessary, and refers to this as "Step 3A" (DON, 1999).

Several less conservative factors to be considered that are outside the boundaries of simple concentration/guideline comparisons have already been presented. These include the use of average chemical concentrations and LOAELs in the foodchain modeling.

The frequency of detection and spatial analysis of exceedances should be evaluated for all COPCs. Evaluation of these items allows for determination of whether potential risks are widespread or limited to a small area. The magnitude of the HQs should also be evaluated. As described earlier, the relationship between the magnitude of an HQ and toxicity is not necessarily linear. However, the magnitude of an HQ can be used as rough approximation of the extent of potential risks, especially if there is sufficient confidence in the guideline used. USEPA Region IV guidelines are designed to be conservative. Therefore, less conservative guidelines will be presented for surface soils when chemical concentrations exceed USEPA Region IV screening levels. ORNL (Sample et al., 1998) suggest the presentation of all available screening levels in the ERA to help determine potential risks using the "weight-of-evidence."

When chemical concentrations exceed USEPA Region IV screening levels, or no USEPA Region IV screening level is available, less conservative guidelines will be presented as part of Step 3A in tables containing all surface soil COPCs. The tables will also present the average concentration of the COPCs. Stakeholders can use this information to decide if chemicals should be dropped from further consideration.

For surface soils, Dutch "B" and "C" values from Beyer (1990) may be considered, as well as surface soil guidelines from ORNL indicative of toxicity to soil invertebrates and terrestrial plants (Efroymson et al., 1997a, b). In addition, Dutch (MHSP&E, 1994) Intervention values may be considered, which superceded the Dutch values presented in Beyer (1990). Additionally, Canadian Council of Ministers of the Environment (CCME) guidelines may be considered.

Re-evaluation of the conservative parameters used in the foodchain modeling will be performed. Literature-based home ranges for representative receptors may be used, as well as less conservative (more realistic) intake rates. If the HQs drop near or below unity for some chemicals, then the stakeholders should discuss eliminating these chemicals from further consideration. Background data will be presented for inorganic COPCs. COPCs with maximum concentrations comparable to or below background may be dropped from further consideration.

The weight-of-evidence approach (USEPA 1997b) will be used to determine the extent of potential risks when HQ values exceed 1.0. However, analytes will be automatically selected as COPCs if their maximum concentration HQ exceeds 1.0 after screening against USEPA Region IV guidelines.

5.2.6.2 BERA Problem Formulation Issues

If the ERA process continues after Step 3A for some or all COPCs then additional factors are considered in the remainder of Step 3. Issues addressed in the screening-level ERA and Step 3A are refined and reassessed. Further information regarding fate and transport of COPCs will be obtained, the ecosystems potentially at risk will be evaluated in more detail, and COPC exposure routes will be re-evaluated. This information will allow for further refinement of the assessment endpoints and conceptual model. Finally, risk questions and risk hypotheses for the BERA will be developed as they relate to the assessment endpoints. An SMDP occurs following Step 3 that allows all stakeholders to determine if a BERA should be conducted and, if so, what data should be collected.

5.2.7 Step 4: Study Design and Data Quality Objectives

The purpose of the study design is to prove or refute the hypotheses in the ERA conceptual model developed in Step 3 and produce a BERA Work Plan and Sampling and Analysis Plan (SAP). The study design should provide all procedures used for sampling and all methods, models, or techniques used for data analysis. The relation of the measurement endpoints to these procedures and the specific COPCs will also be specified.

5.2.7.1 Measurement Endpoints

Measurement endpoint selection is an important part of this step (Step 4); again, these endpoints are measurable characteristics related to environmental values to be protected (assessment endpoints). They should serve to help answer the risk questions and hypotheses from Step 3. Examples of measurement endpoints follow, which are more focused than the broad endpoints of the screening-level assessment.

- Endpoints for predictive assessments based on environmental chemical concentrations or doses.
  - Concentrations or doses associated with reproductive or developmental effects in published toxicological studies.
  - Concentrations or doses associated with any effect impacting population fitness.

- Endpoints for toxicity testing.

  - Survival
  - Growth

- Fecundity of test organisms

- Endpoints for field studies.

  - Population size
  - Population recruitment
  - Community taxonomic diversity
  - Community standing crop or density
  - Community functional group composition

5.2.7.2 Study Design

In general, the BERA study design will be centered around additional field work. Field work for the assessment may include additional sampling of environmental media, biological tissue sampling, and population/community studies. The uses of these types of data are presented below.

Sampling of surface soil or groundwater may be required to:

- Verify actual concentrations.
- Obtain data for areas not yet sampled.
- Establish temporal trends.
- Provide information needed in transport models.
- Evaluate bioavailability.

Tissue sampling for chemicals known to bioconcentrate or bioaccumulate may be necessary to estimate exposure for herbivores or predators, especially for mammalian and avian receptors. This approach is more accurate than estimating uptake from foodchain models that use contaminant concentrations in soil as inputs. In complex investigations where use of such models is necessary, tissue sampling may be used to validate these models in addition to providing direct exposure data.

Population or community studies are used to evaluate whether effects due to site contaminants are apparent in the field. Typically, measurements are taken at potentially impacted locations and at background or reference areas. The reference areas are selected carefully to be free of site contaminants or other unusual man-induced influences. If statistical comparison of reference to site areas is important, standard techniques are used for establishing the number of samples to be collected from each area, to minimize occurrences of both false positive and false negative errors.

Community studies may be performed to assess potential impacts at the community level. In addition to potential impacts, these studies provide information on the types and abundance of organisms present. A combination of community assessment, toxicity testing, and/or tissue sampling is an efficient design likely to produce useful and conclusive data. In general, co-located samples collected for chemical and biological analysis will be obtained.

5.2.7.3 Project Data Quality Objectives

Project DQOs are also determined as part of Step 4. The goal of DQOs is to clarify the study objectives and define the most appropriate types of data to collect; determine the most appropriate field conditions under which to collect site data; and specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support risk management decisions.

In summary, the BERA Work Plan should include an overview of the study site; a summary of previous analyses and conclusions; a refined conceptual model, which includes identification of potential exposure routes; assessment and measurement endpoints and their relationship to risk hypotheses; identification of the investigations to be conducted; and a description of the assumptions and major sources of uncertainty in the conceptual model and existing information (USEPA 1997b). The sampling and analysis plan (SAP) will consist of a quality assurance project plan and a field-sampling plan. The QAPP provides a description of the steps required to achieve the objectives dictated by the intended use of the data. The FSP should include the sampling type and objectives; sampling location, timing, and frequency; sample designation(s); sampling equipment and procedures; and sample handling and analysis (USEPA 1997b).

The completion of the BERA Work Plan and SAP should coincide with an SMDP. Stakeholders should agree on the measurement endpoints, site investigation methods, and selection of data reduction and interpretation techniques. The BERA Work Plan and SAP will also specify how inferences will be drawn from the measurement to the assessment endpoints.

5.2.8 Step 5: Field Verification of Sampling Design

Step 5 in the ERA process is a site assessment to confirm that the ecological SAP is based on accurate observations. If problems with the BERA Work Plan or the SAP are apparent from the site assessment, then changes to these documents will be proposed. For this step the SMDP is approval of the project-specific SAP, with any appropriate changes.

5.2.9 Step 6: Site Investigation and Analysis Phase

Part of Step 6 is the site field investigation, in which the field work specified in the BERA Work Plan and the SAP is carried out. Any field modifications to the BERA Work Plan based on changing field conditions should be communicated to all stakeholders. If the nature and extent of contamination is revealed to be different than expected (e.g., further downstream of a site), the stakeholders will discuss whether additional sampling is needed. At the completion of fieldwork the process of analysis begins; there is no decision point immediately after the field investigation step, unless alterations to the Work Plan and SAP are required (USEPA 1997b). The analysis phase consists of analysis of ecological exposures and effects from the data collected during Steps 1 through 6. The result of the exposure analysis is an exposure profile that quantifies the magnitude and spatial and temporal patterns of exposure as they relate to the assessment endpoints and risk questions developed during problem formulation (USEPA 1997b). Ecological effects are characterized by an exposure-response analysis, which describes the relationship between the magnitude, frequency, or duration of a chemical stressor in an experimental or observational setting and the magnitude of response. These analyses are used to establish evidence of causality. That is, "does a COPC or COPCs appear to be responsible for observed effects?" All supporting evidence should be used when determining evidence of causality.

5.2.10 Step 7: Risk Characterization

Risk characterization is the seventh step in the eight-step ERA process and final phase of the risk assessment, in which the results of the field assessment are reviewed, combined with data collected earlier, and analyzed. It consists of risk estimation and risk description. There are potentially four approaches used in risk estimation: effects predicted by exposure modeling (including measured contaminant concentrations in tissue) as compared to toxicological data, effects inferred from population/community studies, effects observed in toxicity testing, and chemical data. A risk characterization is developed for each approach, and conclusions are drawn after consideration of each characterization.

Reaching conclusions may be difficult because results from different approaches may be contradictory. If so, a weight-of-evidence approach is used to assess ecological impacts (USEPA 1997b), where the assignment of weight to a particular result is based on the reliability of the data. Reliability is a function of combined measurement error, applicability to the receptors of concern, the degree of realism in modeling, and the confidence and power levels associated with statistical testing.

Risk description is used to document the chemical concentrations that bound the threshold for adverse effects on the assessment endpoints (USEPA 1997b). It can also be used to help the stakeholders judge the ecological significance of the estimated risks. Using all available information an upper- and lower-bound of the threshold for effects should be developed. These can be used to determine the likelihood of potential risks. The risk assessor should also put the estimated risks in context with regard to their extent, magnitude, and ecological significance.

Uncertainty analysis is an important part of risk characterization. Due to the number of potential receptor species and frequent lack of knowledge regarding their life histories, feeding habits, toxicological sensitivities, interactions with other species, and responses to natural environmental changes, the uncertainties surrounding estimates of ecological risk are substantial. Thus, the interpretation of toxicity quotients greater than 1.0, positive results from toxicity testing, or negative results from community comparisons are not necessarily straightforward.

Added to the foregoing sources of uncertainty are those that are common to both human and ecological predictive risk assessments. These include lack of toxicological data, error in analytical data, the COPC identification process, computation of exposure point concentrations, using conservative fate and transport assumptions, and selection of exposure pathways. These uncertainties can be categorized as conceptual model uncertainties, natural variation and parameter error, and model error (USEPA 1997b). These sources of uncertainty and their anticipated effect on estimated risks will be discussed in the risk characterization section of the assessment.

The risk characterization is completed with the production of the ecological risk assessment portion of an RFI report. Decisions regarding future actions take place in the risk management step.

5.2.11 Step 8: Risk Management

Risk management is the eighth and final step in the ERA process. In this step the stakeholders discuss the advisability of no action, remediation, monitoring, or other activities. It should be noted that, as discussed earlier, risk management may have already been employed after the screening-level assessment (in Step 3A), if warranted.

The National Contingency Plan (40 CFR 300.430(f)(1)(i)) specifies nine criteria to be evaluated as part of the analysis of remedial actions (USEPA 1997b), as listed below. The first two are threshold criteria.

1. Overall protection of human health and the environment.

2. Compliance with appropriate or relevant and applicable requirements (ARARs).
3. Long-term effectiveness and permanence.
4. Reduction of toxicity, mobility, or volume of hazardous wastes through the use of treatment.
5. Short-term effectiveness.
6. Implementability.
7. Cost.
8. State acceptance.
9. Community acceptance.

The final SMDP is the Record of Decision (ROD), which will be based on the criteria listed above. The decision should minimize the risk of long-term impacts that could result from the remedy and any residual contamination (USEPA 1997b).

6.0 INVESTIGATION-DERIVED WASTE MANAGEMENT

IDW generated during the CA and RFI field activities will be managed in accordance with the practices and procedures perviously taken by the CLEAN I contractor as described in the *Draft Resource Conservation and Recovery Act Facility Investigation (RFI) Work Plan, Addendum 1, Investigation-Derived Waste Management Plan* (ABB-ES, 1992). Tetra Tech NUS, Inc. emphasizes that management of all IDW will be handled in an environmentally responsible manner consistent with RCRA requirements (USEPA, 1991a). The objectives of IDW management are:

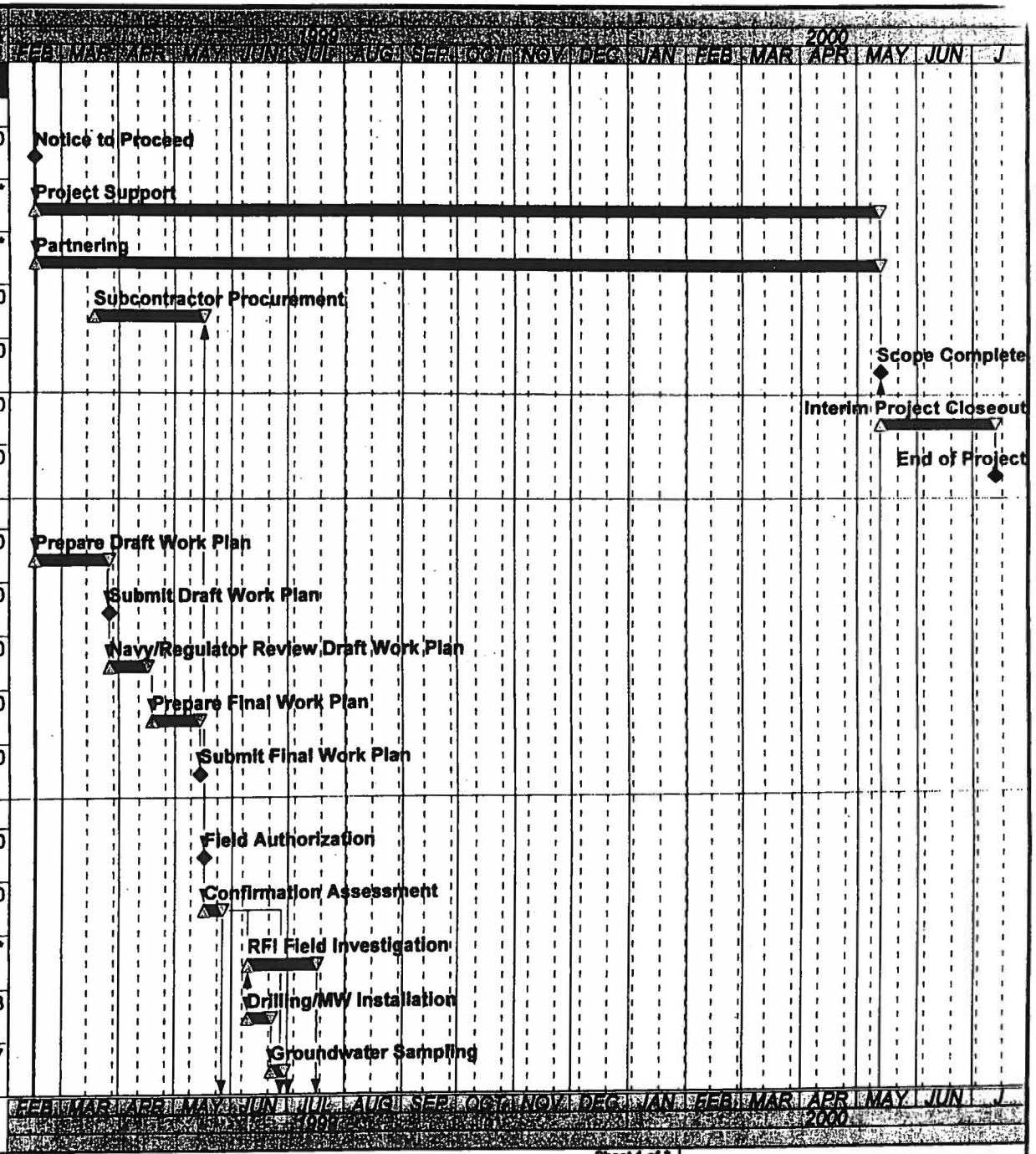
- management of IDW in a manner that prevents contamination of uncontaminated areas (by IDW) and that is protective of human health and the environment;
- minimization of IDW, thereby reducing costs and the potential for human or ecological exposure to contaminated materials; and
- compliance with federal and state requirements that are appropriate or relevent and applicable requirements (ARARs).

A copy of the Draft 1992 Mayport IDW Plan has been included in Appendix F as a general reference for the field investigation IDW Management activities.

7.0 PROJECT SCHEDULE

The anticipated schedule for all major CA and RFI project tasks is presented in Figure 7-1. This schedule is based on assumed site conditions. The estimated start and finish dates as well as the duration of each task, in working days, are shown on the project schedule.

ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	OD
SOW 114 - NS MAYPORT RFI @ AOC C			
PROJECT MANAGEMENT			
Notice to Proceed	15FEB99*		0
Project Support	15FEB99	12MAY00	451*
Partnering	15FEB99	12MAY00	451*
Subcontractor Procurement	18MAR99	16MAY99	60
Scope Complete		12MAY00	0
Interim Project Closeout	13MAY00	12JUL00	60
End of Project		12JUL00	0
PLANNING DOCUMENTS			
Prepare Draft Work Plan	15FEB99	26MAR99	30
Submit Draft Work Plan		26MAR99	0
Navy/Regulator Review Draft Work Plan	27MAR99	16APR99	30
Prepare Final Work Plan	19APR99	14MAY99	20
Submit Final Work Plan		14MAY99	0
FIELD INVESTIGATIONS			
Field Authorization	17MAY99		0
Confirmation Assessment	17MAY99	26MAY99	10
RFI Field Investigation	10JUN99	16JUL99	36*
Drilling/MW Installation	10JUN99	22JUN99	13
Groundwater Sampling	23JUN99	29JUN99	7



Project Start 15FEB99
Project Finish 12JUL00
Data Date 15FEB99
Run Date 03FEB99

Early Bar
Progress Bar
Critical Activity

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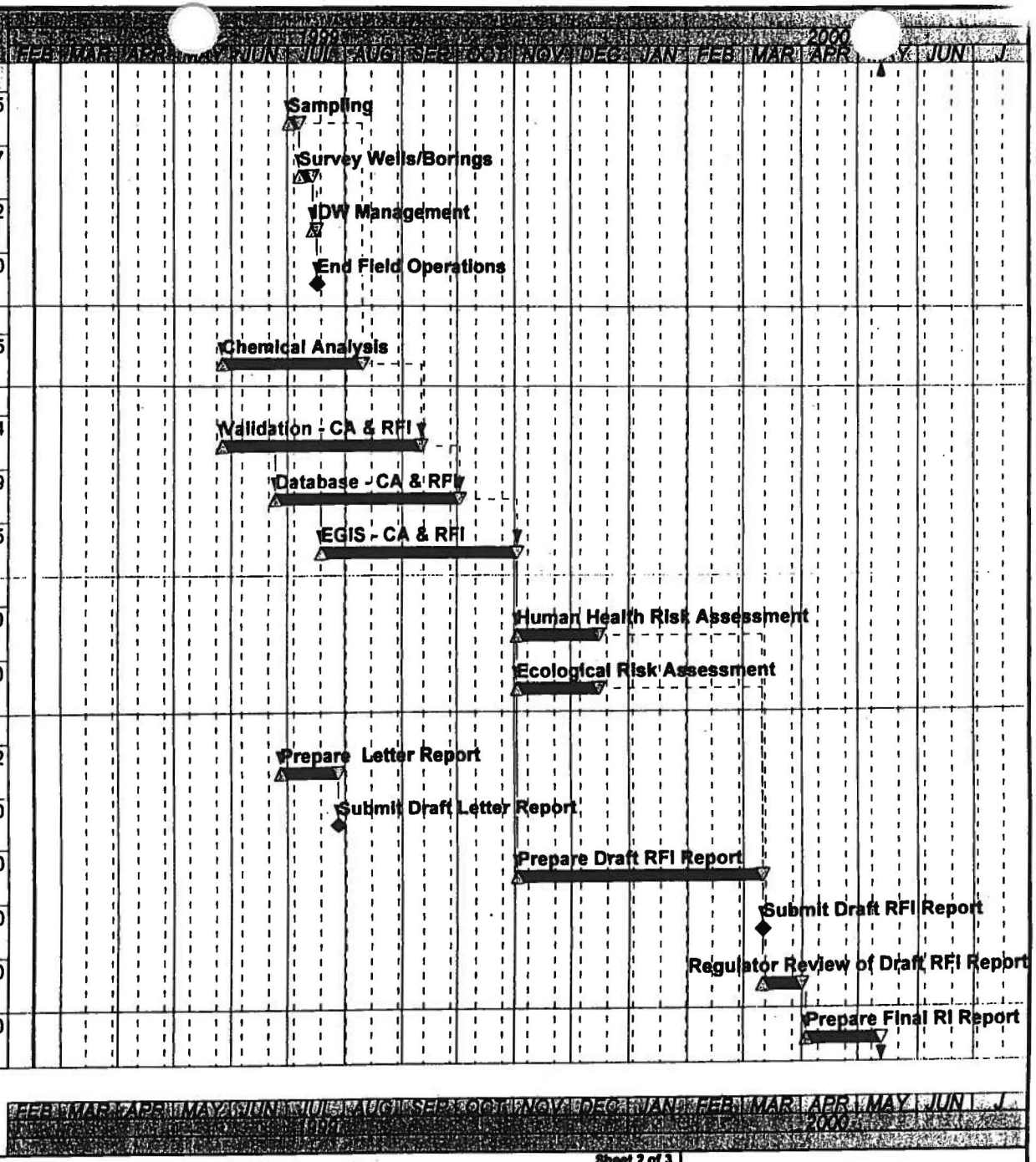
Sheet 1 of 3

SDIV - NAVY CLEAN III

NEGOTIATED BASELINE SCHEDULE

ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	OD
FIELD INVESTIGATIONS			
Sampling	02JUL99	07JUL99	5
Survey Wells/Borings	08JUL99	14JUL99	7
IDW Management	15JUL99	16JUL99	2
End Field Operations		16JUL99	0
LABORATORY ANALYSIS			
Chemical Analysis	27MAY99	10AUG99	75
DATA MANAGEMENT			
Validation - CA & RFI	27MAY99	10SEP99	74
Database - CA & RFI	25JUN99	01OCT99	69
EGIS - CA & RFI	19JUL99	01NOV99	75
RISK ASSESSMENT & REPORT			
Human Health Risk Assessment	02NOV99	15DEC99	30
Ecological Risk Assessment	02NOV99	15DEC99	30
DATA EVALUATION & REPORT			
Prepare Letter Report	28JUN99	28JUL99	22
Submit Draft Letter Report		28JUL99	0
Prepare Draft RFI Report	02NOV99	10MAR00	90
Submit Draft RFI Report		10MAR00	0
Regulator Review of Draft RFI Report	11MAR00	31MAR00	30
Prepare Final RI Report	03APR00	12MAY00	30



Project Start	15FEB99
Project Finish	12JUL00
Data Date	15FEB99
Run Date	03FEB99

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Critical Activity

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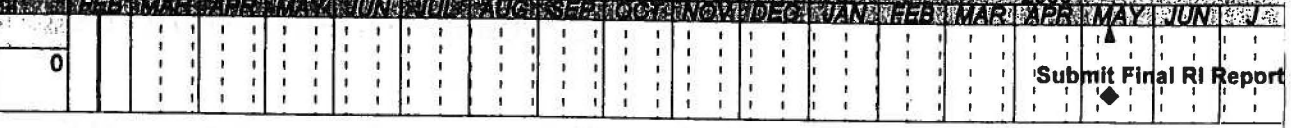
SDIV - NAVY CLEAN III

NEGOTIATED BASELINE SCHEDULE

ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	TOTAL FLOAT
DATA EVALUATION & REPORT			
Submit Final RI Report		12MAY00	0



Project Start	15FEB99
Project Finish	12JUL00
Data Date	15FEB99
Run Date	03FEB99

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Sheet 3 of 3

SDIV - NAVY CLEAN III

NEGOTIATED BASELINE SCHEDULE

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Health and Safety Plan
for
RCRA Facility Investigation

Area of Concern "C"
Building 191/Echo Pier

NAVAL STATION
Mayport, Florida

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 0094

November 1999

HEALTH AND SAFETY PLAN
FOR
RCRA FACILITY INVESTIGATION

AREA OF CONCERN "C"
BUILDING 191/ECHO PIER

NAVAL STATION
MAYPORT, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Department of the Navy, Southern Division
Naval Facilities Engineering Command
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North Charleston, South Carolina 29419-9010

Submitted by:
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CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0094

November 1999

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1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been developed to provide practices and procedures for Tetra Tech NUS, Inc. (TtNUS) and subcontractor personnel engaged in investigatory activities at the Naval Station in Mayport, Florida (NAVSTA Mayport). This HASP must be used in conjunction with the TtNUS Health and Safety Guidance Manual. Both of these documents must be present at the site during the performance of all site activities. The Guidance Manual provides detailed information pertaining to the HASP as well as applicable TtNUS Standard Operating Procedures (SOPs). This HASP and the contents of the Guidance Manual were developed to comply with the requirements stipulated in 29 CFR 1910.120 (OSHA's Hazardous Waste Operations and Emergency Response Standard), OSHA's Construction Industry Standards, 29 CFR 1926; and NAVSTA Mayport procedures and protocol, as they may apply.

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

1.1 KEY PROJECT PERSONNEL AND ORGANIZATION

This section defines responsibility for site safety and health for TtNUS 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 point 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 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 the NAVSTA Mayport, the FOL may also be responsible for SSO duties. This action will be performed only as credentials or experience permits.

1.2 SITE INFORMATION AND PERSONNEL ASSIGNMENTS

Site Name: Naval Station Mayport, Florida

Client Contact: Randy Bishop
Phone Number: (904) 270-6730

Scheduled Activities: This activity will be divided into a multi-task operation, including the tasks of multi-media sampling, soil borings, and monitoring well installation and development. Further detail on these and other site tasks can be found in Section 4 of this HASP.

Dates of scheduled activities: Site activities are expected to begin in mid-1999, and continue until project completion.

Project Team:

TtNUS Management Personnel:	Discipline/Tasks Assigned:
Terry Hansen, P.G.	Task Order Manager (TOM)
TBD ABBY WILCOX	Field Operations Leader (FOL) 904 281-0400
TBD ABBY WILCOX	Site Safety Officer (SSO) 904-281-0400
Matthew M. Soltis, CIH, CSP	CLEAN Health and Safety Manager
Delwyn E. Kubeldis, CIH, CSP	Project Health and Safety Officer (PHSO)

page (800 480 1748
cell 1904 614 4444

Other Potential TtNUS Project Personnel:

TBD	Field Geologist

Non-TtNUS Personnel Affiliation/Discipline/Tasks Assigned

TBD	Drilling subcontractor

Prepared by: Delwyn E. Kubeldis, CIH, CSP

2.0 EMERGENCY ACTION PLAN

2.1 INTRODUCTION

This section has been developed as part of a planning effort to direct and guide field personnel in the event of an emergency. All site activities will be coordinated with the client contact, Randy Bishop. In the event of an emergency which cannot be mitigated using onsite resources, personnel will evacuate to a safe place of refuge and the appropriate emergency response agencies will be notified. It has been determined that the majority of potential emergency situations would be better supported by outside emergency responders. Based on this determination, TtNUS and subcontractor personnel will not provide emergency response support beyond the capabilities of onsite response. Workers who are ill or who have suffered a non-serious injury may be transported by site personnel to nearby medical facilities, provided that such transport does not aggravate or further endanger the welfare of the injured/ill person. The emergency response agencies listed in this plan are capable of providing the most effective 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. NAVSTA Mayport contact Randy Bishop 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, provide the following emergency action measures:

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

2.2 PRE-EMERGENCY PLANNING

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

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

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

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

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

The TtNUS FOL will be responsible for the following tasks:

- Identifying a chain of command for emergency action.

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

- Periodically performing practice drills to ensure site workers are familiar with incidental response measures.

- Providing the necessary equipment to safely accomplish identified tasks.

2.3 EMERGENCY RECOGNITION AND PREVENTION

2.3.1 Recognition

Emergency situations that may be encountered during site activities will generally be recognized by visual observation. Visual observation is primarily relevant for physical hazards that may be associated with the proposed scope of work. Visual observation will also play a role in detecting some chemical hazards. To adequately recognize chemical exposures, site personnel must have a clear knowledge of signs and symptoms of exposure associated with site contaminants. This information is provided in Table 6-1. Tasks to be performed at the site, potential hazards associated with those tasks and the recommended

control methods are discussed in detail in Sections 5.0 and 6.0. Additionally, early recognition of hazards will be supported by daily site surveys to eliminate any situation predisposed to an emergency. The FOL and/or the SSO will be responsible for performing surveys of work areas prior to initiating site operations and periodically while operations are being conducted. Survey findings will be documented by the FOL and/or the SSO in the Site Health and Safety logbook, however, all site personnel will be responsible for reporting hazardous situations. Where potential hazards exist, TtNUS will initiate control measures to prevent adverse effects to human health and the environment.

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

2.3.2 Prevention

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

2.4 EVACUATION ROUTES, PROCEDURES, AND PLACES OF REFUGE

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

In the event of an emergency requiring evacuation, all personnel will immediately stop activities and report to the designated safe place of refuge unless doing so would pose additional risks. When evacuation to the primary place of refuge is not possible, personnel will proceed to a designated alternate location and remain until further notification from the TtNUS FOL. Safe places of refuge will be identified prior to the commencement of site activities by the SSO and will be conveyed to personnel as part of the pre-activities training session. This information will be reiterated during daily safety meetings. Whenever possible, the safe place of refuge will also serve as the telephone communications point for that area.

During an evacuation, personnel will remain at the refuge location until directed otherwise by the TtNUS FOL or the on-site Incident Commander of the Emergency Response Team. The FOL or the SSO will perform a head count at this location to account for and to confirm the location of all site personnel. Emergency response personnel will be immediately notified of any unaccounted personnel. The SSO will document the names of all personnel onsite (on a daily basis) in the site Health and Safety Logbook. This information will be utilized to perform the head count in the event of an emergency.

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

2.5 DECONTAMINATION PROCEDURES / EMERGENCY MEDICAL TREATMENT

During any site evacuation, decontamination procedures will be performed only if doing so does not further jeopardize the welfare of site workers. Decontamination will not be performed if the incident warrants immediate evacuation. However, it is unlikely that an evacuation would occur 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. Attachment I provides the procedure to follow when reporting an injury/illness, and the form to be used for this purpose. **If the emergency involves personnel exposures to chemicals, follow the steps provided in Figure 2-1.**

TABLE 2-1

**EMERGENCY REFERENCE
NAVAL STATION
MAYPORT, FLORIDA**

AGENCY	TELEPHONE
EMERGENCY	911
Fire Department	911 or (904) 270-5333
Base Security	(904) 270-5583 or 5584
Base Medical Clinic (For life threatening emergencies only)	(904) 270-5444
Memorial Health Care Center (For other emergencies)	(904) 858-7500
Base Safety Department	(904) 270-5218
Site Point of Contact, Mr. Randy Bishop	(904) 270-6730
Public Works Trouble Desk (for problems with utilities)	(904) 542-2122
Chemtrec National Response Center	(800) 424-9300 (800) 424-8802
Task Order Manager Terry Hansen	(850) 656-5458
Health and Safety Manager Matthew M. Soltis, CIH, CSP	(412) 921-8912
Project Health and Safety Officer Delwyn E. Kubeldis, CIH, CSP	(412) 921-8529

NOTE: When calling base telephone numbers from within the Base (i.e., from an on-base telephone), dial a zero (0) and the last four digits of the telephone number. For example, to contact the Base Medical Clinic dial 05444.

2.6 EMERGENCY ALERTING AND ACTION/RESPONSE PROCEDURES

TtNUS personnel will be working in close proximity to each other at NAVSTA Mayport. As a result, hand signals, voice commands, and line of site communication will be sufficient to alert site personnel of an emergency. When project tasks are performed simultaneously on different sites, vehicle horns will be used to communicate emergency situations.

If an emergency warranting evacuation occurs, the following procedures are to be initiated:

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

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

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

FIGURE 2-1
EMERGENCY RESPONSE PROTOCOL

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

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

- Rescue, when necessary, employing proper equipment and methods.
- Give attention to emergency health problems -- breathing, cardiac function, bleeding, shock.
- Transfer the victim to the medical facility designated in this HASP by suitable and appropriate conveyance (i.e. ambulance for serious events)
- Obtain as much exposure history as possible (a Potential Exposure report is attached).
- If the exposed person is a Tetra Tech NUS employee, call the medical facility and advise them that the patient(s) is/are being sent and that they can anticipate a call from the Continuum Healthcare physician. Continuum Healthcare will contact the medical facility and request specific testing which may be appropriate. The care of the victim will be monitored by Continuum Healthcare physicians. Site officers and personnel should not attempt to get this information, as this activity leads to confusion and misunderstanding.
- Call Continuum Healthcare at 1-800-229-3674, being prepared to provide:
  - Any known information about the nature of the exposure.
  - As much of the exposure history as was feasible to determine in the time allowed.
  - Name and phone number of the medical facility to which the victim(s) has/have been taken.
  - Name(s) of the exposed Tetra Tech NUS, Inc. employee(s).
  - Name and phone number of an informed site officer who will be responsible for further investigations.
  - Fax appropriate MSDS to Continuum Healthcare at (770) 457-1429.
- Contact Corporate Health and Safety Department (Matt Soltis) at 1-800-245-2730.

As environmental data is gathered and the exposure scenario becomes more clearly defined, this information should be forwarded to the Continuum Healthcare Medical Director or Assistant Medical Director.

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

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

FIGURE 2-1 (continued)
POTENTIAL EXPOSURE REPORT

Name: _____ Date of Exposure: _____

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

Client Contact: _____ Phone No.: _____

Company Name: _____

I. Exposing Agent

Name of Product or Chemicals (if known): _____

_____

Characteristics (if the name is not known)

Solid Liquid Gas Fume Mist Vapor

II. Dose Determinants

What was individual doing? _____

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

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

Was there skin contact? _____

Was the exposing agent inhaled? _____

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

III. Signs and Symptoms (check off appropriate symptoms)

Immediately With Exposure:

Burning of eyes, nose, or throat
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: _____

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

- Dial 911 (outside services) and call other pertinent emergency contacts listed in Table 2-1 and report the incident. Give the emergency operator the location of the emergency, the type of emergency, the number of injured, and a brief description of the incident. Stay on the phone and follow the instructions given by the operator. The operator will then notify and dispatch the proper emergency response agencies.

2.7 PPE AND EMERGENCY EQUIPMENT

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

2.8 EMERGENCY CONTACTS

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

2.9 EMERGENCY ROUTE TO HOSPITAL

The Base Medical Clinic should be used for life-threatening emergencies only. Memorial Health Care Center will be used for medical care beyond basic first aid treatment. Directions to the Center are:

> Exit base, take Mayport Road (A1A) to Atlantic Blvd. Take a right onto Atlantic Blvd. across the Intercoastal Waterway. At the first intersection, take a left onto San Pablo Blvd. The Medical Center is at the intersection of San Pablo Blvd. and Beach Blvd. (14444 Beach Blvd.)

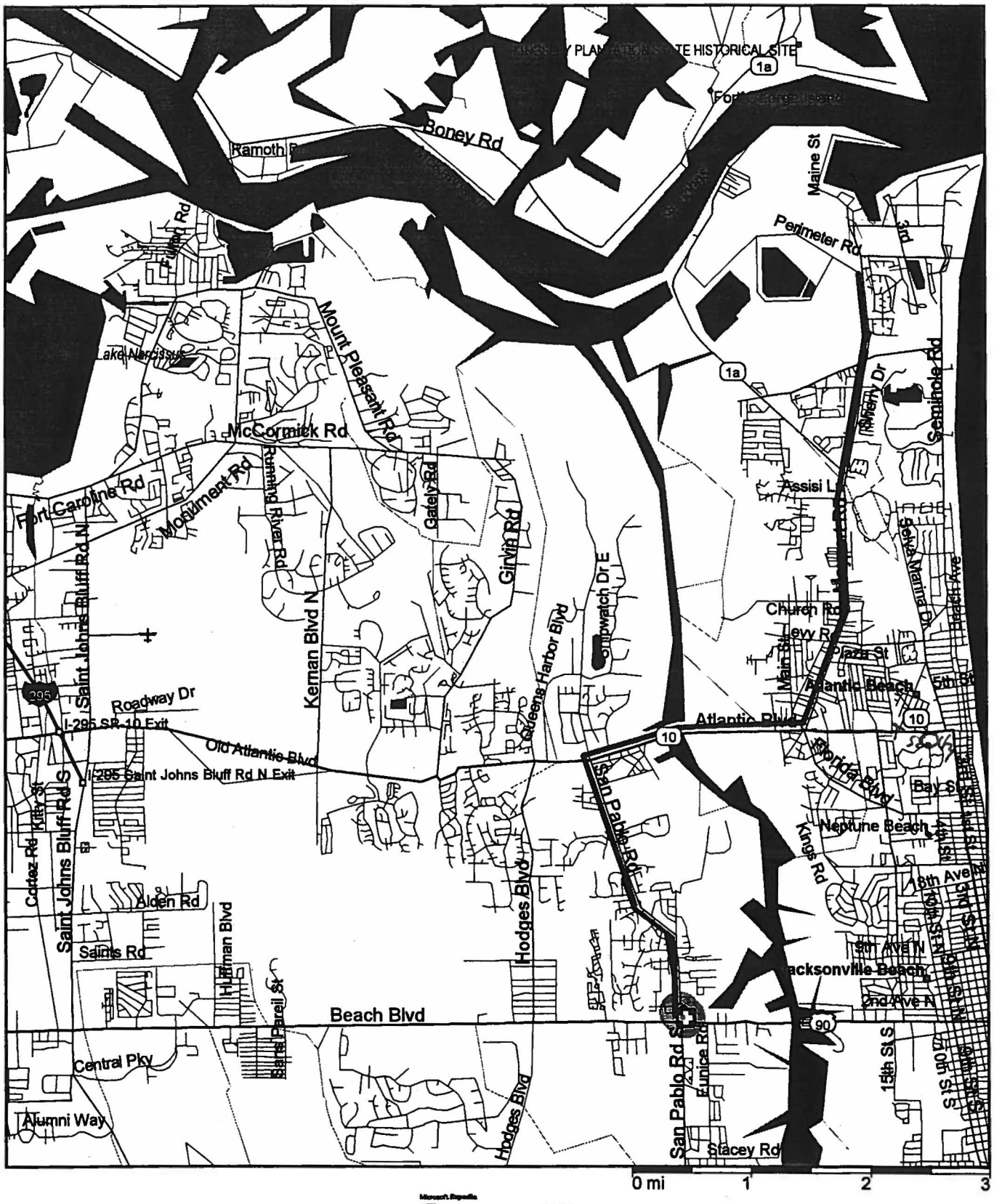
A map indicating the travel route from the site to the Medical Center will be inserted as Figure 2-2.

As soon as possible Navy contact Randy Bishop must be informed of any incident or accident that requires medical attention.

Any pertinent information regarding allergies to medications or other special conditions will be provided to medical services personnel. This information is listed on Medical Data Sheets filed onsite. If an exposure to hazardous materials has occurred, provide hazard information from Table 6-1 to medical service personnel.

ROUTE TO HOSPITAL

AREA OF CONCERN C, H&SP



Streets98

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3.0 SITE BACKGROUND

3.1 SITE HISTORY AND INVESTIGATION AREAS

NAVSTA Mayport is in Duval County, Florida, and approximately 16 miles northeast of Jacksonville at the mouth of the St. Johns River. The base was established in 1942 and is primarily involved in the intermediate-level maintenance of equipment, ships, aircraft, and other support units stationed at the facility .,

3.2 PROJECT SITE DESCRIPTION

Building 191, the Fleet Industrial Supply Center (FISC), is located south of Echo Pier and the Mayport Turning Basin. Storage areas at Building 191 are used to support ship and shore services at NAVSTA Mayport by providing areas to receive, temporarily store, and distribute supplies. Outlying buildings are used to warehouse hazardous materials such as solvents and compressed gases. Three Solid Waste Management Units (SWMUs) are located in the vicinity of Building 191: SWMU 46, the Shore Intermediate Maintenance Activity (SIMA),; SWMU 20, the Hobby Shop Drain; and SWMU 21, Scrap Storage Areas. SIMA is located to the north, across from Building 191 on Massey Avenue. The Hobby Shop (Building 414) is located approximately 270 feet to the east of Building 191. The area south of Building 191 is part of the NAVSTA Mayport Golf Course. Past uses of Building 191 and the results of prior sampling investigations indicate that the groundwater is contaminated with various solvents. Further, an accidental release of tetrachlorethene is documented to have occurred on the asphalt pavement north of Building 191.

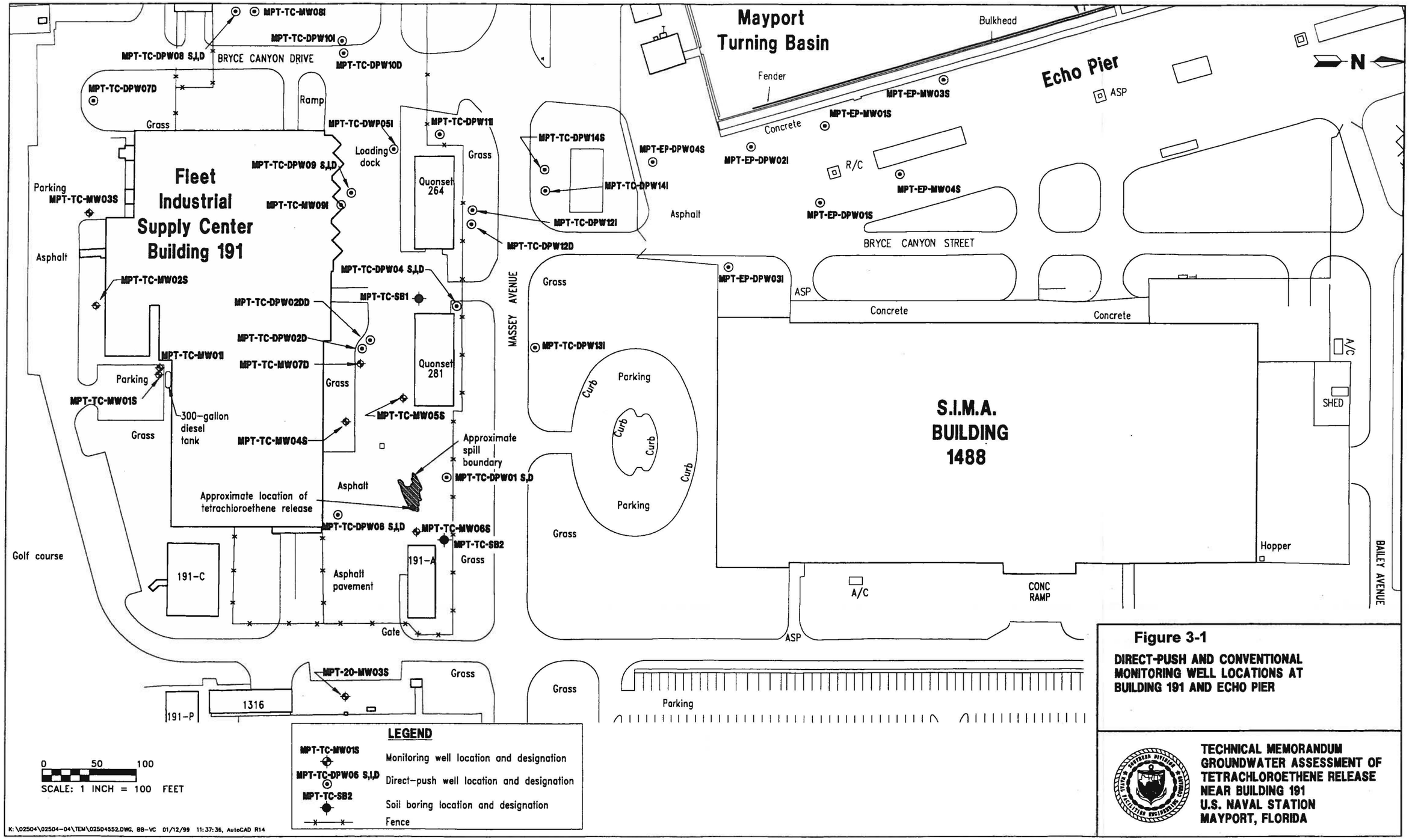

Figure 3-1

DIRECT-PUSH AND CONVENTIONAL MONITORING WELL LOCATIONS AT BUILDING 191 AND ECHO PIER

TECHNICAL MEMORANDUM GROUNDWATER ASSESSMENT OF TETRACHLOROETHENE RELEASE NEAR BUILDING 191 U.S. NAVAL STATION MAYPORT, FLORIDA

Source: Harding Lawson Associates

4.0 SCOPE OF WORK

This section describes the project tasks that will be performed at NAVSTA Mayport. Additionally, each task has been evaluated and the associated hazards and recommended control measures are listed in Table 5-1 of this HASP. The planned activities involved in this effort are presented in detail in the Work Plan developed for the project. If new tasks are to be performed at the site, Table 5-1 and this section will be modified accordingly.

Field investigations to be performed by TtNUS are designed to characterize soil and groundwater conditions at NAVSTA Mayport. Specific tasks to be conducted include, but are not necessarily limited to, the following:

- Soil borings (using Direct Push Technology and hollow-stem augers)
- Multi-media sampling, including:
  - Soil (surface and subsurface)
  - Groundwater
  - IDW
- Monitoring well installation, development, and purging
- Decontamination of sampling and heavy equipment
- Mobilization and demobilization

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

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.

As discussed earlier, 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 Tetra Tech NUS' SOPs are also provided in this Guidance Manual.

Safe Work Permits issued for all exclusion zone activities (See Section 10.10) 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.

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TABLE 5-1
TASKS/HAZARDS/CONTROL MEASURES COMPENDIUM FOR NAVAL STATION, MAYPORT, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring	Personal Protective Equipment	Decontamination Procedures
Soil borings using Direct-Push Technology (such as the Geoprobe®) and hollow stem augers. This task also includes monitoring well installation, development, and purging.	*Chemical Hazards* 1) Primary types of contaminants include VOCs, specifically solvents trichloroethylene, perchloroethylene, 1,1-Dichloroethene, and vinyl chloride; and SVOCs, including diesel fuel, waste oils, and general Polynuclear Aromatic Hydrocarbons (PAH's). Note that these contaminants may be bound to particulates (dusts, soils, etc.) and contact with dusts should be avoided whenever possible. None of the site contaminants, however, are anticipated to be present in significant concentrations to present an inhalation hazard. See Table 6-1 for more information on the chemicals of concern. . 2) Transfer of contamination into clean areas or onto persons *Physical hazards* 3) Heavy equipment hazards (pinch/compression points, rotating equipment, hydraulic lines, etc.) 4) Noise in excess of 85 dBA 5) Energized systems (contact with underground or overhead utilities) 6) Lifting (strain/muscle pulls) 7) Slip, trips, and falls 8) Vehicular and Pier traffic 9) Ambient temperature extremes (heat stress) *Natural hazards* 10) Insect/animal bites and stings (including fire ants and Eastern diamondback rattlesnakes) 11) Inclement weather	1) Use real-time monitoring instrumentation, action levels, and identified PPE to control exposures to potentially contaminated media (air, water, soils, etc.). Generation of dusts should be minimized. If airborne dusts are observed, area wetting methods may be used. If area wetting methods are not feasible, termination of activities may be used to minimize exposure to excessive airborne dusts. 2) Decontaminate all equipment and supplies between boreholes and prior to leaving the site. 3) All equipment to be used will be - Inspected in accordance with Federal safety and transportation guidelines, OSHA (1926.600,.601,.602), and manufacturers design and documented as such using Equipment Inspection Sheet (see Attachment III of this HASP). - Operated by knowledgeable operators and ground crew. - Only manufacturer approved equipment may be used in conjunction with equipment repair procedures In addition to the equipment considerations, the following standard operating procedures will be employed: - All personnel not directly supporting the drilling operation will remain at least 25 feet from the point of operation. - All loose clothing/protective equipment will be secured to avoid possible entanglement. - Hand signals will be established prior to the commencement of direct push activities. - A remote sampling device must be used to sample drill cuttings near rotating tools. - Work areas will be kept clear of clutter. - All personnel will be instructed in the location and operations of the emergency shut off device(s). This device will be tested initially (and then periodically) to insure its operational status. - Areas will be inspected prior to the movement of direct push rigs and support vehicles to eliminate any physical hazards. This will be the responsibility of the FOL and/or SSO. 4) Hearing protection will be used during all subsurface activities. 5) All utility clearances shall be obtained, in writing, prior to subsurface activities (contact Randy Bishop). Prior to any subsurface investigations, the locations of all underground utilities will be identified and marked. 6) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 7) Preview work locations for unstable/uneven terrain. 8) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base and Pier requirements. 9) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual. 10) Avoid potential nesting areas of biting/stinging insects and snakes. Use commercially available insect repellents. Wear appropriate clothing, including snake chaps where warranted. Tape ankle and wrists areas to prevent fire ants, ticks, chiggers, etc. from attaching themselves to you skin. Wear light colored clothing so that biting insects can be easily visible and be removed. Follow directions as specified in Section 6.3 and Attachment II concerning natural hazards. 11) Suspend or terminate operations until directed otherwise by SSO	**It is anticipated that potential contaminant concentrations at outdoor sample locations will not present an inhalation hazard.** A direct reading Photoionization Detector (PID) or 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: - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above background in the breathing zone of the at-risk employees requires site activities to be suspended and site personnel to report to an unaffected area. - Work may only resume if airborne readings in worker breathing zone return to below background levels. If elevated readings in worker breathing zone persist, the PHSO and HSM will be contacted to determine necessary actions and levels of protection. Site contaminants may adhere to or be part of airborne dusts or particulates generated during site activities. Generation of dusts should be minimized to avoid inhalation of contaminated dusts or particulates. Evaluation of dust concentrations will be performed by observing work conditions for visible dust clouds. Potential exposure to contaminated dust will be controlled using water suppression, by avoiding dust plumes, or evacuating the operation area until dust subsides. Where the utility clearance cannot be determined, subsurface activities shall proceed with extreme caution using a magnetometer for periodic down-hole surveys every 2 feet to a depth of at least 10 feet.	All subsurface operations are to be initiated in Level D protection. Level D protection constitutes the following minimum protection - Standard field attire (Sleeved shirt; long pants) - Safety shoes (Steel toe/shank) - Safety glasses - Nitrile gloves or leather gloves with surgical style inner gloves - Hardhat - Reflective vest for traffic areas - *Tyvek coveralls and disposable boot covers if surface contamination is present or if the potential exists for soiling work attire. Coveralls may also be worn to protect exposed skin from insects, fire ants, etc. Joints (ankles and wrists) should be taped.* - *Snake chaps shall be worn in areas of known or suspected snake infestation.* - *Hearing protection during drilling or for other high noise areas as directed by the SSO.* *(Items in italics are deemed optional as conditions or the FOL or SSO dictate.)* **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	**Personnel Decontamination** - Will consist of a soap/water wash and rinse for reusable protective equipment (e.g., gloves). This function will take place at an area adjacent to the drilling operations bordering the support zone. This decontamination procedure for Level D protection will consist of - Equipment drop - Soap/water wash and rinse of reusable outer gloves, as applicable - Outer coveralls, boot covers, and/or outer glove removal - Removal, segregation, and disposal of non-reusable PPE in bags/containers provided - Wash hands and face, leave contamination reduction zone. In addition, workers should inspect themselves and one another for the presence of fire ants, ticks, and other insects when exiting wooded areas, grassy fields, etc. This action will be employed to stop the transfer of these insects into vehicles, homes, and offices.

TABLE 5-1
TASKS/HAZARDS/CONTROL MEASURES COMPENDIUM FOR NAVAL STATION, MAYPORT, FLORIDA
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Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring	Personal Protective Equipment	Decontamination Procedures
Multi-media sampling, including soil (surface and subsurface) and groundwater sampling. IDW sampling is included in this task.	*Chemical Hazards* 1) Primary types of contaminants include VOCs, specifically solvents trichloroethylene, perchloroethylene, 1,1-Dichloroethene, and vinyl chloride; and SVOCs, including diesel fuel, waste oils, and general Polynuclear Aromatic Hydrocarbons (PAH's). Note that these contaminants may be bound to particulates (dusts, soils, etc.) and contact with dusts should be avoided whenever possible. None of the site contaminants, however, are anticipated to be present in significant concentrations to present an inhalation hazard. See Table 6-1 for more information on the chemicals of concern. 2) Transfer of contamination into clean areas *Physical hazards* 3) Noise in excess of 85 dBA 4) Lifting (strain/muscle pulls) 5) Pinches and compressions 6) Slip, trips, and falls 7) Ambient temperature extremes (heat stress) 8) Vehicular and Pier traffic 9) Working over or near water (drowning) *Natural hazards* 10) Insect/animal bites and stings (including fire ants and Eastern diamondback rattlesnakes) 11) Inclement weather	1) Use real-time monitoring instrumentation, action levels, and identified PPE to control exposures to potentially contaminated media (e.g. air, water, soils). Generation of dusts should be minimized. If airborne dusts are observed, area wetting methods may be used. If area wetting methods are not feasible, termination of activities may be used to minimize exposure to observed airborne dusts. 2) Decontaminate all equipment and supplies between sampling locations and prior to leaving the site. 3) When sampling at the drill rig and Geoprobe use hearing protection. The use of hearing protection outside of 25 feet from the drill rig and Geoprobe should be incorporated under the following condition: If you have to raise your voice to talk to someone who is within 2 feet of your location, hearing protection must be worn. 4) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 5) Keep any machine guarding in place. Avoid moving parts. Use tools or equipment where necessary to avoid contacting pinch points. - A remote sampling device must be used to sample drill cuttings near rotating tools. The equipment operator shall shutdown machinery if the sampler is near moving machinery parts. 6) Preview work locations for unstable/uneven terrain. 7) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding cold/heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual. 8) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base and Pier requirements. 9) All personnel working on or near water will wear USCG-approved flotation devices. At least one life saving skiff or other vessel shall be immediately available for rescue purposes. 10) Avoid potential nesting areas of biting/stinging insects and snakes. Use commercially available insect repellents. Wear appropriate clothing, including snake chaps where warranted. Tape ankle and wrists areas to prevent fire ants, ticks, chiggers, etc. from attaching themselves to you skin. Wear light colored clothing so that biting insects can be easily visible and be removed. Follow directions as specified in Section 6.3 and Attachment II concerning natural hazards. 11) Suspend or terminate operations until directed otherwise by SSO	**It is anticipated that potential contaminant concentrations at outdoor sample locations will not present an inhalation hazard.** A direct reading Photoionization Detector (PID) or 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: - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above background in the breathing zone of the at-risk employees requires site activities to be suspended and site personnel to report to an unaffected area. - Work may only resume if airborne readings in worker breathing zone return to below background levels. If elevated readings in worker breathing zone persist, the PHSO and HSM will be contacted to determine necessary actions and levels of protection. Site contaminants may adhere to or be part of airborne dusts or particulates generated during site activities. Generation of dusts should be minimized to avoid inhalation of contaminated dusts or particulates. Evaluation of dust concentrations will be performed by observing work conditions for visible dust clouds. Potential exposure to contaminated dust will be controlled using water suppression, by avoiding dust plumes, or evacuating the operation area until dust subsides.	Level D protection will be utilized for the initiation of all sampling activities. Level D - (Minimum Requirements) - Standard field attire (Sleeved shirt; long pants) - Safety shoes (steel toe/shank) - Safety glasses - Surgical style gloves (double-layered if necessary) - Reflective vest for high traffic areas - *Hardhat (when overhead hazards exists, or identified as a operation requirement)* - *Tyvek coveralls and disposable boot covers if surface contamination is present or if the potential exists for soiling work attire. Coveralls may also be worn to protect exposed skin from insects, fire ants, etc. Joints (ankles and wrists) should be taped.* - *Snake chaps shall be worn in areas of known or suspected snake infestation.* *(Items in italics are deemed optional as conditions or the FOL or SSO dictate.)* **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	**Personnel Decontamination** will consist of a removal and disposal of non-reusable PPE (gloves, coveralls, etc., as applicable). The decon function will take place at an area adjacent to the site activities. This procedure will consist of: - Equipment drop - Outer coveralls, boot covers, and/or outer glove removal (as applicable) - Removal, segregation, and disposal of non-reusable PPE in bags/containers provided - Soap/water wash and rinse of reusable PPE (e.g., hardhat) if potentially contaminated - Wash hands and face, leave contamination reduction zone. In addition, workers should inspect themselves and one another for the presence of fire ants, ticks, and other insects when exiting wooded areas, grassy fields, etc. This action will be employed to stop the transfer of these insects into vehicles, homes, and offices.

TABLE 5-1
TASKS/HAZARDS/CONTROL MEASURES COMPENDIUM FOR
NAVAL STATION, MAYPORT, FLORIDA
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Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring	Personal Protective Equipment	Decontamination Procedures
Mobilization/ Demobilization	*Physical Hazards* 1) Lifting (strain/muscle pulls) 2) Pinches and compressions 3) Slip, trips, and falls 4) Heavy equipment hazards (rotating equipment, hydraulic lines, etc.) 5) Vehicular and foot traffic 6) Ambient temperature extremes (heat stress) *Natural hazards* 7) Insect/animal bites and stings (including fire ants and Eastern diamondback rattlesnakes) 8) Inclement weather	1) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 2) Keep any machine guarding in place. Avoid moving parts. Use tools or equipment where necessary to avoid contacting pinch points. 3) Preview work locations for unstable/uneven terrain. 4) All equipment will be - Inspected in accordance with OSHA, and manufacturer's design. - Operated by knowledgeable operators, and knowledgeable ground crew. 5) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base and Pier requirements. 6) 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. 7) Avoid potential nesting areas of biting/stinging insects and snakes. Use commercially available insect repellents. Wear appropriate clothing, including snake chaps where warranted. Tape ankle and wrists areas to prevent fire ants, ticks, chiggers, etc. from attaching themselves to you skin. Wear light colored clothing so that biting insects can be easily visible and be removed. Follow directions as specified in Section 6.3 and Attachment II concerning natural hazards. 8) Suspend or terminate operations until directed otherwise by SSO.	Not required	Level D - (Minimum Requirements) - Standard field attire (Sleeved shirt; long pants) - Safety shoes (Steel toe/shank) - *Safety glasses* - *Hardhat (when overhead hazards exists, or identified as a operation requirement)* - *Reflective vest for high traffic areas* - *Coveralls may be worn to protect exposed skin from insects, fire ants, etc. Joints (ankles and wrists) should be taped.* - *Snake chaps shall be worn in areas of known or suspected snake infestation.* *(Items in italics are deemed optional as conditions or the FOL or SSO dictate.)*	Not required
Decontamination of Sampling and Heavy Equipment	*Chemical Hazards* 1) Primary types of contaminants include VOCs, specifically solvents trichloroethylene, perchloroethylene, 1,1-Dichloroethene, and vinyl chloride; and SVOCs, including diesel fuel, waste oils, and general Polynuclear Aromatic Hydrocarbons (PAH's). Note that these contaminants may be bound to particulates (dusts, soils, etc.) and contact with dusts should be avoided whenever possible. None of the site contaminants, however, are anticipated to be present in significant concentrations to present an inhalation hazard. See Table 6-1 for more information on the chemicals of concern. 2) Decontamination fluids - Liquinox (detergent), acetone or isopropanol *Physical Hazards* 3) Lifting (strain/muscle pulls) 4) Noise in excess of 85 dBA 5) Flying projectiles 6) Vehicular and Pier traffic 7) Ambient temperature extremes (heat stress) 8) Slips, trips, and falls	1) and 2) Employ protective equipment to minimize contact with site contaminants and hazardous decontamination fluids. Obtain manufacturer's MSDS for any decontamination solvents used onsite. Use appropriate PPE as identified on MSDS. All chemicals used must be listed on the Chemical Inventory for the site, and site activities must be consistent with the Hazard Communication section of the Health and Safety Guidance Manual (Section 5). 3) Use multiple persons where necessary for lifting and handling sampling equipment for decontamination purposes. 4) Wear hearing protection when operating pressure washer. 5) Use eye and face protective equipment when operating pressure washer. All other personnel must be restricted from the area. 6) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base and Pier requirements. 7) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding cold/heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual. 8) Preview work locations for unstable/uneven terrain.	Use visual observation, and real-time monitoring instrumentation to ensure all equipment has been properly cleaned of contamination and dried. After decon is completed, screen equipment with a PID/FID. If any elevated readings (i.e., above background) are observed, perform decon again and rescreen. Repeat until no elevated PID/FID readings are noted.	For Heavy Equipment This applies to high pressure soap/water, steam cleaning wash and rinse procedures. Level D Minimum requirements - - Standard field attire (Long sleeve shirt; long pants) - Safety shoes (Steel toe/shank) - Chemical resistant boot covers - Nitrile outer gloves - *PVC Rainsuits or PE or PVC coated Tyvek* - *Safety glasses underneath a splash shield* - *Hearing protection (plugs or muffs)* *Items in italics are at the discretion of the SSO.* For sampling equipment (trowels, MacroCore Samplers, bailers, etc.), the following PPE is required Level D Minimum requirements - - Standard field attire (Long sleeve shirt; long pants) - Safety shoes (Steel toe/shank) - Nitrile outer gloves - Safety glasses	**Personnel Decontamination** will consist of a soap/water wash and rinse for reusable outer protective equipment (boots, gloves, PVC splash suits, as applicable). The decon function will take place at an area adjacent to the site activities. This procedure will consist of: - Equipment drop - Soap/water wash and rinse of outer boots and gloves, as applicable - Soap/water wash and rinse of the outer splash suit, as applicable - Disposable PPE will be removed and bagged. **Equipment Decontamination** - All heavy equipment decontamination will take place at a centralized decontamination pad utilizing steam or pressure washers. The drill rig and Geoprobe will have the wheels and tires cleaned along with any loose debris removed, prior to transporting to the central decontamination area. All site vehicles will have restricted access to exclusion zones, and have their wheels/tires sprayed off as not to track mud onto the roadways servicing this installation. Roadways shall be cleared of any debris resulting from the onsite activity. **Sampling Equipment Decontamination** Sampling equipment will be decontaminated as per the requirements in the Sampling and Analysis Plan and/or Work Plan. MSDS for any decon solutions (Alconox, isopropanol, etc.) will be obtained and used to determine proper handling / disposal methods and protective measures (PPE, first-aid, etc.). All equipment used in the exclusion zone will require a complete decontamination between locations and prior to removal from the site. The FOL or the SSO will be responsible for evaluating equipment arriving onsite and leaving the site. No equipment will be authorized access or exit without this evaluation.

TABLE 5-1
TASKS/HAZARDS/CONTROL MEASURES COMPENDIUM FOR
NAVAL STATION, MAYPORT, FLORIDA
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Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring	Personal Protective Equipment	Decontamination Procedures
IDW management.	***Chemical hazards:*** **Exposure to potential site contaminants during these activities is unlikely given the nature of the work and the limited contact with potentially contaminated media.** ***Physical hazards:*** 1) Slip, trips, and falls 2) Pinches and compressions ***Natural Hazards:*** 3) Insect/animal bites and stings (including fire ants and Eastern diamondback rattlesnakes) 4) Inclement weather	1) Preview work locations and site lines for uneven and unstable terrain. Clear necessary vegetation, establish temporary means for traversing hazardous terrain(i.e., rope ladders, etc.) 2) Keep hands and fingers away from pinch areas associated with moving/handling IDW drums. Avoid moving parts. Use tools or equipment where necessary to avoid contacting pinch points. 3) Avoid potential nesting areas of biting/stinging insects and snakes. Use commercially available insect repellents. Wear appropriate clothing, including snake chaps where warranted. Tape ankle and wrists areas to prevent fire ants, ticks, chiggers, etc. from attaching themselves to you skin. Wear light colored clothing so that biting insects can be easily visible and be removed. Follow directions as specified in Section 6.3 and Attachment II concerning natural hazards. 4) Suspend or terminate operations until directed otherwise by SSO.	No air monitoring is needed given the unlikelihood that volatile contaminants are present during surveying activities and the non-intrusive nature of the task. The potential for exposure to site contaminants during this activity is considered minimal. Minimize the generation of airborne dusts since most site contaminants are in the form of a particulate or may be bound to particulates.	These miscellaneous activities will be performed in Level D protection (unless otherwise indicated) consisting of the following: - Standard field dress including sleeved shirt and long pants - Steel-toe work boots or shoes - Safety glasses and hard hats (if working near machinery) *- Coveralls may also be worn to protect exposed skin from insects, fire ants, etc. Joints (ankles and wrists) should be taped.* *- Snake chaps shall be worn in areas of known or suspected snake infestation.* *(Items in italics are deemed optional as conditions or the FOL or SSO dictate.)*	Personnel Decontamination - A structured decontamination is not required as the likelihood of encountering contaminated media is considered remote. Workers should inspect themselves and one another for the presence of fire ants, ticks, and other insects when exiting wooded areas, grassy fields, etc. This action will be employed to stop the transfer of these insects into vehicles, homes, and offices.

6.0 HAZARD ASSESSMENT

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

6.1 CHEMICAL HAZARDS

The potential health hazards associated with Building 191 and Echo Pier at NAVSTA Mayport include inhalation, ingestion, and dermal contact of various contaminants that may be present in shallow and deep soils and groundwater. As the focus of this field investigation is to conduct additional sampling of various media at the sites, concentrations of the chemical hazards present are not fully determined. Based on the operations at Building 191 and the Pier the types of contaminants anticipated include solvents, diesel fuel, and waste oil products. The following have been identified as the primary classes of these contaminants, including the specific compound(s) of interest:

- Volatile Organic Compounds (VOCs), specifically the solvents trichloroethylene, perchloroethylene, 1,1-Dichloroethene, and vinyl chloride
- Semi-Volatile Organic Compounds (SVOCs), including Total Petroleum Hydrocarbons (TPHs) such as diesel fuel, waste oils, and general Polynuclear Aromatic Hydrocarbons (PAH's)

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 (drilling, 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.

TABLE 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
NAVAL STATION
MAYPORT, FLORIDA

Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
Diesel Fuel No.2-D	Mixture	Components of this substance will be detected readily; however, no documentation exists as to the relative response ratio of either PID or FID.	Air sampling use charcoal tube as a collection media; carbon disulfide desorption; GC/FID detection. Sampling and analytical protocol in accordance with NIOSH Method #1550.	OSHA; NIOSH; ACGIH: 5 mg/m^3 as mineral oil mist. In addition NIOSH and ACGIH establish 10 mg/m^3 as a STEL.	Kerosene odor **Recommended air-purifying cartridges:** Organic vapor **Recommended gloves:** Nitrile	**Boiling Pt:** <300-550°F; 149-288°C **Melting Pt:** Not available **Solubility:** Negligible **Flash Pt:** 95-145°F; 35-62°C **Autoignition: 475°**F, 246°C **LEL/LFL:** 0.6% **UEL/UFL:** 8.0% **Vapor Density:** >5 **Vapor Pressure:** <0.1 mmHg @ 70°F; 21°C **Specific Gravity:** 0.80 **Incompatibilities:** strong oxidizers, halogens, and hypochlorites **Appearance and odor:** Colorless to amber with a kerosene odor	Prolonged or repeated exposures to this product may cause skin and eye irritation. Because of the defatting capabilities ,this exposure may lead to a dermatitis condition. High vapor concentrations are irritating to the eyes and respiratory tract. Exposure to high airborne concentrations may result in narcotic effects, including dizziness, headaches, and anesthetic to unconsciousness. High concentrations in a confined space may adequately displace oxygen thereby resulting in suffocation.
Waste Oils All information is based on mineral oil	Mixture N.E. 8012-95-1 for mineral oil	Varies between fractions however waste oils tend to be less volatile. The FID tends to handle the longer chained aliphatic hydrocarbons more efficiently than its PID counterpart and would be selected as the instrument of choice.	Sampling and analytical protocol shall be in accordance with NIOSH Method #5026 (the recommended method for mineral oil mist).	ACGIH; NIOSH: 5 mg/m^3 (oil mists); 10 mg/m^3 STEL. OSHA; 5 mg/m^3 (Oil mists)	Non-volatile substance, therefore no respiratory protection is required. In an aerosol form, dust and mist respirator would be considered acceptable for up to 500 mg/m^3 . **Recommended gloves: Any glove suitable to prevent skin contact (Nitrile has been the one most widely used for the other substances, and will be acceptable). Natural rubber gloves should be avoided.** **Recommended gloves:** Nitrile	**Boiling Pt:** 680°F; 360°C **Melting Pt:** Not available **Solubility:** Insoluble **Flash Pt:** 275-500°F; 135-260°C depends on the distillation fraction **LEL/LFL:** Not available **UEL/UFL:** Not available **Vapor Density:** Not available **Vapor Pressure:** <0.5 mmHg **Specific Gravity:** 0.90 **Incompatibilities:** None reported **Appearance and odor:** Colorless, oily, with an odor of burned lubricating oil.	Minor irritation to the eyes, skin, and respiratory system.
Trichloroethylene	79-01-6	PID: I.P. 9.45 eV, High response with PID and 10.2 eV lamp. FID: 70% Response with FID.	Air sample using charcoal tube; carbon disulfide desorption; Sampling and analytical protocol shall proceed in accordance with OSHA Method #07, or NIOSH Method #1022 or #1003.	OSHA: 50 ppm 200 ppm (Ceiling) ACGIH: 50 ppm 100 ppm STEL NIOSH: 25 ppm IDLH: 1000 ppm	Inadequate - Odor threshold 82 ppm. APRs with organic vapor/acid gas cartridges may be used for escape purposes. Exceedances over the exposure limits require the use of positive pressure-demand supplied air respirator. **Recommended gloves:** PV Alcohol unsupported >16.00 hrs; Silver shield >6.00 hrs; Teflon >24.00 hrs; or Viton >24.00 hrs; Nitrile (Useable time limit 0.5 hr, complete submersion for the nitrile selection)	**Boiling Pt:** 188°F; 86.7°C **Melting Pt:** -99°F; -73°C **Solubility:** 0.1% @ 77°F; 25°C **Flash Pt:** 90°F; 32°C **LEL/LFL:** 8% @ 77°F; 25°C **UEL/UFL:** 10.5 @ 77°F; 25°C **Vapor Density:** 4.53 **Vapor Pressure:** 100 mmHg @ 90°F; 32° C **Specific Gravity:** 1.46 **Incompatibilities:** Strong caustics and alkalis, chemically active metals (barium, lithium, sodium, magnesium, titanium, and beryllium) **Appearance and Odor:** Colorless liquid with a chloroform type odor. Combustible liquid, however, burns with difficulty.	Central nervous system effects including euphoria, analgesia, anesthesia, paresthesia, headaches, tremors, vertigo, and somnolence. Damage to the liver, kidneys, heart, lungs, and skin have also been reported. Contact may result in irritation to the eyes, skin, and mucous membranes. Ingestion may result in GI disturbances including nausea, and vomiting NIOSH lists this substance a potential human carcinogen.

TABLE 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
NAVAL STATION, MAYPORT, FLORIDA
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Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
Tetrachloroethylene See also Perchloroethylene PERK PCE	127-18-4	PID: I.P. 9.32 eV, relative response ratio 200% with 10.6 eV lamp. FID: 70% relative response ratio with a FID.	Air sample using charcoal tube; carbon disulfide desorption; GC/FID detection. Sampling and analytical protocol shall proceed in accordance with OSHA Method #07, or NIOSH Method #1003.	ACGIH: 25 ppm 100 ppm STEL OSHA: 100 ppm 200 ppm Ceiling; 300 ppm 5-minute max peak in any 3-hr period. IDLH: 150 ppm	Odor threshold for this substance has been determined to be at airborne concentrations of approximately 47 ppm, which is considered adequate. APR with organic vapor/acid gas cartridges should be used for escape purposes only. Exceedances over the recommended exposure limits requires the use of airline or airline/APR combination units. **Recommended glove:** Viton, PV alcohol 5-16 hrs; silver shield >6.00 hrs; teflon 10-24 hrs; and Nitrile in that order. The breakthrough time for the nitrile glove ranges between 1.5 - 5.5 hrs. during complete immersion.	**Boiling Pt:** 250°F; 121°C **Melting Pt:** -2°F; 19°C **Solubility:** 0.02% **Flash Pt:** Not available **LEL/LFL:** Not available **UEL/UFL:** Not available **Vapor Density:** 5.83 **Vapor Pressure:** 14 mmHg @ 77°F; 25° C **Specific Gravity:** 1.62 @ 77°F; 25°C **Incompatibilities:** Strong oxidizers, alkalis, fuming sulfuric acid, and chemically active metals. When heated to decomposition temperatures will emit toxic fumes of chlorine. **Appearance and Odor:** Colorless liquid with a mild chloroform like odor.	Overexposure may result in irritation to eyes, nose, throat, and skin. Potential CNS effects including sleepiness, incoordination, headaches, hallucinations, distorted perceptions, and stupor (narcosis). Systemically, symptoms may result in nausea, vomiting, weakness, tremors, and cramps. Chronic exposures may result in dermatitis, enlarged tender liver, kidney, and lung damage. This material is considered a animal carcinogen (liver tumors), however, inadequate evidence exists concerning carcinogenic potential in humans.
General PAHs / Coal Tar Pitch Volatiles / Creosote / cresol (Fluoranthene, pyrene, benzo(a) anthracene, benzo(a) pyrene, benzo(f)fluoranthene, benzo(k)fluoranthene), etc.)	(CAS Numbers vary depending on specific compound)	PID: I.P. of 8.97 eV, relative response ratio unknown. FID: Response factor unknown but given the substances flammability, detection by FID can be anticipated.	Refer to NIOSH methods for each specfic compound for appropriate air sampilng protocols. Many PAHs can be sampled using NIOSH Method 5506 or 5515 - Teflon filter with support ring - High pressure liquid chromatography with UV detector. For cresol (a major constituent of creosote) by silica gel or xad-7 sorbent tube; Acetone desorption and analysis by GC/FID or high-pressure liquid chromatography. (NIOSH Method #2001, or OSHA Method #32)	**General PAHs**: Most PAHs have no established exposure limits. Other Coal Tar Pitch Volatiles / PAHs such as chrysene and benzo(a)pyrene have an exposure limit of 0.2 mg/m^3 (OSHA and ACGIH). 0.1 mg/m^3 - (NIOSH) **Creosote / Cresol:** OSHA; ACGIH: 5 ppm NIOSH: 2.3 ppm IDLH: 80 mg/m^3	Adequate - use a full-face air-purifying respirator with organic vapor / dust/mist cartridge up to 250 ppm. Cresol has an Odor Threshold of 0.00005-0.0079 ppm. **Recommended gloves:** Viton >96.00 hrs; butyl rubber >90.00 hrs; neoprene >4.50 hrs	Properties of various PAHs/Coal Tar Pitch Volatiles vary depending upon the specific compound. *For Creosote/Cresol:* **Boiling Pt:** 376-397°F; 191-203°C **Melting Pt:** 52-96°F; 10.9-35.5°C **Solubility:** Insoluble **Flash Pt:** 178°F; 81°C **LEL/LFL:** Not available **UEL/UFL:** Not available **Vapor Density:** 3.72 **Vapor Pressure:** 1 mmHg @ 100-127° F; 38-53°C **Specific Gravity:** 1.030-1.038 **Incompatibilities:** Nitric acid, oleum, chlorosulfonic acid, oxidizers **Appearance and Odor:** Yellowish or colorless, flammable, oily liquid (often brownish because of impurities or oxidation)	Regulated based on effects on respiratory tract and skin irritation Other effects may include eye irritiation and central nervous system, distrubances. Acute exposures may result in difficulty breathing, respiratory failure and skin and eye irritation and burns. Chronic exposure may damage the liver, kidneys, lungs and skin and cause photosensitivity. IARC, NTP, NIOSH, ACGIH, and the EPA list some PAHs such as benzo(a)pyrene as a potential carcinogen (ARC 2A, NTP-2, ACGIH TLV-A2, NIOSH-X, EPA-B2).

TABLE 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
NAVAL STATION, MAYPORT, FLORIDA
PAGE 3

Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
1,1 Dichloroethene See also vinylidene chloride	75-34-4	PID: I.P. 10.00 eV, relative response ratio is 80%. FID: Relative response ratio for detection with the FID is 40%.	Air sample using a charcoal filter tube; carbon disulfide desorption; GC/FID detection in accordance with NIOSH Method #1015.	ACGIH: 5 ppm, STEL 20 ppm NIOSH & OSHA have not established exposure limits.	Odor threshold - 190 ppm. An air purifying respirator equipped with a organic vapors filter is acceptable for escape purposes only. For exposures greater than the recommended exposures limits should employ supplied air respirators. **Recommended glove:** Butyl, nitrile, or neoprene.	**Boiling Pt:** 89°F; 32°C **Melting Pt:** -188°F;-122°C **Solubility:** Slight (0.04%) **Flash Pt:** -2°F; -19°C **LEL/LFL:** 6.5% **UEL/UFL:** 15.5% **Vapor Density:** 3.25 **Vapor Pressure:** 500 mmHg @ 68°F; 20° C **Specific Gravity:** 1.21 @ 20°F; 4°C **Incompatibilities:** Aluminum, air, copper, and heat. Polymerization may occur if exposed to oxidizers. **Appearance and Odor:** Colorless liquid with a slight sweet chloroform odor.	Overexposure to this substance may result in irritation to the eyes, nose, throat, and respiratory system. Dermal contact with concentrated solutions may cause slight irritation, redness and inflammation. Systemically, headaches, dizziness, nausea, and difficulty in breathing. Chronic effects may include kidney and liver dysfunction, and pneumonitis. This material has expressed cancer causing potential in laboratory animals including liver and kidney tumors.
Vinyl chloride	75-01-4	PID: I.P. 9.99 eV, High response with PID and 10.2 eV lamp. FID: 40% response with FID.	Air sample using charcoal or Anasorb CMS sorbent tube; carbon disulfide desorption; gas chromatography-flame ionization detection; Sampling and analytical protocol shall proceed in accordance with NIOSH Method #1007, or OSHA Method #75.	OSHA: 1.0 ppm PEL 5.0 ppm (Ceiling) ACGIH: 5 ppm NIOSH: Lowest Feasible Concentration	Inadequate - Odor threshold 10-20 ppm. Gas Mask with a vinyl chloride Type N canister may be employed for concentrations up to 25 ppm. Canisters employed must have a minimum service life of 4-hrs. Exceedances over 25 ppm, must use a positive pressure demand, open-circuit, self-contained breathing apparatus, pressure demand type, with full facepiece. Refer to 29 CFR 1910.1017(g) for specific requirements based on atmospheric concentrations of vinyl chloride. **Recommended gloves:** Silver shield >6.00 hrs; Nitrile 5.70 hrs; or Viton 4.4 hrs	**Boiling Pt:** 7°F; -13.9°C **Melting Pt:** -256°F; -160°C **Solubility:** 0.1% @ 77°F; 25°C **Flash Pt:** 18°F; -8°C **LEL/LFL:** 3.6% **UEL/UFL:** 33% **Vapor Density:** 2.21 **Vapor Pressure:** 3.3 atm **Specific Gravity:** N.A. **Incompatibilities:** Oxidizers, copper, aluminum, peroxides, iron, steel, **Appearance and Odor:** Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations.	A severe skin, eye, and mucous membrane irritant(Liquid: frostbite). Narcotic effect causing weakness, abdominal pains, GI bleeding, and pallor skin or cyanosis. Chronic exposure has been linked to the formation of malignant tumors originating from blood lymphatic vessels in the liver (associated enlargement of the liver), and kidneys (angiosarcoma and nephroblastoma). Listed as a carcinogen by NTP, IARC and ACGIH.

6.2 PHYSICAL HAZARDS

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

- Heavy equipment hazards (pinch/compression points, rotating equipment, etc.).
- Slips, trips, and falls
- Energized systems (contact with underground or overhead utilities)
- Lifting (strain/muscle pulls)
- Noise in excess of 85 decibels (dBA)
- Working over or near water
- Flying projectiles
- Ambient temperature extremes (heat stress)
- Pinches and compressions
- Vehicular and Pier traffic

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

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

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

- Emergency stop devices (if applicable) will be tested daily to ensure that they are operational.

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

- The driller may not leave the controls when the augers are rotating.

6.2.2 Energized Systems (Contact with Underground or 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. Clearance of underground and overhead utilities

for each sample location will be coordinated with NAVSTA Mayport personnel. Additionally, drilling operations will be conducted at a safe distance (>20 feet) from overhead power lines. Whenever underground utilities are suspected to be close to subsurface sampling locations, the borehole will be advanced to a minimum of five (5) feet with a hand auger prior to drilling. As built drawings may also be utilized for additional clarification. In certain cases, Base personnel may need to deenergize electrical cables using facility lockout/tagout procedures to insure electrical hazards are eliminated.

6.2.3 Ambient Temperature Extremes

Overexposure to high ambient temperatures (heat stress) may exist during performance of this work depending on the project schedule. Extremely cold temperatures are not expected to be encountered due to project location. Work performed when ambient temperatures exceed 70°F may result in varying levels of heat stress (heat rash, heat cramps, heat exhaustion, and/or heat stroke) depending on variables such as wind speed, humidity, and percent sunshine, as well as physiological factors such as metabolic rate and skin moisture content. Additionally, work load and level of protective equipment will affect the degree of exposure. Site personnel will be encouraged to drink plenty of fluids to replace those lost through perspiration. Additional information such as Work-Rest Regimens and personnel monitoring may be found in Section 4.0 of the Health & Safety Guidance Manual. The SSO will recommend additional heat stress control measures as they are deemed necessary as per ACGIH guidelines.

6.3 NATURAL HAZARDS

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

6.3.1 Fire Ants

Fire ants present a unique situation when working outdoors in Florida. Their aggressive behavior and their ability to sting repeatedly can pose a unique health threat. The sting injects a venom 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.

6.3.2 Snakes, Insects, and Other Animals

The site is suspected of supporting a large population of eastern diamondback rattlesnakes. Given that areas to be investigated could be prime nesting and/or hiding locations for snakes and insects, precautions will be taken when opening manholes and other access doors. When possible, doors and manhole covers will be opened away from personnel to allow snakes or insects to escape. Personnel should avoid reaching into areas that are not visibly clear of snakes or insects. Snake chaps will be worn in areas of known or anticipated snake infestation. All site personnel who are allergic to stinging insects such as bees, wasps, and hornets must be particularly careful since severe illness and death may result from allergic reactions. As with any medical condition or allergy, information regarding the condition must be listed on the Medical Data Sheet and the FOL and SSO notified.

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 Attachment II of this HASP or Section 4.0 of the Health and Safety Guidance Manual.

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

6.3.3 Inclement Weather

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

7.0 AIR MONITORING

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

7.1 INSTRUMENTS AND USE

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

7.1.1 Photoionization Detector or Flame Ionization Detector

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

Prior to 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 which will initiate the use of elevated levels of protection. The SSO may decide to increases these frequencies based on instrument responses and site observations. The frequency at which monitoring is performed will not be reduced without the prior consent of the PHSO or HSM.

7.2 INSTRUMENT MAINTENANCE AND CALIBRATION

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

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

FIGURE 7-1

DOCUMENTATION OF FIELD CALIBRATION

SITE NAME: _____ PROJECT NO.: _____

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

8.0 TRAINING/MEDICAL SURVEILLANCE REQUIREMENTS

8.1 INTRODUCTORY/REFRESHER/SUPERVISORY TRAINING

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

8.1.1 Requirements for TtNUS Personnel

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

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

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

8.1.2 Requirements for Subcontractors

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

FIGURE 8-1

TRAINING LETTER

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

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

Month, day, year

Mr. Terry Hansen
Task Order Manager
Tetra Tech NUS, Inc.
1311 Executive Center Drive, Suite 220
Tallahassee, Florida 32301

Subject: HAZWOPER Training for NAVSTA Mayport, Mayport, Florida

Dear Mr. Hansen:

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

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

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

Sincerely,

(Name and Title of Company Officer)

FIGURE 8-2

SITE-SPECIFIC TRAINING DOCUMENTATION

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

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

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

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

8.2 SITE-SPECIFIC TRAINING

TtNUS will provide site-specific training to all site personnel who will perform work on this project. Site-specific training will also be provided to all personnel [U.S. Department of Defense (DOD), 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 on site
- Use of personal protective equipment
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment
- Medical surveillance requirements
- Signs and symptoms of overexposure
- Contents of the Health and Safety Plan
- Emergency response procedures (evacuation and assembly points)
- Spill response procedures
- Review of the contents of relevant Material Safety Data Sheets

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 Pittsburgh office and made available, as necessary.

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" 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 presented in Section 7 of the Health and Safety Guidance Manual. This shall be provided to the SSO, prior to participating in site activities. The purpose of this document is to provide site personnel and emergency responders with additional information that may be necessary in order to administer medical attention.

8.4 SUBCONTRACTOR EXCEPTIONS

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

FIGURE 8-3
SUBCONTRACTOR MEDICAL APPROVAL FORM

For employees of _____
Company Name

Participant Name: _____ Date of Exam: _____

Part A

The above-named individual has:

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

   ( ) qualified to perform work at the NAVSTA Mayport work site
   ( ) not qualified to perform work at the NAVSTA Mayport work site

and,

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

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

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

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

Part B

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

and have determined the following information:

FIGURE 8-3
SUBCONTRACTOR MEDICAL APPROVAL FORM
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 NAVSTA Mayport 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. Terry Hansen
Task Order Manager
Tetra Tech NUS, Inc.
1311 Executive Center Drive, Suite 220
Tallahassee, Florida 32301

Subject: Medical Surveillance for NAVSTA Mayport, Mayport, Florida

Dear Mr. Hansen:

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: Final Rule." I further state that the persons listed below have had physical examinations under this program within the past 12 months and that they have been cleared, by a licensed physician, to perform hazardous waste site work and to wear positive- and negative-pressure respiratory protection. I also state that, to my knowledge, no person listed below has any medical restriction that would preclude him/her from working at the NAVSTA Mayport, Mayport, Florida site.

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)

9.0 SPILL CONTAINMENT PROGRAM

9.1 SCOPE AND APPLICATION

It is anticipated that quantities of bulk potentially hazardous materials (greater than 55-gallons) may be handled during some of the site activities conducted as part of the scope of work (specifically Investigative-Derived Wastes [IDW]). It is not anticipated, however, that spillage of these materials would constitute a significant danger to human health or the environment. Further, it is possible that as the job progresses disposable PPE and other non-reusable items may be generated. As needed, 55 -gallon drums will be used to contain waste waters, IDW, and other unwanted items generated during investigatory activities. These drums will be labeled with the site name and address, the type of contents, and the date the container was filled as well as an identified contact person. Samples will be collected and analyzed to characterize the material and determine appropriate disposal measures. Once characterized they can be removed from the staging area and disposed of in accordance with Federal, State, and local regulations. Table 5-1 contains detailed information about handling IDW at NAVSTA Mayport.

9.2 POTENTIAL SPILL AREAS

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

9.2.1 Site Drums/Containers

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

9.3 LEAK AND SPILL DETECTION

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

9.4 PERSONNEL TRAINING AND SPILL PREVENTION

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

9.5 SPILL PREVENTION AND CONTAINMENT EQUIPMENT

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

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

9.6 SPILL CONTROL PLAN

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

1) Notify the SSO or FOL immediately.

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

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

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

It is not anticipated that a spill will occur in which the field crews cannot handle. Should this occur; however, notification of appropriate emergency response agencies will be carried out by the FOL or SSO.

10.0 SITE CONTROL

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

10.1 EXCLUSION ZONE

The exclusion zone will be considered those areas of the site of known or suspected contamination. It is not anticipated that significant amounts of surface contamination are present in the proposed work areas of this site. It is anticipated that this will remain so until/unless contaminants are brought to the surface by intrusive activities, such as soil boring or sampling operations. Furthermore, once intrusive activities have been completed and surface contamination has been removed, the potential for exposure is again diminished and the area can then be reclassified as part of the contamination reduction zone. Therefore, the exclusion zones for this project will be limited to those areas of the site where active work is being performed plus a designated area surrounding the point of operation (see Table 5-1 for specific operation). When possible, exclusion zones will be delineated using barrier tape, cones and/or drive poles, and postings to inform site personnel.

10.1.1 Exclusion Zone Clearance

Prior to the initiation of site activities, utility locations will be identified by utility companies contacted through the NAVSTA Mayport Base Contact – Randy Bishop at (904) 270-6730. Additional utility surveys may be conducted by TtNUS through the use of available documentation provided by NAVSTA Mayport and/or local utility companies. The positions of identified utilities will be field located and staked to minimize the potential for damage during intrusive activities. Sample locations can be located to avoid buried utilities. In the event that a utility is struck during a subsurface investigative activity, the emergency numbers provided in Table 2-1 will be notified.

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

10.2 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. The personnel and equipment decontamination will not take place in this area, but will take place at a central location established for this project. This area instead will serve as a focal point in supporting exclusion zone activities. When applicable, this area will be delineated using barrier tape, cones and/or drive poles, and postings to inform and direct facility personnel.

10.3 SUPPORT ZONE

The support zone for this project will include a staging area where site vehicles will be parked, equipment will be unloaded, and 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.

10.4 SITE VISITORS

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

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

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

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

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

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

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

10.5 SITE SECURITY

Site security will be accomplished using existing base security resources and procedures, supplemented by TtNUS or subcontractor personnel, if necessary. TtNUS will retain control over active operational areas. The first line of security will take place at the base boundaries restricting the general public. The second line of security will take place at the work site referring interested parties to the FOL. The FOL will serve as a focal point for site personnel, and will serve and the final line of security and the primary enforcement contact.

10.6 SITE MAPS

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

10.7 BUDDY SYSTEM

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

10.8 MATERIAL SAFETY DATA SHEET (MSDS) REQUIREMENTS

TtNUS and subcontractor personnel will provide MSDSs for 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 on site will be developed using Section 5.0 of the Health and Safety Guidance Manual. The MSDSs will then be maintained in a central location and will be available for anyone to review upon request.

10.9 COMMUNICATION

TtNUS personnel will be working in close proximity to each other at NAVSTA Mayport. As a result and since two way radio communication will not be available, hand signals, voice commands, and line of site will provide sufficient means of communication. When project tasks are performed simultaneously on different sites, vehicle horns will be used to communicate emergency situations per Section 2.6 of this HASP.

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

10.10 SAFE WORK PERMITS

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

Use of these permits will provide the communication line for reviewing protective measures and hazards associated with each operation. This HASP will be used as the primary reference for selecting levels of

protection and control measures. The work permit will take precedence over the HASP when more conservative measures are required based on specific site conditions.

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

FIGURE 10-1
SAFE WORK PERMIT

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

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

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

II. Names: _____

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

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

IV. Protective equipment required

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

Respiratory equipment required

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

Modifications/Exceptions: _____

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

_____ _____ _____
_____ _____ _____

VI. Additional Safety Equipment/Procedures

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

Modifications/Exceptions: _____

VII.

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

VIII. Equipment Preparation

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

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

If yes, contact Health Science, Pittsburgh, PA Office

X. Special instructions, precautions: _____

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

11.0 CONFINED SPACE ENTRY

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

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

A Permit-Required Confined Space is one that:

- Contains or has a potential to contain a hazardous atmosphere.
- Contains a material that has the potential to engulf an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
- Contains any other recognized, serious, safety or health hazard.

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

12.0 MATERIALS AND DOCUMENTATION

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

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

12.1 MATERIALS TO BE POSTED AT THE SITE

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

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

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

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

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

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

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

13.0 GLOSSARY

ACGIH	American Conference of Governmental Industrial Hygienists
APR	Air Purifying Respirators
AOC	Area of Concern
CFR	Code of Federal Regulations
CNS	Central Nervous System
CRZ	Contamination Reduction Zone
DOD	Department of Defense
DOT	Department of Transportation
EPA	Environmental Protection Agency
eV	electron Volts
FID	Flame Ionization Detector
FOL	Field Operations Leader
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	High Efficiency Particulate Air
LEL/O_2	Lower Explosive Limit/Oxygen
N/A	Not Available
NIOSH	National Institute Occupational Safety and Health
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor)
PEL	Permissible Exposure Limit
PHSO	Project Health and Safety Officer
PID	Photo Ionization Detector
PPE	Personal Protective Equipment
PVC	Poly Vinyl Chloride
SAP	Sampling and Analysis Plan
SCBA	Self Contained Breathing Apparatus
SSO	Site Safety Officer
STEL	Short Term Exposure Limit
TOM	Task Order Manager
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average
UV	Ultraviolet
WP	Work Plan

ATTACHMENT I

INJURY/ILLNESS PROCEDURE AND REPORT FORM

CASE NO. _____

TETRA TECH NUS, INC.

INJURY/ILLNESS PROCEDURE
WORKER'S COMPENSATION PROGRAM

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

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

ADDITIONAL QUESTIONS REGARDING WORKER'S COMPENSATION:

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

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

WHO IS COVERED:

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

CASE NO. _____

WHAT IS COVERED:

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

CASE NO. _____

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

To: Corporate Health and Safety Manager
Human Resource Administrator

Prepared by: _____

Position: _____

Project Name: _____

Office: _____

Project No. _____

Telephone: _____

Information Regarding Injured or Ill Employee:

Name: _____ Office: _____

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

_____ Marital status: _____

Home telephone: _____ Date of birth: _____

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

Department: _____

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

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

Street address: _____

City, state, and zip code: _____

County: _____

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

TETRA TECH, INC.
INJURY/ILLNESS REPORT

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

Witness(es):

Name:

Address:

Telephone:

Describe the Illness or Injury and Part of Body Affected:

Name the Object or Substance which Directly Injured the Employee:

Medical Treatment Required:

☐ No ☐ Yes ☐ First Aid Only

Physician's Name: _____

Address: _____

Hospital or Office Name: _____

Address: _____

_____

Telephone No.: _____

Lost Work Days:

☐ No. of Lost Work Days _____

Last Date Worked _____

Time Employee Left Work _____

Date Employee Returned to Work _____

☐ No. of Restricted Work Days _____

☐ None

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

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

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

Date of Report: _____ Time of Report: _____

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

To be completed by Human Resources:

Date of hire: Hire date in current job:

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

Position at time of hire:

Shift hours:

State in which employee was hired:

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

Temporary job end date:

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

Date reported: Reported by:

TeleClaim phone number:

TeleClaim account number:

Location code:

Confirmation number:

Name of contact:

Field office of claims adjuster:

ATTACHMENT II

TICK CONTROL
AND
LYME DISEASE

TICK CONTROL
AND
LYME DISEASE

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

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

Recognition

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

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

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

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

Evaluation

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

Control

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

Tick Removal

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

In order to provide for proper and timely response to the occurrence of a tick bite, the SSO will ensure that the site First Aid kit is properly equipped with medical forceps and rubbing alcohol, in addition to the standard kit contents. Also, an adequate supply of commercial insect (tick) repellents will be maintained on-site, and all personnel will be trained in its proper application and will be required to use it, at the direction of FOL.

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 MULTI-MEDIA SAMPLING

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 and soils. IDW sampling is included in this task.**

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	☐
SKA-PAC SAR	☐	Bottle Trailer	☐
Skid Rig	☐	None	☒

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes, surgical style gloves, and safety glasses. Hard hats and hearing protection will be worn when working near operating equipment or when required by SSO. Coveralls and snake chaps will be worn near insect/snake areas.

V.

Chemicals of Concern	Action Level(s)	Response Measures
Site contaminants include VOCs (isolvents) and SVOCs (petroleum compounds)	Any sustained reading above background in worker breathing zones.	Suspend site activities and report to an unaffected area.

VI. Additional Safety Equipment/Procedures

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

Modifications/Exceptions: Reflective vests for high traffic areas. Tyvek coverall if there is a potential for soiling work cloths. Life vest if working over or near water where drowning is a potential hazard.

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: Avoid areas of known or suspected insect/animal nesting or habitat.

Permit Issued by: _____ Permit Accepted by: _____

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 (Geoprobe) and hollow-stem auger techniques. Installation, development, and purging of monitoring wells are included in this task.**

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)

IV. Protective equipment required

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

Respiratory equipment required

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

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

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

Chemicals of Concern	Action Level(s)	Response Measures
Potential site contaminants are VOCs (solvents) and SVOCs (petroleum compounds)	Any sustained readings above background in worker breathing zones.	Suspend site activities and report to an unaffected area.

VI. Additional Safety Equipment/Procedures

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

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

VII. Procedure review with permit acceptors

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

VIII. 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: Avoid areas of known or suspected insect/animal nesting or habitat.

Permit Issued by: _____ Permit Accepted by: _____

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

AREA OF CONCERN C
BUILDING 191/ECHO PIER
RESOURCE CONSERVATION AND RECOVER ACT
FACILITY INVESTIGATION
AT
NAVAL STATION – MAYPORT
JACKSONVILLE, FLORIDA

Submitted by:
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Foster Plaza 7
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NOVEMBER 1999

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

In support of:

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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by Tetra Tech NUS, Inc (TtNUS) on behalf of the United States Navy Southern Division Naval Facilities Engineering Command and the Naval Station Mayport (NAS-MAYPORT), Mayport, Florida, under the Comprehensive Long-Term Environmental Action Navy (CLEAN III) Contract Number N62467-94-D-0888, Contract Task Order (CTO) 094. The QAPP and other associated documents, including the TtNUS Florida Department of Environmental Protection (FDEP) approved Comprehensive Quality Assurance Plan (CompQAP) No. 980038, dated August 24, 1998, Resource Conservation and Recovery Act (RCRA) Facilities Sampling and Analysis Plan (SAP), prepared by TtNUS, dated 16 April 1999 and the Health and Safety Plan (HASP), constitute the project planning documents for the RCRA Facilities Sampling program to be performed at Area of Concern (AOC) C Building 191 /Echo Pier, located in Mayport, Florida.

This QAPP presents the organization, objectives, planned activities, and specific Quality Assurance/Quality Control (QA/QC) procedures associated with the sampling program. Specific protocols for sampling, sample handling and storage, chain-of-custody, and laboratory and field analyses are described within this document. All QA/QC procedures are structured in accordance with the Naval Facilities Engineering Service Center (NFESC) guidance document "Navy Installation Restoration Laboratory Quality Assurance Guide (February 1996), United States Environmental Protection Agency (USEPA) Region IV and FDEP requirements, regulations, guidance, and technical standards.

1.2 FACILITY DESCRIPTION

A description of AOC C at NAS-MAYPORT, including its location, size and borders, site conditions, natural and man-made features, and zones of investigation, is provided in Section 1.3 of the SAP.

1.3 PROJECT OBJECTIVES

This section discusses the overall project objectives; the anticipated target parameters and intended data uses for both field and laboratory analytical data.

1.3.1 Overall Project Objectives

The overall objectives of the work will be to perform additional sampling of the groundwater and soil located at AOC C to further delineate the previously identified contamination and evaluate the potential for off-site originating from the site. Project objectives are discussed in more detail in Section 3.3 of the SAP.

1.3.2 Project Target Parameters and Intended Data Uses

This section discusses the field and laboratory analytical information to be generated during the course of the investigation. Field parameters and intended data uses are discussed in Section 1.3.2.1. Laboratory parameters and intended data uses are discussed in Section 1.3.2.2.

1.3.2.1 Field Parameters

Field parameters will include those parameters associated with groundwater and soil sampling and analysis. All field measurements will be completed using simple field instrumentation or field test kits.

Field parameters including pH, specific conductance, turbidity and temperature will be completed for all groundwater samples. These measurements will be used to support monitoring well purging of stagnant water from well casings. Specific conductance and pH will also be used as general indicators of water quality. Turbidity will be measured on discrete samples using a turbidity meter. The remaining field parameters will be measured using a meter with a flow-through cell. Further details regarding field-sampling methods are provided in Section 7.5 of TtNUS' CompQAP.

1.3.2.2 Laboratory Parameters

The analytical methods to be used for analysis of the NAS-MAYPORT samples have been selected based on existing analytical data from previous investigations. The suite of analyses for the NAS-MAYPORT investigation includes Target Compound list (TCL) volatiles, Appendix IX volatiles, Appendix IX non-halogenated volatiles, TCL semivolatiles, Appendix IX semivolatiles, TCL pesticides, Appendix IX pesticides, TCL PCBs, Appendix IX PCBs, Appendix IX herbicides, Target Analyte List (TAL) metals and Appendix IX inorganics. These parameters will be used to evaluate the nature and extent of contamination, and to evaluate contaminant migration pathways and likely source areas to potential receptors. Tables 1-1 through 1-4 provide a summary of all target analytes and associated Required Quantitation Limits (RQL) for volatiles, RQL for semivolatiles, RQL for pesticides/PCBs and Required Detection Limits (RDL) for metals. Analytical methods are further discussed in Section 7.0 of this QAPP.

1.4 SAMPLE NETWORK DESIGN AND RATIONALE

The sample network design and rationale is discussed in detail in Section 3.3 of the SAP. Figures displaying all proposed sampling locations are provided in Section 3.0 of the SAP.

1.5 PROJECT SCHEDULE

The project schedule is discussed in Section 7.0 of the project SAP.

TABLE 1-1

SW-846 8260B ANALYTICAL DETECTION LIMITS
APPENDIX IX AND CLP/TCL LISTS
NAVSTA - MAYPORT
PAGE 1 OF 2

Parameter	RQL[1]	
	Solid Samples	Groundwater Samples
Volatile Organic Compounds	µg/kg	µg/L
Acetone	10	5
Benzene	10	1[2]
Bromodichloromethane	10	1
Bromoform	10	1
Bromomethane	10	1
2-Butanone	10	5
Carbon disulfide	10	1
Carbon tetrachloride	10	1
Chlorobenzene	10	1
Chloroethane	10	1
Chloroform	10	1
Chloromethane	10	1
Dibromochloromethane	10	1
1,2-Dibromo-3-chloropropane	NA	1
1,2-Dibromoethane	10	1
1,2-Dichlorobenzene	NA	1
1,3-Dichlorobenzene	NA	1
1,4-Dichlorobenzene	NA	1
1,1-Dichloroethane	10	1
1,2-Dichloroethane	10	1[2]
1,1-Dichloroethene	10	1[2]
cis-1,2-Dichloroethene	NA	1[2]
trans-1,2-Dichloroethene	NA	1
1,2-Dichloropropane	10	1
cis-1,3-Dichloropropene	10	1
trans-1,3-Dichloropropene	10	1
1,2-Dichloroethene (total)	10	NA
1,2-Dichloropropane	10	1
cis-1,3-Dichloropropene	10	1
trans-1,3-Dichloropropene	10	1
Ethylbenzene	10	1
2-Hexanone	10	5
4-Methyl-2-pentanone	10	5
Methylene chloride	10	2
Styrene	10	1
1,1,2,2-Tetrachloroethane	10	1
1,1,1-Trichloroethane	10	1
1,1,2-Trichloroethane	10	1
Trichloroethene	10	1[2]
Tetrachloroethene	10	1
Toluene	10	1
Vinyl chloride	10	1[2]
Xylenes (total)	10	1

TABLE 1-1

SW-846 8260B ANALYTICAL DETECTION LIMITS
APPENDIX IX AND CLP/TCL LISTS
NAVSTA – MAYPORT
PAGE 2 OF 2

Parameter	RQL[1]	
	Solid Samples	Groundwater Samples
Volatile Organic Compounds	µg/kg	µg/L
Trichlorofluoromethane	10	5
2-chloroethylvinyl ether	10	1[2]
Acrolein	10	1
Acrylonitrile	10	1
Chloroprene	10	1
3-Chloroprene	10	1
Dibromomethane	10	1
Ethyl Methacrylate	10	1
Iodomethane	10	1
Methacrylonitrile	10	1[2]
Methyl methacrylate	10	1[2]
Vinyl acetate	10	1[2]
Trans-1,4-dichloro-2-butene	10	1
Dichlorodifluoromethane	10	1
Isobutyl alcohol	NA	PQL
Propionitrile	NA	PQL
Acetonitrile	NA	PQL
Pentachloroethane	10	1
1,1,1,2-Tetrachloroethane	10	1
1,2,3-Trichloropropane	10	1

PQL Practical Quantitation Limit
1 RQL Required Maximum Quantitation Limit.
2 COC Chemicals historically present at the site (Chemical of Concern)
3 Appendix IX 40 Code of Federal Regulations Part 264, Appendix IX Groundwater Monitoring List
4 CLP TCL U.S. Environmental Protection Agency Contract Laboratory Program Target Compound List OLM03.0

TABLE 1-2

SW-846 8270C ANALYTICAL DETECTION LIMITS
APPENDIX IX AND CLP/TCL LISTS
NAVSTA - MAYPORT
PAGE 1 OF 4

Parameter	RQL[1]	
	Solid Samples	Groundwater Samples
Semivolatile Organic Compounds	µg/kg	µg/L
Acenaphthene	330	10
Acenaphthylene	330	10
Anthracene	330	10
Benzo(a)anthracene	330	10
Benzo(a)pyrene	330	10
Benzo(b)fluoranthene	330	10
Benzo(g,h,i)perylene	330	10
Benzo(k)fluoranthene	330	10
Bis(2-chloroethoxy)methane	330	10
Bis(2-chloroethyl)ether	330	10
Bis(2-ethylhexyl)phthalate	330	5[2]
4-Bromophenyl-phenylether	330	10
Butylbenzylphthalate	330	10
Carbazole	330	NA
4-Chloro-3-methylphenol	330	10
4-Chloroaniline	330	10
2-Chloronaphthalene	330	10
2-Chlorophenol	330	10
4-Chlorophenyl-phenylether	330	10
Chrysene	330	10
Dibenz(a,h)anthracene	330	10
Dibenzofuran	330	10
3,3'-Dichlorobenzidine	330	10
Diethylphthalate	330	10
Di-n-butylphthalate	330	10
Di-n-octylphthalate	330	10
4,6-Dinitro-2-methylphenol	830	25
2,4-Dinitrophenol	830	25
2,4-Dinitrotoluene	330	10
1,2-Dichlorobenzene	330	10
1,3-Dichlorobenzene	330	10
1,4-Dichlorobenzene	330	10
2,4-Dichlorophenol	330	10
Dimethylphthalate	330	10
2,4-Dimethylphenol	330	10
2,6-Dinitrotoluene	330	10
Fluoranthene	330	10

TABLE 1-2

SW-846 8270C ANALYTICAL DETECTION LIMITS
APPENDIX IX AND CLP/TCL LISTS
NAVSTA – MAYPORT
PAGE 2 OF 4

Parameter	RQL[1]	
	Solid Samples	Groundwater Samples
Semivolatile Organic Compounds	**µg/kg**	**µg/L**
Fluorene	330	10
Hexachlorobenzene	330	10
Hexachlorobutadiene	330	10
Hexachlorocyclopentadiene	330	10
Hexachloroethane	330	10
Indeno(1,2,3-cd)pyrene	330	10
Isophorone	330	10
2-Methylnaphthalene	330	10
2-Methylphenol	330	10
4-Methylphenol	330	10
Naphthalene	330	10
2-Nitroaniline	330	25
3-Nitroaniline	830	25
4-Nitroaniline	830	25
Nitrobenzene	830	10
2-Nitrophenol	330	10
4-Nitrophenol	830	25
N-nitroso-di-n-propylamine	330	10
N-nitrosodiphenylamine	330	10
2,2'-Oxybis(1-chloropropane)	330	10
Pentachlorophenol	830	25
Phenanthrene	330	10
Phenol	330	10
Pyrene	330	10
1,2,4-Trichlorobenzene	330	10
2,4,5-Trichlorophenol	830	25
2,4,6-Trichlorophenol	330	10
2,3,4,6-Tetrrachlorophenol	NA	10
2,6-Dichlorophenol	NA	10
n-Nitrosodimethylamine	NA	10
2-Picoline	NA	10
Diphenylamine	NA	10
Benzyl alcohol	NA	10
n-Nitrosomethylethylamine	NA	10
p-Phenylenediamine	NA	10
3-and-4-Methylphenol	NA	10

TABLE 1-2

SW-846 8270C ANALYTICAL DETECTION LIMITS
APPENDIX IX AND CLP/TCL LISTS
NAVSTA - MAYPORT
PAGE 3 OF 4

Parameter	RQL[1]	
	Solid Samples	Groundwater Samples
Semivolatile Organic Compounds	**µg/kg**	**µg/L**
Pyridine	NA	10
3,3'-Dimethylbenzidine	NA	10
Isosafrole	NA	10
1,4-Napthoquinone	NA	10
1-Napthylamine	NA	10
Aramite	NA	10
Hexachloropropene	NA	10
Pronamide	NA	10
2-Acetylaminofluorene	NA	10
n-Nitrosodiethylamine	NA	10
3-Methylcholanthrene	NA	10
4-Nitroquinoline-1-oxide	NA	10
7,12-Dimethylbenz(a)axobenzene	NA	10
n-Nitrosomorpholine	NA	10
p-(Dimethylamino)azobenzene	NA	10
Pentachlorobenzene	NA	10
Phenacetin	NA	10
Ethyl methanesulfonate	NA	10
Aniline	NA	10
Methyl methanesulfonate	NA	10
Hexachlorophene	NA	10
Pentachloronitrobenzene	NA	10
2-Naphthylamine	NA	10
Methapyrilene	NA	10
4-Aminobiphenyl	NA	10
n-Nitroso-di-n-butylamine	NA	10
n-Nitrosopyrrolidine	NA	10
o-Toluidine	NA	10
1,2,4,5-Tetrachlorobenzene	NA	10
Acetophenone	NA	10
1,3,5-Trinitrobenzene	NA	10
5-Nitro-o-toluidine	NA	10
1,3-Dinitrobenzene	NA	10
Sulfotepp	NA	10
Thionazin (Zinphos)	NA	10

TABLE 1-2

SW-846 8270C ANALYTICAL DETECTION LIMITS
APPENDIX IX AND CLP/TCL LISTS
NAVSTA - MAYPORT
PAGE 4 OF 4

Parameter	RQL[1]	
	Solid Samples	Groundwater Samples
Semivolatile Organic Compounds	**µg/kg**	**µg/L**
1,4-dioxane	NA	PQL
Safrole	NA	10

PQL Practical Quantitation Limit
1 RQL Required Maximum Quantitation Limit
2 COC Chemicals historically present at the site (Chemical of Concern)
3 Appendix IX 40 Code of Federal Regulatioins Part 264, Appenmdix IX Groundwater Monitoring List
4 CLP TCL U.S. Environmental Protection Agency Contract Laboratory Program Target Compound List OLM03.0
NA Not Applicable

TABLE 1-3

SW-846 8081A ANALYTICAL DETECTION LIMITS
APPENDIX IX AND CLP/TCL LISTS
NAVSTA - MAYPORT
PAGE 1 OF 1

Parameter	RQL[1]	
	Solid Samples	Groundwater Samples
Pesticides	µg/kg	µg/L
Aldrin	1.7	0.05
alpha-Benzene hexachloride (BHC)	1.7	0.05
alpha-Chlordane	1.7	0.05
beta-BHC	1.7	0.1
4,4'-DDE	3.3	0.1
4,4'-DDD	3.3	0.1
4,4'-DDT	3.3	0.1
delta-BHC	1.7	0.05
Dieldrin	3.3	0.1
Endosulfan I	1.7	0.05
Endosulfan II	3.3	0.05
Endosulfan sulfate	3.3	0.1
Endrin	3.3	0.1
Endrin aldehyde	3.3	0.1
Endrin ketone	3.3	0.1
gamma-BHC (Lindane)	1.7	0.2
gamma-Chlordane	1.7	0.05
Heptachlor	1.7	0.05
Heptachlor epoxide	1.7	0.1
Methoxychlor	17	0.4
Toxaphene	170	1.0

PQL Practical Quantitation Limit
1 RQL Required Maximum Quantitation Limit
2 COC Chemicals historically present at the site (Chemical of Concern)
3 Appendix IX 40 Code of Federal Regulatioins Part 264, Appenmdix IX Groundwater Monitoring List
4 CLP TCL U.S. Environmental Protection Agency Contract Laboratory Program Target Compound List OLM03.0
NA Not Applicable

TABLE 1-3

SW-846 8081A ANALYTICAL DETECTION LIMITS
APPENDIX IX AND CLP/TCL LISTS
NAVSTA - MAYPORT
PAGE 1 OF 1

Parameter	RQL[1]	
	Solid Samples	Groundwater Samples
Pesticides	**µg/kg**	**µg/L**
Aroclor-1016	33	PQL
Aroclor-1221	33	PQL
Aroclor-1232	33	PQL
Aroclor-1242	33	PQL
Aroclor-1248	33	PQL
Aroclor-1254	33	PQL
Aroclor-1260	33	PQL

PQL Practical Quantitation Limit
1 RQL Required Maximum Quantitation Limit
2 COC Chemicals historically present at the site (Chemical of Concern)
3 Appendix IX 40 Code of Federal Regulatioins Part 264, Appenmdix IX Groundwater Monitoring List
4 CLP TCL U.S. Environmental Protection Agency Contract Laboratory Program Target Compound List OLM03.0
NA Not Applicable

TABLE 1-4

SW-846 6010B, 9010B, 7000A ANALYTICAL DETECTION LIMITS
CLP/TAL, CYANIDE, AND TIN LISTS
NAVSTA – MAYPORT
PAGE 1 OF 1

Parameter	RDL[1]
	Groundwater Samples
Target Analyte List Metals	µg/L
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium (total)	10
Cobalt	50
Copper	25
Iron	25
Lead	3
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Tin	10
Vanadium	50
Zinc	20
Cyanide	1.0

PQL Practical Quantitation Limit
1 RQL Required Maximum Quantitation Limit – Detection Limit expressed as Instrument Detection Limit obtained in pure water. Detection Limit for soil adjusted for the amount of sample analyzed and percent moisture.
2 COC Chemicals historically present at the site (Chemical of Concern)
3 Appendix IX 40 Code of Federal Regulatioins Part 264, Appenmdix IX Groundwater Monitoring List
4 CLP TCL U.S. Environmental Protection Agency Contract Laboratory Program Target Compound List OLM03.0
NA Not Applicable

TABLE 1-5

SW-846 8141A ANALYTICAL DETECTION LIMITS
APPENDIX IX LISTS
NAVSTA – MAYPORT
PAGE 1 OF 1

Parameter	RDL[1] Groundwater
Target Compound List	**µg/L**
Dimethoate	PQL
Disulfoton	PQL
Famphur	PQL
Parathion, methyl	PQL
Phorate	PQL

PQL Practical Quantitation Limit
1 RQL Required Maximum Quantitation Limit
2 COC Chemicals historically present at the site (Chemical of Concern)
3 Appendix IX 40 Code of Federal Regulatioins Part 264, Appenmdix IX Groundwater Monitoring List

NA Not Applicable

TABLE 1-6

SW-846 8151A ANALYTICAL DETECTION LIMITS
APPENDIX IX LISTS
NAVSTA – MAYPORT
PAGE 1 OF 1

Parameter	RDL[1]
	Groundwater Samples
Target Compound List	µg/L
2,4-Dichlorophenoxyacid[2,4-D]	PQL
Dinoseb	PQL
-[2,4,5-Trichlorophenoxyl] propionic acid[2,4,5-TP][Silvex]	PQL
2,4,5-T	PQL

PQL Practical Quantitation Limit
1 RQL Required Maximum Quantitation Limit
2 COC Chemicals historically present at the site (Chemical of Concern)
3 Appendix IX 40 Code of Federal Regulatioins Part 264, Appenmdix IX Groundwater Monitoring List

NA Not Applicable

TABLE 1-7

SW-846 3810 and 9056 ANALYTICAL DETECTION LIMITS
APPENDIX IX LISTS
NAVSTA – MAYPORT
PAGE 1 OF 1

Parameter	RDL[1]
	Groundwater Samples
Target Compound List	µg/L
Sulfate	PQL
Methane	PQL

PQL Practical Quantitation Limit
1 RQL Required Maximum Quantitation Limit
2 COC Chemicals historically present at the site (Chemical of Concern)
3 Appendix IX 40 Code of Federal Regulatioins Part 264, Appenmdix IX Groundwater Monitoring List

NA Not Applicable

2.0 PROJECT ORGANIZATION

The project organization for the NAS-MAYPORT sampling program is discussed in Section 3.1 of the SAP.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results, that will provide results which support project objectives. Intended data uses are described in Section 1.3.2 of this QAPP. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field and laboratory equipment, and corrective action are described in other sections of this QAPP.

The PARCC parameters (precision, accuracy, representativeness, comparability, and completeness) are qualitative and/or quantitative statements regarding the quality characteristics of the data used to support project objectives and ultimately, environmental decisions. These parameters are discussed in the remainder of this section. Specific routine procedures used to assess the quantitative parameters (precision, accuracy, and completeness) are provided in Section 12.0.

3.1 PRECISION

3.1.1 Definition

Precision is a measure of the amount of variability inherent in a data set. Precision describes the reproducibility of measurements of the same parameter for samples under similar conditions. The equation for determining precision is provided in Section 12.2.

3.1.2 Field Precision Objectives

Field duplicates for aqueous matrix samples will not be required. In lieu of taking duplicate measurements and using independent QC check standards, more frequent continuing calibrations will be performed. Field precision is further discussed in Section 7.5 of TtNUS' CompQAP.

3.1.3 Laboratory Precision Objectives

Laboratory precision QC samples are analyzed at a frequency of 5 percent (i.e., one quality control sample per 20 environmental samples). Laboratory precision is measured via comparison of calculated RPD values and Precision Control Limits specified in the analytical method.

With the exception of low-concentration volatiles analysis, precision for volatile and semivolatile organic analyses will be measured via the RPDs for matrix spike/matrix spike duplicate (MS/MSD) samples. The

analytical method for low-concentration volatile analysis does not require a specific QC sample to monitor precision. The calibration requirements of the method (i.e., specific limits of precision for the calibration standards) do ensure that a sufficient level of precision is achieved. (Calibration is further discussed in Section 6.0.) Precision for metals analysis will be measured via RPDs for laboratory duplicates. Table 3-1 presents precision control limits for MS/MSD RPDs for organics. Table 3-2 presents precision control limits for laboratory duplicate RPDs for metals. Precision for the remaining parameters (i.e., natural attenuation and miscellaneous parameters) will typically be measured via the RPD results for laboratory duplicate samples. Internal laboratory control limits for precision, which are typically set at three times the standard deviation of a series of RPDs, will be used for evaluation of precision for these parameters.

3.2 ACCURACY

3.2.1 Definition

Accuracy is the degree of agreement between the observed value and an accepted reference value. The equation for determining accuracy is provided in Section 12.1.

3.2.2 Field Accuracy Objectives

The determination of accuracy in the field is not required. In lieu of using independent QC check standards, more frequent continuing calibrations will be performed. Field accuracy is further discussed in Section 7.5 of TtNUS' CompQAP.

3.2.3 Laboratory Accuracy Objectives

Accuracy in the laboratory is measured through the comparison of a spiked sample result against a known or calculated value expressed as a percent recovery (%R). Percent recoveries are derived from the analysis of known amounts of compounds spiked into deionized water [i.e., laboratory control sample (LCS) analysis], or into actual samples (i.e., surrogate or MS analysis). LCS analyses measure the accuracy of laboratory operations. Surrogate and MS analyses measure the accuracy of laboratory operations as affected by matrix. LCS and/or MS analyses are performed with a frequency of one per

TABLE 3-1

PRECISION CONTROL LIMITS (RPDs)[1]
MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLES
VOLATILE AND SEMIVOLATILE ORGANIC ANALYSIS[2]
NAS-MAYPORT, MAYPORT, FLORIDA

Chemical	Solid Samples	Aqueous Samples
VOLATILE ORGANICS		
1,1-Dichloroethene	22	22
Trichloroethene	24	24
Benzene	21	21
Toluene	21	21
Chlorobenzene	21	21
SEMIVOLATILE ORGANICS		
Phenol	35	42
2-Chlorophenol	50	40
1,4-Dichlorobenzene	27	28
N-Nitroso-di-n-propylamine	38	38
1,2,4-Trichlorobenzene	23	28
4-Chloro-3-methylphenol	33	42
Acenaphthene	19	31
4-Nitrophenol	50	50
2,4-Dinitrotoluene	47	38
Pentachlorophenol	47	50
Pyrene	36	31
PESTICIDES		
gamma-BHC (Lindane)	50	50
Heptachlor	31	31
Aldrin	43	43
Dieldrin	38	38
Endrin	45	45
4,4'-DDT	50	50

1 RPD - Relative Percent Difference as described in Section 12.0.
2 USEPA Methods SW-846 8260B,8270C, and 8081A

TABLE 3-2

PRECISION CONTROL LIMITS (RPDs)[1]
LABORATORY DUPLICATE SAMPLES
METALS ANALYSIS[2]
NAS-MAYPORT, MAYPORT, FLORIDA

Chemical	Aqueous Samples	Solid Samples
METALS		
Aluminum	20	35
Antimony	20	35
Arsenic	20	35
Barium	20	35
Beryllium	20	35
Cadmium	20	35
Calcium	20	35
Chromium (total)	20	35
Cobalt	20	35
Copper	20	35
Iron	20	35
Lead	20	35
Magnesium	20	35
Manganese	20	35
Mercury	20	35
Nickel	20	35
Potassium	20	35
Selenium	20	35
Silver	20	35
Sodium	20	35
Thallium	20	35
Tin	20	35
Vanadium	20	35
Zinc	20	35

1 RPD - Relative Percent Difference as described in Section 12.0.
2 USEPA Method SW-846 6010B

twenty associated samples of like matrix. Surrogate spike analysis is performed for all chromatographic organic analyses. Laboratory accuracy is assessed via comparison of calculated %Rs with Accuracy Control Limits specified in the analytical method.

Accuracy for volatile and semivolatile organic analysis will be measured via the %Rs for surrogate spikes and MS/MSDs. Accuracy for metals analysis will be measured via %Rs for LCSs. Table 3-3 presents control limits for LCS and surrogate spike recoveries for low-concentration volatiles. Tables 3-4 and 3-5 present control limits for matrix and surrogate spike recoveries, respectively, for organics. Tables 3-6 and 3-7 present control limits for MS and LCSs, respectively, for metals. Accuracy for the remaining parameters will typically be measured via %Rs for MSs and/or LCSs. Internal laboratory control limits for accuracy, which are typically set at the mean contration +/- three times the standard deviation of a series of %R values, will be used for evaluation of accuracy for these parameters.

3.3 COMPLETENESS

Completeness is a measure of the amount of usable, valid analytical data obtained, compared to the amount expected. Completeness is typically expressed as a percentage. The equation for completeness is presented in Section 12.3.

The ideal objective for completeness is 100 percent (i.e., every sample planned to be collected is collected; every sample submitted for analysis yields valid data for each analyte). However, samples can be rendered unusable during shipping or preparation (e.g., bottles broken or extracts accidentally destroyed), errors can be introduced during analysis (e.g., loss of instrument sensitivity, introduction of ambient laboratory contamination), or strong matrix effects can become apparent (e.g., extremely low matrix spike recovery).

These instances result in data that do not meet QC criteria. Based on these considerations, 95 percent is considered an acceptable target for the data completeness objective. If critical data points are lost, resampling and/or reanalysis might be required.

As further discussed in Section 9.2, one hundred percent of the laboratory data for the NAS-MAYPORT investigation program will be reviewed. Data rejected as a result of the review process will be treated as unusable data.

TABLE 3-3

ACCURACY CONTROL LIMITS (%R)[1]
LABORATORY CONTROL SAMPLE AND SURROGATE SPIKE
VOLATILE ORGANIC ANALYSIS[2]
NAS-MAYPORT, MAYPORT, FLORIDA

Chemical	Aqueous Samples
LABORATORY CONTROL SAMPLE	
Vinyl chloride	60-140
1,2-Dichloroethane	60-140
Carbon tetrachloride	60-140
1,2-Dichloropropane	60-140
Trichloroethene	60-140
1,1,2-Trichloroethane	60-140
Benzene	60-140
cis-1,3-Dichloropropene	60-140
Bromoform	60-140
Tetrachloroethene	60-140
1,2-Dibromoethane	60-140
1,4-Dichlorobenzene	60-140
SURROGATE SPIKE	
Bromoflourobenzene	80-120

1 %R - Percent Recovery as described in Section 12.0.
2 USEPA Method 8260B

TABLE 3-4

ACCURACY CONTROL LIMITS (%R)[1]
MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLES
VOLATILE AND SEMIVOLATILE ORGANIC ANALYSIS[2]
NAS-MAYPORT, MAYPORT, FLORIDA

Chemical	Solid Samples	Aqueous Samples
VOLATILE ORGANICS		
1,1-Dichloroethene	59-172	50-180
Trichloroethene	62-137	61-142
Benzene	66-142	61-145
Toluene	59-139	52-141
Chlorobenzene	60-133	57-131
SEMIVOLATILE ORGANICS		
Phenol	26-90	12-110
2-Chlorophenol	25-102	27-123
1,4-Dichlorobenzene	28-104	36-97
N-Nitroso-di-n-propylamine	41.126	41-116
1,2,4-Trichlorobenzene	38-107	39-98
4-Chloro-3-methylphenol	26-103	23-97
Acenaphthene	31-137	46-118
4-Nitrophenol	11-114	10-80
2,4-Dinitrotoluene	28-89	24-96
Pentachlorophenol	17-109	9-103
Pyrene	35-142	26-127
PESTICIDES		
gamma-BHC (Lindane)	46-127	46-127
Heptachlor	35-130	35-130
Aldrin	34-132	34-132
Dieldrin	31-134	31-134
Endrin	42-139	42-139
4,4'-DDT	23-134	23-134

1 %R - Percent Recovery as described in Section 12.0
2 USEPA Method SW-846 8260B, 8270C, and 8081A

TABLE 3-5

ACCURACY CONTROL LIMITS (%R)[1]
SURROGATE SPIKES
VOLATILE AND SEMIVOLATILE ORGANIC ANALYSIS[2]
NAS-MAYPORT, MAYPORT, FLORIDA

Chemical	Aqueous Samples	Solid Samples
VOLATILE ORGANICS		
Toluene-d8	84-138	84-138
Bromofluorobenzene	59-113	59-113
1,2-Dichloroethane-d4	70-121	70-121
SEMIVOLATILE ORGANICS		
Nitrobenzene-d5	35-114	23-120
2-Fluorobiphenyl	43-116	30-115
Terphenyl-d14	33-141	18-137
Phenol-d5	10-110	24-113
2-Fluorophenol	21-110	24-121
2,4,6-Tribromophenol	10-123	19-122
2-Chlorophenol-d4	33-110	20-130
1,2-Dichlorobenzene-d4	16-110	20-130
PESTICIDES		
Tetrachloro-m-xylene	60-150	60-150
Decachlorobiphenyl	60-150	60-150

1 %R - Percent Recovery as described in Section 12.0.
2 USEPA Method SW-846 Method 8260B, 8270C, and 8081A

TABLE 3-6

ACCURACY CONTROL LIMITS (%R)[1]
MATRIX SPIKE SAMPLES
METALS ANALYSIS[2]
NAS-MAYPORT, MAYPORT, FLORIDA

Chemical	Aqueous Samples	Solid Samples
METALS		
Aluminum	75-125	75-125
Antimony	75-125	75-125
Arsenic	75-125	75-125
Barium	75-125	75-125
Beryllium	75-125	75-125
Cadmium	75-125	75-125
Calcium	75-125	75-125
Chromium (total)	75-125	75-125
Cobalt	75-125	75-125
Copper	75-125	75-125
Iron	75-125	75-125
Lead	75-125	75-125
Magnesium	75-125	75-125
Manganese	75-125	75-125
Mercury	75-125	75-125
Nickel	75-125	75-125
Potassium	75-125	75-125
Selenium	75-125	75-125
Silver	75-125	75-125
Sodium	75-125	75-125
Thallium	75-125	75-125
Tin	75-125	75-125
Vanadium	75-125	75-125
Zinc	75-125	75-125

1 %R - Percent Recovery as described in Section 12.0.
2 USEPA Method 6010B

TABLE 3-7

ACCURACY CONTROL LIMITS (%R)[1]
LABORATORY CONTROL SAMPLES
METALS ANALYSIS[2]
NAS-MAYPORT, MAYPORT, FLORIDA

Chemical	Aqueous Samples	Solid Samples
Aluminum	80-120	80-120
Antimony	80-120	80-120
Arsenic	80-120	80-120
Barium	80-120	80-120
Beryllium	80-120	80-120
Cadmium	80-120	80-120
Calcium	80-120	80-120
Chromium	80-120	80-120
Cobalt	80-120	80-120
Copper	80-120	80-120
Iron	80-120	80-120
Lead	80-120	80-120
Magnesium	80-120	80-120
Manganese	80-120	80-120
Mercury	NA	NA
Nickel	80-120	80-120
Potassium	80-120	80-120
Selenium	80-120	80-120
Silver	80-120	80-120
Sodium	80-120	80-120
Thallium	80-120	80-120
Tin	80-120	80-120
Vanadium	80-120	80-120
Zinc	80-120	80-120

1 Recovery as described in Section 12.0.
2 USEPA Method 6010B

3.4 REPRESENTATIVENESS

3.4.1 Definition

Representativeness is an expression of the degree to which the data accurately and precisely depict the actual characteristics of a population or environmental condition within a specified spatial and temporal boundary.

Use of standardized sampling, handling, analytical, and reporting procedures ensures that the final data accurately represent actual site conditions.

3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program. It will be satisfied by ensuring that the SAP is followed and that proper sampling techniques are used. The sampling network for the NAS-MAYPORT sampling program was designed to provide data representative of site conditions. During development of this network, consideration was given to past waste disposal practices, existing analytical data, and physical setting and processes. The rationale of the sampling network is discussed in detail in Section 3.3 of the SAP.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory data is ensured by using the proper analytical procedures, meeting sample holding times, and analyzing and assessing duplicate samples.

3.5 COMPARABILITY

3.5.1 Definition

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

3.5.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the SAP is followed and that proper sampling techniques are used. It is also dependent on recording field measurements using the correct units. Field measurement units are further discussed in Section 9.1.1.

3.5.3 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented. Results will be reported in units that ensure comparability with previous data and with current state and Federal standards and guidelines. Laboratory measurement units are further discussed in Section 9.1.2.

3.6 LEVEL OF QUALITY CONTROL EFFORT

Trip blank, rinsate blank, method blank, field and laboratory duplicate, laboratory control, and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

External QC measures (i.e., field quality control samples) consist of field duplicates, trip blanks, and equipment rinsate blanks. Information gained from these analyses further characterizes the level of data quality obtained to support project goals. Each of these types of field quality control samples undergo the same preservation, analysis, and reporting procedures as the related environmental samples. Each type of field quality control sample is discussed below.

Field duplicates are either two samples collected independently at a sampling location (e.g., surface water), or a single sample homogenized and split into two portions. [When volatile organic compounds (VOCs) are to be analyzed, the VOC sample aliquots are containerized first to avoid loss of constituents, and then the remaining sample matrix is homogenized.] Field duplicates are collected and analyzed for all chemical constituents to measure the precision of the sampling and analysis methods employed. The level of the QC effort will be one field duplicate for every 5 to 9 samples and then 10% of the number of additional investigative samples.

Trip blanks, consisting of analyte-free water, will be submitted to the laboratory to provide the means to assess the quality of the data resulting from the field-sampling program. Trip blanks only pertain to samples collected for VOC analysis. Trip blanks are used to assess the potential for contamination of

samples to be analyzed for VOCs by contaminant migration into sample containers during sample shipment and storage. Trip blanks are prepared by the laboratory prior to the sampling event, shipped to the site with the sample containers, and kept with the investigative samples throughout the sampling event. They are then packaged for shipment with other VOC samples and sent for analysis. There should be one trip blank included in each sample-shipping container that contains samples for VOC analysis. At no time after trip blank preparation are their sample containers to be opened before they reach the laboratory. Trip blanks are further discussed in Section 9.0 of TtNUS' CompQAP.

Equipment rinsate blanks are obtained under representative field conditions by collecting the rinse water generated by running analyte-free water through sample collection equipment after decontamination and prior to use. At least one equipment blank will be collected per day, per matrix. If pre-cleaned, dedicated, or disposable sampling equipment is used, one rinsate blank per type of equipment used must be collected as a "batch blank." Rinsate blanks are analyzed for the same chemical constituents as the associated environmental samples. Equipment blanks are further discussed in Section 9.0 of TtNUS' CompQAP.

Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. Laboratory duplicate samples are analyzed for inorganic parameters to check for sampling and analytical reproducibility. MSs provide information about the effect of the sample matrix on the digestion and measurement methodology. All MSs for organic analyses are performed in duplicate and, as previously defined, are referred to as MS/MSD samples.

MS/MSD samples are investigative samples. Aqueous MS/MSD samples must be collected at triple the volume for VOCs and extractable organics. One MS/MSD sample will be collected/designated for every 20 or fewer investigative samples per sample matrix (i.e., groundwater, surface water).

The level of QC effort for analytical testing will conform to the appropriate analytical methods, as specified in Tables 7-1 of this QAPP.

4.0 SAMPLING PROCEDURES

Field sampling procedures for the NAS-MAYPORT sampling program are discussed in TtNUS' CompQAP. In addition, the TtNUS' CompQAP and the SAP addresses the following sampling procedures and field investigation tasks:

- Groundwater-level measurements - Section 4.2.5.4 TtNUS CompQAP
- Monitoring well purging - Section 4.2.5.5 TtNUS CompQAP
- Sample containers, preservatives, and volume requirements – Appendix C
- Field measurements - Section 7.5 TtNUS CompQAP
- Decontamination procedures - Section 4.1 TtNUS CompQAP
- Investigation derived waste - Section 6.0 SAP
- Sample identification system - Section 3.1.3.14 SAP
- Sample packaging and shipping procedures - Section 4.4.3.2 TtNUS CompQAP
- Field quality control samples - Section 9.1.1 TtNUS CompQAP
- Recordkeeping – TtNUS SOP SA-6.3 (Appendix B)

5.0 CUSTODY PROCEDURES

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

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

The chain-of-custody (COC) report is a multi-part, standardized form used to summarize and document pertinent sample information, such as sample identification and type, matrix, date and time of collection, preservation, and requested analyses. Furthermore, through the sequential signatures of various sample custodians (e.g., sampler, airbill number, laboratory sample custodian), the COC report documents sample custody and tracking. A "Cradle-to-Grave" sample tracking will be employed. Custody procedures apply to all environmental and associated field quality control samples obtained as part of the data collection system.

5.1 FIELD CUSTODY PROCEDURES

The FOL (or designee) is responsible for the care and custody of the samples collected until they are relinquished to the analyzing laboratory or entrusted to a commercial overnight courier. COC reports are completed for each sample shipment. The reports are filled out in a legible manner, using waterproof ink, and are signed (and dated) by the sampler. Pertinent notes, such as whether the sample was field filtered, or whether the sample is suspected to be high in contaminant concentration, are also indicated on the COC report. Information similar to that contained in the COC report is also provided on the sample label, which is securely attached to the sample bottle. COC report forms and sample labels will be supplied by the laboratory subcontractor. In accordance with NFESC guidelines, samples for chemical constituent analysis must be sent (for next-day receipt) to the laboratory within 24-hours of collection.

Full details regarding sample COCs (including use of custody seals and sample shipment protocols) are contained in TtNUS Standard Operating Procedure (SOP) SA-6.1, which is provided as Appendix A. TtNUS SOP SA-6.3, also provided as Appendix B, discusses maintenance of site logbooks, site notebooks, and other field records. Additionally, each of the various sampling SOPs incorporated into this QAPP contains a section that addresses relevant sample documentation (i.e., completion of sample logsheets, etc.). All sample records are eventually docketed into the TtNUS project central file.

5.2 LABORATORY CUSTODY PROCEDURES

When samples are received by the laboratory subcontractor, the laboratory's sample custodian examines each cooler's custody seals to verify that they are intact and that the integrity of the environmental samples has been maintained. The sample custodian then signs the COC report. The custodian then opens the cooler and measures its internal temperature. The temperature reading is noted on the accompanying COC report. The sample custodian then examines the contents of the cooler. Sample container breakages or discrepancies between the COC report and sample label documentation are recorded. With the exception of samples for volatile analysis, the pH of chemically preserved samples is checked using pH paper and recorded. All problems or discrepancies noted during this process are to be promptly reported to the TtNUS Project Manager. Inter-laboratory COC procedures and specific procedures for sample handling, storage, disbursement for analysis, and remnant disposal will be followed as specified by the subcontract laboratory's SOPs and/or QA Plan.

5.3 FINAL EVIDENCE FILES

The TtNUS central file will be the repository for all documents, which constitute evidence relevant to sampling and analysis activities as described in this QAPP. TtNUS is the custodian of the evidence file and maintains the contents of these files, including all relevant records, reports, logs, field notebooks, photographs, subcontractor reports and data reviews in a secure, limited access location and under custody of the TtNUS facility manager. The control file will include at a minimum:

- field logbooks
- field data and data deliverables
- photographs
- drawings
- soil boring logs
- laboratory data deliverables
- data validation reports
- data assessment reports

- progress reports, QA reports, interim project reports, etc.
- all custody documentation (chain-of-custody forms, airbills, etc.)

Upon completion of the contract, all pertinent files will be relinquished to the custody of the United States Navy.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

All instrumentation used to perform chemical measurements must be properly calibrated prior to use in order to obtain valid and usable results. The requirement to properly calibrate instruments prior to use applies equally to field instruments as it does to fixed laboratory instruments. Field instrument calibration is discussed in Section 6.1. Laboratory instrument calibration is discussed in Section 6.2.

6.1 FIELD INSTRUMENT CALIBRATION

Field instrument calibration is discussed in Section 7.5 of TtNUS CompQAP.

6.2 LABORATORY INSTRUMENT CALIBRATION

Calibration procedures for a specific laboratory instrument will consist of initial calibration (generally 3 to 5 points), initial calibration verification (inorganic methods only), and continuing calibration verification. In all cases, the initial calibration will be verified using an independently prepared calibration verification solution. The frequency of calibration will be performed according to the requirements of the specific methods.

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

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

6.2.1 GC/MS Volatile Organic Compound Analyses

For volatile organic compounds, the gas chromatograph/mass spectrometer (GC/MS) system will be tuned and calibrated in accordance with the appropriate analytical method. A bromofluorobenzene (BFB) instrument performance check (tuning check) must be run prior to the initial and each continuing calibration and must meet all method-specified criteria before analysis may continue. Initial calibration is required before any samples are analyzed and must include a blank and a minimum of five different

concentrations as specified in the method. A BFB tuning check and a continuing calibration check, including the mid-range standard and a blank, must be performed at the beginning of each 12-hour shift during which analyses are performed.

6.2.2 GC/MS Semivolatile Organic Compound Analyses

For semivolatile organic compounds, the GC/MS system will be tuned and calibrated in accordance with the appropriate analytical method. A decafluorotriphenyl phosphine (DFTPP) instrument performance check (tuning check) must be run prior to the initial and each continuing calibration and must meet all method-specified criteria before analysis may continue. Initial calibration is required before any samples are analyzed and must include a blank plus five different concentrations as specified in the method. A DFTPP tuning check and a continuing calibration check, including the mid-range standard and a blank, must be performed at the beginning of each 12-hour shift during which analyses are performed.

6.2.3 Metals Analyses

6.2.3.1 Inductively Coupled Argon Plasma (ICP) Analyses

Inductively coupled plasma (ICP) spectrometry systems will be calibrated for the analysis of metals in accordance with the appropriate analytical method. Initial calibration is required each day before any samples are analyzed and consists of a calibration blank and at least three calibration standards (at least four standards for CVAA) covering the range of concentrations of interest. The standard must be within the demonstrated linear range of the instrument. The linear range is verified quarterly. Immediately following initial calibration, an initial calibration verification sample (obtained from a different source than the solutions used for calibration), an initial calibration blank, and an interference check sample are analyzed. A continuing calibration verification sample and a continuing calibration blank are run every 2 hours or every 10 samples, whichever occurs first. A continuing calibration verification sample, a continuing calibration blank, and an interference check sample are also run after analysis of the last sample. The initial calibration verification standard, continuing calibration verification standard, and interference check sample each contain analytes of interest at different concentrations. In addition, a standard prepared at a concentration of two times the quantitation limit is analyzed at the beginning and end of each sample analysis run or a minimum of twice per 8-hour period. Linearity spanning the range of analysis is verified using this combination of standards. All calibration standards contain acids at the same concentrations as the sample digestates.

6.2.3.2 Atomic Absorption Analyses

Graphite furnace and cold vapor atomic absorption (GFAA and CVAA) analyses will be calibrated in accordance with the appropriate analytical method. Initial calibration is required each day before any samples are analyzed and consists of a calibration blank and at least three calibration standards (at least four standards for mercury) covering the range of concentrations of interest. The correlation coefficient of the regression of concentration versus response should be 0.995 or greater. Immediately following initial calibration, an initial calibration verification sample (obtained from a different source than the solutions used for calibration) and an initial calibration blank are analyzed. A continuing calibration verification sample and a continuing calibration blank are run every two hours or every ten samples, whichever occurs first. A continuing calibration verification sample and a continuing calibration blank are also run after analysis of the last sample.

6.2.4 Miscellaneous Parameters

Calibration and standardization requirements for the analysis of the remaining parameters will be performed as specified in the applicable analytical methods. Analytical methods are further discussed in Section 7.0 of this QAPP.

7.0 ANALYTICAL AND MEASUREMENT PROCEDURES

Samples will be subjected to field and laboratory parameter measurement as necessary based on the sample location under investigation. The analytical program for environmental samples collected at each anticipated location is provided in Section 3.3.2.6 of the SAP.

Chemical/physical parameters to be measured using field instrumentation include; temperature, specific conductance, pH, and turbidity. Measurement of field parameters and calibration of field instruments are discussed in Section 7.5 of TtNUS' CompQAP.

The analytical laboratory responsible for the chemical analyseswhich must be NFESC-approved, will be certified by the Florida Department of Health – Division of Laboratory Certification for all analyses that are requested by TtNUS and will be required to have a current FDEP approved CompQAP.

All groundwater samples for low-concentration volatiles analysis will be analyzed in accordance with current SW-846 methods. All samples for organics, metals and other inorganics analyses will be analyzed in accordance with current SW-846 methods. Table 7-1 provides a summary of the laboratory analytical methods for the NAS – MAYPORT sampling program.

A complete list of the target compounds/analytes, RQLs, RDLs, and estimated PQLs is provided in Section 1.3.2.2 of this QAPP. Data generated through use of the EPA method protocols will be reported to the RQL for organics analysis and the RDL for inorganics analysis. Analytes which are positively identified and which can be quantitated at concentrations below the RQL/RDL will be reported as specified in the appropriate analytical method. All environmental data generated through use of non-CLP methods will be reported to the analyte's PQL. An analyte's PQL is computed similarly to the method detection limit with consideration given to required adjustments to ensure that the precision and accuracy requirements of the method are attainable. The PQLs provided in the tables in Section 1.3.2.2 are estimated since these values may vary based on the laboratory.

Quantitation and detection limits will also be adjusted, as necessary, based on dilutions and sample volume.

TABLE 7-1

SUMMARY OF ORGANIC AND INORGANIC ANALYTICAL PROCEDURES APPENDIX IX AND CLP TCL LISTS NAS – MAYPORT, MAYPORT, FLORIDA

Analytical Parameter	Analytical Method
TCL Volatile Organics	SW-846 8260B
Appd IX Volatile Organics	SW-846 8260B
Appd IX Non-haloginated Volatile Organics	SW846 8015B mod.
TCL Semivolatile Organics	SW-846 8270C
Appd IX Semivolatile Organics	SW-846 8270C
TCL PCBs	SW-846 8082
TCL Pesticides	SW-846 8081A
Appd IX Pesticides	SW-846 8081A
Appd IX PCBs	SW-846 8082
Appd IX Organochlorine Herbicides	SW-846 8151A
Appd IX Organophosorous Pesticides	SW-846 8141A
TAL Metals/Cyanide	SW-846 6010B/335.1
Appd IX Metals/Cyanide	SW-846 6010B/9010B/9012A/9013

8.0 INTERNAL QUALITY CONTROL CHECKS

Field-related QC checks were discussed in Section 3.0 of this QAPP and in Section 9.1.1 of TtNUS' CompQAP. This section provides additional information regarding internal quality control checks for the field and the laboratory.

8.1 FIELD QUALITY CONTROL CHECKS

QC procedures for field measurements will include calibrating the instruments as discussed in Section 7.5 of TtNUS' CompQAP. Assessment of field sampling precision and bias will be made by collection of field duplicates and rinsate blanks for laboratory analysis as discussed in Section 3.6 of this QAPP.

8.2 LABORATORY QUALITY CONTROL CHECKS

The subcontract laboratory will have a QC program that ensures the reliability and validity of the analyses performed at the laboratory. Internal quality control procedures for analyses will comply with the applicable analytical method requirements.

Several internal laboratory QC checks are briefly discussed in the remainder of this section.

Laboratory method blanks are prepared and analyzed in accordance with the analytical method employed to determine whether contaminants originating from laboratory sources have been introduced and have affected environmental sample analyses. A method blank generally consists of an aliquot of analyte-free water that is subjected to the same preparation and analysis procedures as the environmental samples undergoing analysis. With the exception of recognized volatile and semivolatile common laboratory contaminants (i.e., methylene chloride, acetone, 2-butanone, and phthalate esters) detected, method blanks must not contain levels of target analytes above the reported detection limits (above 2.5X the RQL for methylene chloride and above 5X the RQL for acetone, 2-butanone, and phthalate esters). Under no circumstances are laboratory method blank contaminant values subtracted from environmental sample analysis results.

Matrix spike analysis for organic fraction analyses is performed in duplicate as a measure of laboratory precision. For inorganic analyses, one matrix spike analysis and one **laboratory duplicate** analysis are performed for every 20 environmental sample analyses of like matrix. With the exception of VOC MSD analyses, laboratory duplicates are prepared by thoroughly mixing and splitting a sample aliquot into two portions and analyzing each portion following the same analytical procedures that are used for the

environmental sample analyses. For VOC MSD analyses, a second sample aliquot is used for analysis in order to avoid VOC constituent loss through the homogenization process. The field crew provides extra volumes of sample matrices designated for laboratory quality control analyses, as required. As discussed in Section 3.0 of this QAPP, control limits for MS and laboratory duplicate analyses.

Surrogates are organic compounds (typically brominated, fluorinated, or isotopically labeled) which are similar in nature to the compounds of concern, and which are not likely to be present in environmental media. Surrogates are spiked into each sample, standard, and method blank prior to analysis, and are used only in organic chromatographic analysis procedures as a check of method effectiveness. As discussed in Section 3.0, surrogate recoveries are evaluated against control limits specified in the associated method, where applicable, or laboratory-derived control limits.

Laboratory control samples serve to monitor the overall performance of each step during the analysis, including the sample preparation. Laboratory control sample analysis will be performed for low-concentration volatiles, metals, and as required by the applicable analytical. Aqueous LCS results must fall within the control limits specified in the analytical method, where applicable, or established by the laboratory. Aqueous LCSs shall be analyzed utilizing the same sample preparations, analytical methods, and QA/QC procedures as employed for the samples.

Internal standard performance criteria ensure that volatile and semivolatile GC/MS analysis sensitivity and response are stable during every analytical run. Internal standard area counts for samples and blanks must not vary by more than a factor of two (- 50% to + 100%) from the associated 12-hour calibration standard (±40% for low-concentration volatile analysis). The retention time of the internal standards in samples and blanks must not vary by more than ±30 seconds from the retention time of the associated 12-hour calibration standard (±20 seconds for low-concentration volatile analysis).

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

This section describes the procedures to be used for data reduction, review, and reporting for NAS – MAYPORT sampling program. All data generated during the course of the investigation will be maintained in hardcopy format by TtNUS in the Naval Facilities Engineering Command Southern Division designated central files located in TtNUS' Pittsburgh office.

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

9.1 DATA REDUCTION

Data reduction will be completed for both field measurements and laboratory-generated analytical data. Field data reduction will be relatively limited versus the degree of laboratory data reduction required for the project. Reduction of both field data and laboratory data are discussed in the remainder of this section.

9.1.1 Field Data Reduction

Field data will be generated through on-site water quality testing for general indicator parameters including pH, specific conductance, turbidity, and temperature.

The field parameters will be recorded in the site logbook and on sample logsheets immediately after the measurements are taken and later encoded in the NAS – MAYPORT database for presentation in the Report. If an error is made in the logbook, the error will be legibly crossed out (single-line strikeout), initialed and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. No calculations will be necessary to reduce these data for inclusion in Report. Field data will be entered in the electronic database manually, and a representative sampling of the entries will be verified by an independent reviewer to make sure that no "transcription" errors occurred.

Field measurements will be recorded and reported in the following units:

- Hydronium ion concentration (standard pH units)
- Temperature (degrees Celsius)
- Specific Conductance (millimhos/cm)
- Turbidity (Nephelometric turbidity units, NTU)
- Dissolved oxygen (mg/L)
- Ferrous iron (mg/L)
- REDOX Potential (mV)

Standard pH units as specified above are the negative logarithm (base 10) of the hydronium ion chemical activity in moles/liter.

9.1.2 Laboratory Data Reduction

Laboratory data reduction of analytical results generated via non-CLP methods will be completed in accordance with the applicable analytical methods.

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

Groundwater samples:

- Volatile and semivolatile organics - µg/L
- Metals – mg/L
- Cyanide - mg/L

Soil samples:

- Volatile and semivolatile organics - µg/kg
- Metals - mg/kg
- Cyanide - mg/kg

Field Quality Control sample results will be included in the database for the NAS – MAYPORT sampling program. Specifically, the analytical results for field duplicates, trip blanks, and rinsate blanks will be

provided. The results for field QC samples will be considered during the course of data review (in concert with laboratory method blanks) to eliminate false positive results according to the 5- and 10-times rules specified in the National Functional Guidelines for Organic and Inorganic Data Review. The results for laboratory QC samples such as method blanks will not be presented in the Report database. In addition, only the original (unspiked) sample results for MS/MSD samples will be provided in the database.

9.2 DATA VALIDATION

Validation of field measurements and laboratory analytical data are discussed in this section. Validation of field data will be limited to real time "reality" checks. For example, review for transcription errors, consistency of measurement units with requirements, plausibility of reported value, etc. Laboratory analytical data will be reviewed. Review of laboratory analytical data is discussed in Section 9.2.2.

9.2.1 Field Measurement Data Validation

Field measurements will not be subjected to a formal data validation process. However, field technicians will ensure that the equipment used for field measurement is performing accurately via calibration as discussed in Section 7.5 of TtNUS' CompQAP. As described in Section 9.1.1, all field data entered into the electronic database will be independently reviewed for transcription errors.

9.2.2 Laboratory Data Review

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

Organic data analytical results will be reviewed versus the applicable analytical method. Particular emphasis will be placed on holding time compliance, spike recoveries, and blank results. The inorganic data analytical results for non-CLP parameters will be reviewed versus the applicable analytical methods.

9.3 DATA REPORTING

9.3.1 Field Measurement Data Reporting

Field data will be reported in the units discussed in Section 9.1.1. The Report will include a comprehensive database including all field measurements (specifically pH, specific conductance, temperature, D.O., Fe2+, Eh, and turbidity). Field measurements will be transferred from the site logbook or sample logsheets to the electronic database manually and will be reviewed for accuracy by an

independent reviewer. Transcription of field measurements to the electronic database will be completed shortly after completion of the field investigation and prior to receipt of laboratory analytical data.

All records regarding field measurements (i.e., field logbooks, sampling logbooks, and sample logsheets) will be placed in TtNUS' Southern Division central files upon completion of the field effort. Entry of these results in the database will require removal of these results from the files. Outcards will be used to document the removal of any such documentation from the files (date, person, subject matter). Field measurement data will be reported in an appendix of the Report at a minimum and may also be reported in summary fashion if they are indicative of the presence of contamination (e.g., unexpectedly high specific conductance readings).

9.3.2 Laboratory Data Reporting

Data reported by the laboratory will be in accordance with the reporting format described in TtNUS' analytical Statement of Work for the contracted laboratory. All pertinent quality control data including method blanks, standards analysis, calibration information, etc. will be provided for the non-CLP analyses. Case narratives and a certificate of analysis will be provided for each Sample Delivery Group.

All environmental and field QC sample results (trip blanks, field duplicates, rinsate blanks) will be included in the Report as an appendix. The database will include pertinent sampling information such as sample number, sampling date, general location, depth, and survey coordinates (if applicable). Sample-specific detection limits will be reported for nondetected analytes. Units will be clearly summarized in the database and will conform to those identified in Section 9.1.2. The analytical data may also be reported in summary fashion within the body of the Report text in tabular and graphic fashion.

Data will be handled electronically pursuant to the electronic deliverable requirements specified in TtNUS' Basic Ordering Agreement with analytical laboratories. This agreement requires the analytical laboratories to provide data in both hardcopy and electronic form. The original electronic diskettes and the original hardcopy analytical data are maintained in TtNUS' Southern Division central files as received.

Data review will be completed using the hard copy data. Upon completion of the review of a Sample Delivery Group and review by the Data Validation Coordinator, review qualifiers will be entered in the electronic database and will be subjected to independent review for accuracy. During this review process, the electronic data base printout will also be contrasted with the hard copy data to ensure that the hard copy data and electronic data are consistent.

In addition, a summary of the data qualifiers for all project samples will be prepared. This summary will include a list of chemicals identified as laboratory and/or field QC blank contaminants, holding time exceedences, samples exhibiting unacceptable field duplicate/replicate precision as well as affected chemicals, rejected results and associated specific causes, and general causes of estimated results. This summary will facilitate the preparation of a summary of the data review results and completeness assessment for inclusion in the Report.

10.0 PERFORMANCE AND SYSTEM AUDITS

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

- The FOL will supervise and check daily that the field measurements are made accurately, equipment is thoroughly decontaminated, samples are collected and handled properly, and fieldwork is documented accurately and neatly.

- Performance and system audits of the laboratory will be performed regularly by a Navy Contractor (internal), and in accordance with the Laboratory Quality Assurance Plan (internal).

- Data reviewers will evaluate the chemical analytical data packages submitted by the laboratory. The data reviewers will check that the data were obtained through use of an approved methodology, that the appropriate level of QC effort and reporting was conducted, and whether or not the results are in conformance with QC criteria. Based on these factors, the data reviewer will generate a report describing data limitations, which will be reviewed internally by the Data Validation Coordinator prior to submittal to the Project Manager.

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

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

- The Project Manager will maintain contact with the FOL and Data Validation Coordinator to ensure that management of the acquired data proceeds in an organized and expeditious manner. Similarly, the Project Manager will interface with the Modeling Coordinators, as applicable.

11.0 PREVENTIVE MAINTENANCE PROCEDURES

Measuring equipment used in environmental monitoring or analysis for the NAS – MAYPORT sampling program shall be maintained in accordance with the manufacturer's operation and maintenance manuals. Equipment and instruments shall be calibrated in accordance with the procedures, and at the frequency, discussed in Section 6.0 (Calibration Procedures and Frequency). Preventive maintenance for field and laboratory equipment is discussed in the remainder of this section.

11.1 FIELD EQUIPMENT PREVENTIVE MAINTENANCE

TtNUS has established a program for the maintenance of field equipment to ensure the availability of equipment in good working order when and where it is needed. This program consists of the following elements:

- The TtNUS equipment manager keeps an inventory of the equipment in terms of items (model and serial number), quantity, and condition. Each item of equipment is signed out when in use, and its operating condition and cleanliness checked upon return.

- The equipment manager conducts routine checks on the status of equipment and is responsible for the stocking of spare parts and equipment readiness. The equipment manager also maintains the equipment manual library.

- The FOL is responsible for working with the equipment manager to make sure that the equipment is tested, cleaned, charged, and calibrated in accordance with the manufacturer's instructions and TtNUS SOPs before being taken to the job site and during field activities.

- During calibration, an appropriate maintenance check is performed on each piece of equipment. Any problems encountered while operating the instrument will be recorded in the field log book including a description of the symptoms and corrective actions taken.

- If problem equipment is detected or should require service, the equipment will be logged, tagged, and segregated from equipment in proper working order. Use of the instrument will not be resumed until the problem is resolved.

11.2 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

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

11.2.1 Major Instruments

Table 11-1 provides a summary of preventive maintenance procedures typically performed for key analytical instruments. Maintenance of key instruments is sometimes covered under service contracts with external firms. These contracts provide for periodic routine maintenance to help guard against unexpected instrument downtime. The contracts also provide for quick response for unscheduled service calls when malfunctions are observed by the operator.

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

11.2.2 Refrigerators/Ovens

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

- Date
- Temperature
- Initials of person performing the check

Maintenance of the logs is typically the responsibility of the sample custodian. However, assignment of responsibilities for temperature monitoring to specific personnel does not preclude the participation of other laboratory personnel. If unusual temperature fluctuations are noted, it is the responsibility of the

observer to immediately notify the person in charge of the discrepancy before the condition of the samples is compromised.

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

TABLE 11-1

TYPICAL PREVENTIVE MAINTENANCE FOR KEY ANALYTICAL INSTRUMENTS NAS – WHITING FIELD, MILTON, FLORIDA

Instrument	Preventive Maintenance	Maintenance Frequency
GC/MS	Volatiles: Bake oven, replace septum, check carrier gas.	As required.
	Semivolatiles: Replace the septum, clean injection port, replace liner, bake oven, check carrier gas, clean the source.	As required.
	Replace solvent washes and clean syringe.	Daily.
GC	Replace solvent washes and clean syringe.	Daily.
	Clip column, clean injection port, replace liner, and bake oven.	As required.
ICP	Change sample introduction tubing, clean nebulizer, clean spray chamber, clean torch, manual profile, and automatic profile optics.	As required.
GFAA	Clean contact cylinders, replace/clean tube, check lamp alignment.	As required.
CVAA	Change sample introduction tubing, change drying cell, re-zero detector.	As required.
Spectrophotometer	Check that cuvette has no scratch on its surface.	Daily.
	Turn power off at the end of the day and warm up for at least one hour before use.	Daily
TOC Analyzer	Refresh phosphoric acid.	Biweekly.
	Clean catalyst.	As required.
	Replace water in IC chamber.	Biweekly.

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

Compliance with the QC objectives outlined in Section 3.0 will be monitored via two separate mechanisms. Precision and accuracy will be assessed through data. Compliance with the completeness objectives for field and laboratory data/measurement will be calculated by hand (field measurements) and electronically via a database subroutine (laboratory data). Information necessary to complete the precision and accuracy calculations will be provided in electronic and hardcopy form by the subcontract laboratory. Equations to be used for the precision, accuracy, and completeness assessment are outlined in the remainder of this section.

12.1 ACCURACY ASSESSMENT

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

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

12.2 PRECISION ASSESSMENT

Duplicate samples (for inorganic analyses) and MSD samples (for organic analyses) are prepared and analyzed at a minimum frequency of 1 per every 20 environmental samples. Duplicate samples are prepared by dividing an environmental sample into equal aliquots.

MSD samples are prepared by dividing an environmental sample into equal aliquots and then spiking each of the aliquots with a known amount of analyte. The duplicate samples are then included in the analytical sample set. The splitting of the sample allows the analyst to determine the precision of the preparation and analytical techniques associated with the duplicate samples. The RPD between the sample (or spike) and duplicate (or duplicate spike) is calculated and plotted. The RPD is calculated according to the following formula:

$$RPD = \frac{\text{Amount in Sample} - \text{Amount in Duplicate}}{0.5\ (\text{Amount in Sample} + \text{Amount in Duplicate})} \times 100\ \%$$

12.3 COMPLETENESS ASSESSMENT

Completeness is the ratio of the number of usable, valid sample results to the total number of sample results expected to be obtained for the project as a whole for each analyte. Following the completion of the analytical testing and data validation, the percent completeness will be calculated by the following equation:

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

The results of the data validation process and the completeness assessment will be summarized in the Report using the summary format discussed in Section 9.3.2 and an electronic database subroutine.

13.0 CORRECTIVE ACTION

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

13.1 FIELD CORRECTIVE ACTION

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

Corrective action may include resampling and may involve amending previously approved field procedures. If warranted by the severity of the problem (e.g., if a change in the approved Project Plan documents or SOPs is required), the Navy will be notified in writing via a Field Task Modification Request (FTMR), and Navy (in conjunction with USEPA Region IV and FDEP) approvals will be obtained. The FOL is responsible for initiating FTMRs; an FTMR will be initiated for all deviations from the Project Plan documents, as applicable. An example of an FTMR is provided as Figure 13-1. Copies of all FTMRs will be maintained with the onsite project planning documents and will be placed in the final evidence file.

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

FIGURE 13-1

TETRA TECH NUS, INC.
FIELD TASK MODIFICATION REQUEST FORM

Client Identification _____ Project Number _____ FTMR Number _____

To _____ Location _____ Date _____

Description:

_____
_____
_____
_____

Reason for Change:

_____
_____
_____
_____

Recommended Disposition:

_____
_____
_____
_____

_____
Field Operations Leader (Signature, if applicable) Date

Disposition:

_____
_____
_____
_____

_____
Project Manager (Signature, if required) Date

_____
Distribution:
Program Manager
Quality Assurance Officer
Project Manager
Field Operations Leader

Others as required _____
_____
_____
_____

13.2 LABORATORY CORRECTIVE ACTION

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

- QC data are outside established warning or control limits;
- Method blank analyses yield concentrations of target analytes above acceptable levels;
- Undesirable trends are detected in spike recoveries or in duplicate RPDs;
- There is an unexplained change in compound detection capability;
- Inquiries concerning data quality are received; and
- Deficiencies are detected by laboratory QA staff audits or from performance evaluation sample test results.

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

13.3 CORRECTIVE ACTION DURING DATA REVIEW AND DATA ASSESSMENT

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

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

QA reports to management will be provided in three primary formats during the course of the NAS – MAYPORT sampling program. Data review letter reports will be prepared on a Sample Delivery Group-specific basis and will summarize QA issues for the subcontract laboratory data. In addition, written weekly reports summarizing accomplishments and QA/QC issues during the field investigation will be provided by the FOL. Finally, monthly progress reports are provided by the Project Manager. In addition, a summary of data review qualifiers and a completeness assessment for all project samples will be included in the Report.

14.1 CONTENTS OF PROJECT QUALITY ASSURANCE REPORTS

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

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

14.2 INDIVIDUALS RECEIVING/REVIEWING QUALITY ASSURANCE REPORTS

Data review QA Reports are provided to the Project Manager for inclusion in the project files. In the event that major problems are observed for a given laboratory, the Program Manager, Deputy Program Manager, QA Manager, Project Manager, and Laboratory Services Coordinator are provided with copies of the QA report. Weekly field progress reports are provided to the Project Manager. Monthly progress

reports are provided to the Navy CLEAN III Program Manager and the Navy CLEAN III Contracting Officers Technical Representative.

APPENDIX A

QAPP

TtNUS SOP SA-6.1

BROWN & ROOT ENVIRONMENTAL	STANDARD OPERATING PROCEDURES	Number SA-6.1	Page 1 of 23
		Effective Date 03/01/96	Revision 0
		Applicability B&R Environmental, NE	
		Prepared Earth Sciences Department	
Subject NON-RADIOLOGICAL SAMPLE HANDLING		Approved D. Senovich	

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1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide information on sample preservation, packaging, and shipping procedures to be used in handling environmental samples submitted for chemical constituent, biological, or geotechnical analysis. Sample chain-of-custody procedures and other aspects of field documentation are addressed in SOP SA-6.3. Sample identification is addressed in SOP CT-04.

2.0 SCOPE

This procedure:

- Describes the appropriate containers to be used for samples depending on the analyses to be performed, and the steps necessary to preserve the samples when shipped off site for chemical analysis.
- Provides instruction for sample packaging and shipping in accordance with current U.S. Department of Transportation (DOT) regulations.

3.0 GLOSSARY

Hazardous Material - A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. Under 49 CFR, the term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials, as well as materials designated as hazardous under the provisions of §172.101 and §172.102 and materials that meet the defining criteria for hazard classes and divisions in Part 173.

Hazardous Waste - Any substance listed in 40 CFR, Subpart D (§261.30 et seq.), or otherwise characterized as ignitable, corrosive, reactive, or toxic (as defined by Toxicity Characteristic Leaching Procedure, TCLP, analysis) as specified under 40 CFR, Subpart C (§261.20 et seq.), that would be subject to manifest requirements specified in 40 CFR 262. Such substances are defined and regulated by EPA.

Marking - A descriptive name, identification number, instructions, cautions, weight, specification or UN marks, or combination thereof required on outer packaging of hazardous materials.

n.o.i - Not otherwise indicated (may be used interchangeably with n.o.s.).

n.o.s. - Not otherwise specified.

ORM - Other regulated material (see DOT 49 CFR 173.144).

Packaging - A receptacle and any other components or materials necessary for compliance with the minimum packaging requirements of 49 CFR 174, including containers (other than freight containers or overpacks), portable tanks, cargo tanks, tank cars, and multi-unit tank-car tanks to perform a containment function in conformance with the minimum packaging requirements of 49 CFR 173.24(a) & (b).

Placard - Color-coded, pictorial sign which depicts the hazard class symbol and name and which is placed on the side of a vehicle transporting certain hazardous materials.

Common Preservatives:

- Hydrochloric Acid - HCl
- Sulfuric Acid - H_2SO_4
- Nitric Acid - HNO_3
- Sodium Hydroxide - NaOH

Other Preservatives

- Zinc Acetate
- Sodium Thiosulfate - $Na_2S_2O_3$

Normality (N) - Concentration of a solution expressed as equivalent per liter, an equivalent being the amount of a substance containing 1 gram-atom of replaceable hydrogen or its equivalent. Thus, a one-molar solution of HCl, containing 1 gram-atom of H, is "one normal," whereas a one-molar solution of H_2SO_4, containing 2 gram-atoms of H, is "two normal."

Reportable Quantity (RQ) - For the purposes of this SOP, means the quantity specified in column 3 of the Appendix to DOT 49 CFR §172.101 for any material identified in column 1 of the appendix. A spill greater than the amount specified must be reported to the National Response Center.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the location and time of collection.

4.0 RESPONSIBILITIES

Field Operations Leader - Directly responsible for the bottling, preservation, labeling, packaging, shipping, and custody of samples up to and including release to the shipper.

Field Samplers - Responsible for initiating the Chain-of-Custody Record (per SOP SA-6.3), implementing the packaging and shipping requirements, and maintaining custody of samples until they are relinquished to another custodian or to the common carrier.

5.0 PROCEDURES

Sample identification, labeling, documentation, and chain-of-custody are addressed by SOP SA-6.3.

5.1 Sample Containers

Different types of chemicals react differently with sample containers made of various materials. For example, trace metals adsorb more strongly to glass than to plastic, whereas many organic chemicals may dissolve various types of plastic containers. Attachments A and B show proper containers (as well as other information) per 40 CFR 136. In general, the sample container shall allow approximately 5-10 percent air space ("ullage") to allow for expansion/vaporization if the sample warms during transport. However, for collection of volatile organic compounds, head space shall be omitted. The analytical laboratory will generally provide certified-clean containers for samples to be analyzed for chemical constituents. Shelby tubes or other sample containers are generally provided by the driller for samples requiring geotechnical analysis. Sufficient lead time shall be allowed for a delivery of bottle orders. Therefore, it is critical to use the correct container to maintain the integrity of the sample prior to analysis.

Once opened, the container must be used at once for storage of a particular sample. Unused but opened containers are to be considered contaminated and must be discarded; because of the potential for introduction of contamination, they cannot be reclosed and saved for later use. Likewise, any unused containers which appear contaminated upon receipt, or which are found to have loose caps or a missing Teflon liner (if required for the container), shall be discarded.

5.2 Sample Preservation

Many water and soil samples are unstable and therefore require preservation to prevent changes in either the concentration or the physical condition of the constituent(s) requiring analysis. Although complete and irreversible preservation of samples is not possible, preservation does retard the chemical and biological changes that inevitably take place after the sample is collected. Preservation techniques are usually limited to pH control, chemical addition(s), and refrigeration/ freezing (certain biological samples only).

5.2.1 Overview

The preservation techniques to be used for various analytes are listed in Attachments A and B. Reagents required for sample preservation will either be added to the sample containers by the laboratory prior to their shipment to the field or be added in the field (in a clean environment). Only high purity reagents shall be used for preservation. In general, aqueous samples of low-concentration organics (or soil samples of low- or medium-concentration organics) are cooled to 4°C. Medium-concentration aqueous samples and high-hazard organics samples are typically not preserved. Low-concentration aqueous samples for metals are acidified with HNO_3, whereas medium-concentration and high-hazard aqueous metal samples are not preserved. Low- or medium-concentration soil samples for metals are cooled to 4°C, whereas high-hazard samples are not preserved.

The following subsections describe the procedures for preparing and adding chemical preservatives. Attachments A and B indicate the specific analytes which require these preservatives.

5.2.2 Preparation and Addition of Reagents

Addition of the following acids or bases may be specified for sample preservation; these reagents shall be analytical reagent (AR) grade or purer and shall be diluted to the required concentration with deionized water before field sampling commences. To avoid uncontrolled reactions, be sure to Add Acid to water (not vice versa). A dilutions guide is provided below.

Acid/Base	Dilution	Concentration	Estimated Amount Required for Preservation
Hydrochloric Acid (HCl)	1 part concentrated HCl: 1 part double-distilled, deionized water	6N	5-10 mL
Sulfuric Acid (H_2SO_4)	1 part concentrated H_2SO_4: 1 part double-distilled, deionized water	18N	2 - 5 mL
Nitric Acid (HNO_3)	Undiluted concentrated HNO_3	16N	2 - 5 mL
Sodium Hydroxide (NaOH)	400 grams solid NaOH dissolved in 870 mL double-distilled, deionized water; yields 1 liter of solution	10N	2 mL

The amounts required for preservation shown in the above table assumes proper preparation of the preservative and addition of the preservative to one liter of aqueous sample (assuming that the sample is initially at pH 7, is poorly buffered, and does not contain particulate matter; as these conditions vary, more preservative may be required). Consequently, the final sample pH must be checked using narrow-range pH paper, as described in the generalized procedure detailed below:

- Pour off 5-10 mL of sample into a dedicated, clean container. Use some of this sample to check the initial sample pH using wide range (0-14) pH paper. Never dip the pH paper into the sample; always apply a drop of sample to the pH paper using a clean stirring rod or pipette.

- Add about one-half of the estimated preservative required to the original sample bottle. Cap and invert gently several times to mix. Check pH (as described above) using medium range pH paper (pH 0-6 or pH 7.5-14, as applicable).

- Cap sample bottle and seal securely.

Additional considerations are discussed below:

- To test if ascorbic acid must be used to remove oxidizing agents present in the sample before it can be properly preserved, place a drop of sample on KI-starch paper. A blue color indicates the need for ascorbic acid addition.

  If required, add a few crystals of ascorbic acid to the sample and retest with the KI-starch paper. Repeat until a drop of sample produces no color on the KI-starch paper. Then add an additional 0.6 grams of ascorbic acid per each liter of sample volume.

  Continue with proper base preservation of the sample as described, generally, above.

- Samples for sulfide analysis must be treated by the addition of 4 drops (0.2 mL) of 2N zinc acetate solution per 100 ml of sample.

  The 2N zinc acetate solution is made by dissolving 220 grams of zinc acetate in 870 mL of double-distilled, deionized water to make 1 liter of solution.

  The sample pH is then raised to 9 using the NaOH preservative.

- To test of sodium thiosulfate must be added to remove residual chlorine from a sample, test the sample for residual chlorine using a field test kit especially made for this purpose.

  If residual chlorine is present, add 0.08 grams of sodium thiosulfate per liter of sample to remove the residual chlorine.

  Continue with proper acidification of the sample as described, generally, above.

For biological samples, 10% buffered formalin or isopropanol may also be required for preservation. Questions regarding preservation requirements should be resolved through communication with the laboratory before sampling begins.

5.3 Field Filtration

At times, field-filtration may be required to provide for the analysis of dissolved chemical constituents. Field-filtration must be performed prior to the preservation of samples as described above. General procedures for field filtration are described below:

- The sample shall be filtered through a non-metallic, 0.45-micron membrane filter, immediately after collection. The filtration system shall consist of dedicated filter canister, dedicated silicon tubing, and a peristaltic pump with pressure or vacuum pumping squeeze action (since the sample is filtered by mechanical peristalsis, the sample travels only through the tubing).

- To perform filtration, thread the silicon tubing through the peristaltic pump head. Attach the filter canister to the discharge end of the silicon tubing (note flow direction arrow); attach the aqueous sample container to the intake end of the silicon tubing. Turn the peristaltic pump on and perform filtration.

- Continue by preserving the filtrate (contained in the filter canister), as applicable and generally described above.

5.4 Sample Packaging and Shipping

Samples collected for shipment from a site shall be classified as either environmental or hazardous material samples. Samples from drums containing materials other than Investigative Derived Waste (IDW) and samples obtained from waste piles or bulk storage tanks are generally shipped as hazardous materials. A distinction must be made between the two types of samples in order to:

- Determine appropriate procedures for transportation of samples (if there is any doubt, a sample shall be considered hazardous and shipped accordingly.)

- Protect the health and safety of transport and laboratory personnel receiving the samples (special precautions are used by the shipper and at laboratories when hazardous materials are received.)

Detailed procedures for packaging environmental and hazardous material samples are outlined in the remainder of this section.

5.4.1 Environmental Samples

Environmental samples are packaged as follows:

- Place sample container, properly identified and with lid securely fastened in a plastic bag (e.g. Ziploc baggie), and seal the bag.

- Place sample in a cooler constructed of sturdy material which has been lined with a large, plastic (e.g. "garbage" bag).

- Pack with enough noncombustible, absorbent, cushioning materials such as vermiculite (shoulders of bottles must be iced if required) to minimize the possibility of the container breaking.

- If cooling is required (see Attachments A and B), double-bag ice in Ziploc baggies and place around container shoulders, and on top of absorbent packing material (minimum of 8 pounds of ice for a medium-size cooler).

- Seal (i.e., tape or tie top in knot) large liner bag.

- The original (top, signed copy) and extra carbonless copies of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the first cooler. The COC form should then state how many coolers are included with that shipment.

- Close and seal outside of cooler as described in SOP SA-6.3. Signed custody seals must be used.

Coolers must be marked as containing "Environmental Samples." The appropriate side of the container must be marked "This End Up" and arrows placed appropriately. No DOT marking or labeling is required; there are no DOT restrictions on mode of transportation.

5.4.2 Determination of Shipping Classification for Hazardous Material Samples

Samples not determined to be environmental samples, or samples known or expected to contain hazardous materials, must be considered hazardous material samples and transported according to the requirements listed below.

5.4.2.1 Known Substances

If the substance in the sample is known or can be identified, package, mark, label, and ship according to the specific instructions for that material (if it is listed) in the DOT Hazardous Materials Table, 49 CFR 172.101. (DOT Guide for shippers can be found in Attachment D of this document.)

To determine the proper shipping name, use the following steps to help locate the shipping name on the Hazardous Materials Table, DOT 49 CFR 172.101.

1. Look first for the chemical or technical name of the material, for example, ethyl alcohol. Note that many chemicals have more than one technical name, for example, perchloroethylene (not listed in 172.101) is listed as tetrachloroethylene (listed 172.101). It may be useful to consult a chemist for all possible technical names a material can have. If your material is not listed by its technical name, then . . .

2. Look for the chemical family name For example, pentyl alcohol is not listed but the chemical family name is: alcohol, n.o.s. (not otherwise specified). If the chemical family name is not listed, then . . .

3. Look for a generic name based on end use. For example, Paint, n.o.s or Fireworks, n.o.s. If a generic name based on end use is not listed, then . . .

4. Look for a generic family name based on end use, for example, drugs, n.o.s. or cosmetics, n.o.s. Finally, if your material is not listed by a generic family name but you suspect or know the material is hazardous because it meets the definition of one or more hazardous classes, then . . .

5. You will have to use the general hazard class for a proper shipping name. For example, Flammable Liquid, n.o.s, or Oxidizer, n.o.s.

5.4.2.2 Unknown Substances

For samples of hazardous substances of unknown content, select the appropriate transportation category according to the DOT hazardous materials classification of a material having more than one hazard. This procedure is outlined in DOT Regulation 49 CFR 173.2a. (This can be found in Attachment C of this SOP.)

The correct shipping classification for an unknown sample is selected through a process of elimination, as outlined in DOT Regulation 49 CFR 172.101(c)(11). By using the provisions in this paragraph, the proper shipping name and description will be determined. A step-by-step guide is provided by the Department of Transportation (DOT) and can be found in Attachment D of this SOP.

5.4.3 Packaging and Shipping of Samples Classified as Flammable Liquid (or Solid)

5.4.3.1 Packaging

Applying the word "flammable" to a sample does not imply that it is in fact flammable. The word prescribes the class of packaging according to DOT regulations.

1. Containerize sample as required (see Attachments A and B). To prevent leakage, fill container no more than 90 percent full. Seal lid with teflon tape or wire.

2. Complete sample label and attach securely to sample container.

3. Seal container and place in 2-mil-thick (or thicker) polyethylene bag (e.g., Ziploc baggie), one sample per bag. Position sample identification label so that it can be read through bag. Seal bag.

4. For soil jars, place sealed bag inside metal can (available from laboratory or laboratory supplier) and cushion it with enough noncombustible, absorbent material (for example, vermiculite or diatomaceous earth) between the bottom and sides of the can and bag to prevent breakage and absorb leakage. Pack one bag per can. Use clips, tape, or other positive means to hold can lid securely, tightly and permanently. Mark can as indicated in Paragraph 1 of Section 5.3.4.2, below. Single 1-gallon bottles do not need to be placed in metal cans.

5. Place one or more metal cans (or a single 1-gallon bottle) into a strong outside container, such as a metal picnic cooler or a DOT-approved fiberboard box. Surround cans (or bottle) with noncombustible, absorbent cushioning materials for stability during transport. The absorbent material should be able to absorb the entire contents of the container. Mark container as indicated in Paragraph 2 below.

5.4.3.2 Marking/Labeling

1. Use abbreviations only where specified. Place the following information, either hand-printed or in label form, on the metal can (or 1-gallon bottle):

   - Laboratory name and address.

- Proper shipping name from the hazardous materials table (DOT Regulation CFR 49 172.101). Example: "Flammable Liquid, n.o.s. UN1993" or "Flammable Solid, n.o.s. UN1325." This will include packing group (see Section 5.3.4.2, No. 2.)

Not otherwise specified (n.o.s) is not used if the flammable liquid (or solid) is identified. If identified, the name of the specific material is listed before the category (for example, Acetone, Flammable Liquid), followed by its appropriate UN number found in the DOT Hazardous Materials table (49 CFR 172.101).

2. Determine packing group. The packing group is part of the proper shipping name and must be included on the shipping papers in the description section.

I. Most Hazardous
II. Medium Hazard
III. Least Hazardous

The packing group will be listed in the hazardous materials table, column 5.

3. Place all information on outside shipping container as on can (or bottle), specifically:

- Proper shipping name
- UN or NA number
- Proper label(s)
- Addressee and sender

Place the following labels on the outside shipping container: "Cargo Aircraft Only" and DOT label such as: "Flammable Liquid" (or "Flammable Solid"). "Dangerous When Wet" label shall be used if the Flammable Solid has not been exposed to a wet environment. "Laboratory Samples" and "THIS SIDE UP" or "THIS END UP" shall also be marked on the top of the outside container, and upward-pointing arrows shall be placed on all four sides of the container.

5.4.3.3 Shipping Papers

1. Use abbreviations only where specified. Complete the carrier-provided bill of lading and sign certification statement. Provide the following information in the order listed (one form may be used for more than one exterior container):

- Proper shipping name. (Example: "Flammable Liquid, n.o.s. UN1993" or "Flammable Solid, n.o.s. UN1325 Packing Group I, II, III").
- "Limited Quantity" (or "Ltd. Qty."). (See No. 3, below.)
- "Cargo Aircraft Only."
- Net weight (wt) or net volume (vol), just before or just after "Flammable Liquid, n.o.s." or "Flammable Solid, n.o.s.," by item, if more than one metal can is inside an exterior container.
- "Laboratory Samples" (if applicable).

2. Include Chain-of-Custody Record, properly executed in outside container; use custody seals.

3. "Limited Quantity" means the maximum amount of a hazardous material for which there is a specific labeling or packaging exception (DOT CFR 49 171.8). This may mean that packages are exempted from labeling requirements. To determine if your sample meets the Limited Quantity Exception, refer to DOT Regulation CFR 49 Subpart C 173.50 through 173.156. First, determine the proper classification and shipping name for the material; then refer to the exception requirements for that particular class of material beginning with 173.50.

   Example: "Flammable Liquid n.o.s. UN1993 Packing Group 1." The outer package can weigh no more than 66 pounds gross weight. The inner package or container can weigh no more than 0.1 gallon net capacity for each container.

   To determine whether the material can be shipped as a "Limited Quantity," you must check the specific requirement for that class of material.

5.4.3.4 Transportation

1. The majority of unknown hazardous substance samples will be classified as flammable liquids. The samples will be transported by rented or common carrier truck, railroad, or express overnight package services. Do not transport samples on any passenger-carrying air transport system, even if the system has cargo-only aircraft. DOT regulations permit regular airline cargo-only aircraft, but difficulties with most suggest avoiding them. Instead, ship by airline carriers that carry only cargo. If unsure of what mode of transportation to use, consult the FOL or Project Manager.[1]

2. For transport by government-owned vehicle, including aircraft, DOT regulations do not apply. However, procedures described above, with the exception of execution of the bill of lading with certification, shall still be followed.

3. Use the hazardous materials shipping check list (Attachment E) as a guidance to ensure that all sample-handling requirements are satisfied.

4. In some cases, various materials may react if they break during shipment. To determine if you are shipping such materials, refer to the DOT compatibility chart in Attachment F.

5.5 Shipment of Lithium Batteries

Monitoring well data are analyzed using either the Hermit SE 1000 or the Hermit SE 2000 environmental data logger. These instruments are powered by lithium batteries. The Department of Transportation has determined that lithium batteries are a hazardous material and are to be shipped using the following information:

---

[1] Note: If you are unsure as how to ship the sample (hazardous or environmental sample), contact the FOL or Project Manager so that a decision can be made as to the proper shipping practices. The DOT penalties for improper shipment of a hazardous material are stringent and may include a prison term for intentional violations.

- Product Designation
  - Hermit SE 1000
  - Hermit SE 2000

- DOT Proper Shipping Name
  - Lithium batteries, contained in equipment, UN3091

- Classification or Division
  - Class 9

Shipment of equipment containing lithium batteries must be accompanied by shipping papers completed as indicated in Attachment G. The instrument will be shipped by Federal Express as a Hazardous Material. Place the instrument in the same container in which it was received. This container or case is a DOT-approved shipping container. For Federal Express procedures to ship hazardous materials, call 1-800-238-5355, extension 922-1666. In most cases, the return shipping papers and DOT labels will be shipped to you from the company warehouse or the vendor. An example of the types of labels used for shipment and the wording are shown in Attachment G. These labels will be attached to the outside container with the following wording:

- Lithium Batteries Contained in Equipment
  - UN-3091
  - Shipped Under CA-9206009

6.0 REFERENCES

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U.S. Department of Transportation, 1993. Hazardous Materials Regulations, 49 CFR 171-177.

U.S. EPA, 1984. "Guidelines Establishing Test Procedures for the Analysis of Pollutants under Clean Water Act." Federal Register, Volume 49 (209), October 26, 1984, p. 43234.

U.S. EPA, 1979. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020, U.S. EPA-EMSL, Cincinnati, Ohio.

ATTACHMENT A

GENERAL SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Sample Type and Concentration		Container[1]	Sample Size	Preservation[2]	Holding Time[2]
WATER					
Organics (GC&GC/MS)	VOC Low	Borosilicate glass	2 x 40 mL	Cool to 4°C HCl to ≤ 2	14 days[8]
	Extractables (Low SVOCs and pesticide/PCBs)	Amber glass	2x2 L or 4x1 L	Cool to 4°C	7 days to extraction; 40 days after extraction
	Extractables (Medium SVOCs and pesticide/PCBs)	Amber glass	2x2 L or 4x1 L	None	7 days to extraction; 40 days after extraction
Inorganics	Metals Low	High-density polyethylene	1 L	HNO_3 to pH ≤2	6 months (Hg-28 days)
	Medium	Wide-mouth glass	16 oz.	None	6 months
	Cyanide Low	High-density polyethylene	1 L	NaOH to pH>12	14 days
	Cyanide Medium	Wide-mouth glass	16 oz.	None	14 days
Organic/ Inorganic	High Hazard	Wide-mouth glass	8 oz.	None	14 days
SOIL					
Organics (GC&GC/MS)	VOC	Wide-mouth glass with teflon liner	2 x 4 oz.	Cool to 4°C	14 days
	Extractables (Low SVOCs and pesticides/PCBs)	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
	Extractables (Medium SVOCs and pesticides/PCBs)	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
Inorganics	Low/Medium	Wide-mouth glass	8 oz.	Cool to 4°C	6 months (Hg - 28 days) Cyanide (14 days)
Organic/ Inorganic	High Hazard	Wide-mouth glass	8 oz.	None	NA
Dioxin/Furan	All	Wide-mouth glass	4 oz.	None	7 days until extraction; 40 days after extraction
TCLP	All	Wide-mouth glass	8 oz.	None	7 days until preparation; analysis as per fraction
AIR					
Volatile Organics	Low/Medium	Charcoal tube – 7 cm long, 6 mm OD, 4 mm ID	100 L air	Cool to 4°C	5 days recommended

(1) All glass containers should have Teflon cap liners or septa.
(2) See Attachment E. Preservation and maximum holding time allowances per 40 CFR 136.

ATTACHMENT B

ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter Number/Name	Container[1]	Preservation[2][3]	Maximum Holding Time[4]
INORGANIC TESTS:			
Acidity	P, G	Cool, 4°C	14 days
Alkalinity	P, G	Cool, 4°C	14 days
Ammonia - Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Biochemical Oxygen Demand (BOD)	P, G	Cool, 4°C	48 hours
Bromide	P, G	None required	28 days
Chemical Oxygen Demand (COD)	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Chloride	P, G	None required	28 days
Chlorine, Total Residual	P, G	None required	Analyze immediately
Color	P, G	Cool, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination	P, G	Cool, 4°C; NaOH to pH 12; 0.6 g ascorbic acid[5]	14 days[6]
Fluoride	P	None required	28 days
Hardness	P, G	HNO_3 to pH 2; H_2SO_4 to pH 2	6 months
Total Kjeldahl and Organic Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Nitrate - Nitrogen	P, G	None required	48 hours
Nitrate-Nitrite - Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Nitrite - Nitrogen	P, G	Cool, 4°C	48 hours
Oil & Grease	G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Total Organic Carbon (TOC)	P, G	Cool, 4°C; HCl or H_2SO_4 to pH 2	28 days
Orthophosphate	P, G	Filter immediately; Cool, 4°C	48 hours
Oxygen, Dissolved-Probe	G Bottle & top	None required	Analyze immediately
Oxygen, Dissolved-Winkler	G Bottle & top	Fix on site and store in dark	8 hours
Phenols	G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Phosphorus, Total	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Residue, Total	P, G	Cool, 4°C	7 days
Residue, Filterable (TDS)	P, G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS)	P, G	Cool, 4°C	7 days
Residue, Settleable	P, G	Cool, 4°C	48 hours
Residue, Volatile (Ash Content)	P, G	Cool, 4°C	7 days
Silica	P	Cool, 4°C	28 days
Specific Conductance	P, G	Cool, 4°C	28 days
Sulfate	P, G	Cool, 4°C	28 days

ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
PAGE TWO

Parameter Number/Name	Container(1)	Preservation(2)(3)	Maximum Holding Time(4)
INORGANIC TESTS (Cont'd):			
Sulfide	P, G	Cool, 4°C; add zinc acetate plus sodium hydroxide to pH 9	7 days
Sulfite	P, G	None required	Analyze immediately
Turbidity	P, G	Cool, 4°C	48 hours
METALS:(7)			
Chromium VI (Hexachrome)	P, G	Cool, 4°C	24 hours
Mercury (Hg)	P, G	HNO_3 to pH 2	28 days
Metals, except Chromium VI and Mercury	P, G	HNO_3 to pH 2	6 months
ORGANIC TESTS:(8)			
Purgeable Halocarbons	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$(5)	14 days
Purgeable Aromatic Hydrocarbons	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$(5) HCl to pH 2 (9)	14 days
Acrolein and Acrylonitrile	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$(5) adjust pH to 4-5 (10)	14 days
Phenols(11)	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction
Benzidines(11), (12)	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$(5)	7 days until extraction(13)
Phthalate esters(11)	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
Nitrosamines(11), (14)	G, Teflon-lined cap	Cool, 4°C; store in dark; 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction
PCBs(11)	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
Nitroaromatics & Isophorone(11)	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$(5); store in dark	7 days until extraction; 40 days after extraction
Polynuclear Aromatic Hydrocarbons (PAHs)(11),(14)	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$(5); store in dark	7 days until extraction; 40 days after extraction
Haloethers(11)	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction
Dioxin/Furan (TCDD/TCDF)(11)	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction

ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
PAGE THREE

Parameter Number/Name	Container(1)	Preservation(2)(3)	Maximum Holding Time(4)
RADIOLOGICAL TESTS:			
1-5 Alpha, beta and radium	P, G	HNO_3 to pH 2	6 months

(1) Polyethylene (P): generally 500 ml or Glass (G): generally 1L.
(2) Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
(3) When any sample is to be shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172).
(4) Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer periods, and has received a variance from the Regional Administrator.
(5) Should only be used in the presence of residual chlorine.
(6) Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustments are made to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.
(7) Samples should be filtered immediately on site before adding preservative for dissolved metals.
(8) Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.
(9) Sample receiving no pH adjustment must be analyzed within 7 days of sampling.
(10) The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.
(11) When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re: the requirement for thiosulfate reduction of residual chlorine) and footnotes 12, 13 (re: the analysis of benzidine).
(12) If 1,2-diphenylthydrazine is likely to be present, adjust the pH of the sample to 4.0±0.2 to prevent rearrangement to benzidine.
(13) Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.
(14) For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.
(15) The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

ATTACHMENT C

DOT HAZARDOUS MATERIAL CLASSIFICATION
(49 CFR 173.2a)

1. Radioactive material (except a limited quantity)
2. Division 2.3, Poisonous Gases
3. Division 2.1, Flammable Gas
4. Division 2.2, Nonflammable gas
5. Division 6.1, Poisonous Liquids, Packing Group 1 (poison by inhalation only)
6. Division 4.2, Pyrophoric Material
7. Division 4.1, Self-Reactive Material
8. Class 3, Flammable Liquids*
9. Class 8, Corrosive Material
10. Division 4.1, Flammable Solid*
11. Division 4.2, Spontaneously Combustible Materials*
12. Division 4.3, Dangerous When Wet Materials*
13. Division 5.1, Oxidizers*
14. Division 6.1, Poisonous Liquids or Solids (other than Packing Group 1)*
15. Combustible liquid
16. Class 9, Miscellaneous Hazardous Materials

* If a material has or meets the criteria for more than one hazard class, use the precedence of hazardous table on the following page for Classes 3 and 8 and Divisions 4.1, 4.2, 4.3, 5.1, and 6.1. The following table ranks those materials that meet the definition of Classes 3 and 8 and Divisions 4.1, 4.2, 4.3, 5.1, and 6.1.

ATTACHMENT C (Continued)

PRECEDENCE OF HAZARD TABLE

(Hazard Class and Packing Group)

Class	Packing Group	4.2	4.3	5.1 I[a]	5.1 II[a]	5.1 III[a]	6.1 I (Dermal)	6.1 I (Oral)	6.1 II	6.1 III	8 I (Liquid)	8 I (Solid)	8 II (Liquid)	8 II (Solid)	8 III (Liquid)	8 III (Solid)
3	I						3	3	3	3	3	[c]	3	[c]	3	[c]
3	II						3	3	3	3	8	[c]	3	[c]	3	[c]
3	III						6.1	6.1	6.1	3[d]	8	[c]	8	[c]	3	[c]
4.1	II[b]	4.2	4.3	5.1	4.1	4.1	6.1	6.1	4.1	4.1	[c]	8	[c]	4.1	[c]	4.1
4.1	III[b]	4.2	4.3	5.1	4.1	4.1	6.1	6.1	6.1	4.1	[c]	8	[c]	8	[c]	4.1
4.2	II		4.3	5.1	4.2	4.2	6.1	6.1	4.2	4.2	[c]	8	[c]	4.2	[c]	4.2
4.2	III		4.3	5.1	4.2	4.2	6.1	6.1	6.1	4.2	[c]	8	[c]	8	[c]	4.2
4.3	I			5.1	4.3	4.3	6.1	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
4.3	II			5.1	4.3	4.3	6.1	4.3	4.3	4.3	8	8	8	4.3	4.3	4.3
4.3	III			5.1	4.3	4.3	6.1	6.1	6.1	4.3	8	8	8	8	4.3	4.3
5.1	I[a]						5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
5.1	II[a]						6.1	5.1	5.1	5.1	8	8	8	5.1	5.1	5.1
5.1	III[a]						6.1	6.1	6.1	5.1	8	8	8	8	5.1	5.1
6.1	I, Dermal										8	6.1	6.1	6.1	6.1	6.1
6.1	I, Oral										8	6.1	6.1	6.1	6.1	6.1
6.1	II, Inhalation										8	6.1	6.1	6.1	6.1	6.1
6.1	II, Dermal										8	6.1	8	6.1	6.1	6.1
6.1	II, Oral										8	8	8	6.1	6.1	6.1
6.1	III										8	8	8	8	8	8

[a] There are at present no established criteria for determining Packing Groups for liquids in Division 5.1. At present, the degree of hazard is to be assessed by analogy with listed substances, allocating the substances to Packing Group I, Great; Group II, Medium; or Group III, Minor Danger.

[b] Substances of Division 4.1 other than self-reactive substances.

[c] Denotes an impossible combination.

[d] For pesticides only, where a material has the hazards of Class 3, Packing Group III, and Division 6.1, Packing Group III, the primary hazard is Division 6.1, Packing Group III.

ATTACHMENT D

GUIDE FOR HAZARDOUS MATERIALS SHIPPERS

USE OF GUIDE - This guide is presented as an aid to shippers of hazardous materials. It does not contain or refer to all of the DOT requirements for shipping hazardous materials. For specific details, refer to all of the DOT requirements for shipping hazardous materials, as provided in the Code of Federal Regulations (CFR), Title 49, Transportation, Parts 100-199.

The following is offered as a step-by-step procedure to aid in compliance with the applicable DOT regulations.

STEP 1 - DETERMINE THE PROPER SHIPPING NAME. The shipper must determine the proper shipping name of the materials as listed in the Hazardous Materials Table, 49 CFR 172.101, Column (2).

STEP 2 - DETERMINE THE HAZARD CLASS OR CLASSES.

a. Refer to the Table, 49 CFR 172.101, Column (3), and locate the hazard class of the material.
b. If more than one class is shown for the proper shipping name, determine the proper class by definition.
c. If the materials have more than one hazard, classify the material based on the order of hazards in 49 CFR 173.2.

STEP 3 - SELECT THE PROPER IDENTIFICATION NUMBERS.

a. Refer to the Table, 49 CFR 172.101, Column (3a), and select the Identification Number (ID) that corresponds to the proper shipping name and hazard class.
b. Enter the ID number(s) on the shipping papers and display them, as required, on packagings, placards and/or orange panels.

STEP 4 - DETERMINE THE MODE(S) OF TRANSPORT TO ULTIMATE DESTINATION.

a. As a shipper, you must assure yourself that the shipment complies with various modal requirements.
b. The modal requirements may affect the following: (1) Packaging; (2) Quantity per Package; (3) Marking; (4) Labeling; (5) Shipping Papers; and (6) Certification.

STEP 5 - SELECT THE PROPER LABEL(S) AND APPLY AS REQUIRED.

a. Refer to the Table, 49 CFR 172.101, Column (4) for required labels.
b. For details on labeling refer to (1) Additional Labels, 49 CFR 172.402; (2) Placement of Labels, 49 CFR 172.406; (3) Packagings (Mixed or Consolidated), 49 CFR 172.404(a) and (h); (4) Packages Containing Samples, 49 CFR 172.402(h); (5) Radioactive Materials, 49 CFR 172.403; and (6) Authorized Label Modifications, 49 CFR 172.405.

STEP 6 - DETERMINE AND SELECT THE PROPER PACKAGES.

a. Refer to the Table, 49 CFR 172.101, Column (5a) for exceptions and Column (5b) for specification packagings. Consider the following when selecting an authorized package: Quantity per Package; Cushioning Material, if required; Proper Closure and Reinforcement; Proper Pressure; Outage; etc., as required.
b. If packaged by a prior shipper, make sure the packaging is correct and in proper condition for transportation.

ATTACHMENT D (Continued)
GUIDE FOR HAZARDOUS MATERIALS SHIPPERS

STEP 7 - MARK THE PACKAGING (INCLUDING OVERPACKS).

a. Apply the required markings (49 CFR 172.300); Proper shipping name and ID number, when required (49 CFR 172.301); Name and address of Consignee or Consignor (49 CFR 172.306).
b. For details and other required markings, see 49 CFR 172.300 through 172.338.

STEP 8 - PREPARE THE SHIPPING PAPERS.

a. The basic requirements for preparing shipping papers include Proper Shipping Name; Hazard Class; ID Number; Total Quantity; Shipper's Certification; and Emergency Response Telephone Number.
b. Make all entries on the shipping papers using the information required and in proper sequence (49 CFR 172.202).

STEP 9 - CERTIFICATION.

a. Each shipper must certify by printing (manually or mechanically) on the shipping papers that the materials being offered for shipment are properly classified, described, packaged, marked and labeled, and in proper condition for transportation according to the applicable DOT Regulations (49 CFR 172.202).

STEP 10 - LOADING, BLOCKING, AND BRACING. When hazardous materials are loaded into the transport vehicle or freight container, each package must be loaded, blocked, and braced in accordance with the requirements for mode of transport.

a. If the shipper loads the freight container or transport vehicle, the shipper is responsible for the proper loading, blocking, and bracing of the materials.
b. If the carrier does the loading, the carrier is responsible.

STEP 11 - DETERMINE THE PROPER PLACARD(S). Each person who offers hazardous materials for transportation must determine that the placarding requirements have been met.

a. For Highway, unless the vehicle is already correctly placarded, the shipper must provide the required placard(s) and required ID number(s) (49 CFR 172.506).
b. For Rail, if loaded by the shipper, the shipper must placard the rail car if placards are required (49 CFR 172.508).
c. For Air and Water shipments, the shipper has the responsibility to apply the proper placards.

STEP 12 - HAZARDOUS WASTE/HAZARDOUS SUBSTANCE.

a. If the material is classed as a hazardous waste or hazardous substance, most of the above steps will be applicable.
b. Pertinent Environmental Protection Agency regulations are found in the Code of Federal Regulations, Title 40, Part 262.

As a final check and before offering the shipment for transportation, visually inspect your shipment. The shipper should ensure that emergency response information is on the vehicle for transportation of hazardous materials.

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Revised March 1995.

ATTACHMENT E

HAZARDOUS MATERIALS SHIPPING CHECK LIST

PACKAGING

1. Check DOT 173.24 for appropriate type of package for hazardous substance.
2. Check for container integrity, especially the closure.
3. Check for sufficient absorbent material in package.
4. Check for sample tags and log sheets for each sample and for chain-of-custody record.

SHIPPING PAPERS

1. Check that entries contain only approved DOT abbreviations.
2. Check that entries are in English.
3. Check that hazardous material entries are specially marked to differentiate them from any nonhazardous materials being sent using same shipping paper.
4. Be careful that all hazardous classes are shown for multiclass materials.
5. Check total amounts by weight, quantity, or other measures used.
6. Check that any limited-quantity exemptions are so designated on the shipping paper.
7. Check that certification is signed by shipper.
8. Make certain driver signs for shipment.

RCRA MANIFEST

1. Check that approved state/federal manifests are prepared.
2. Check that transporter has the following: valid EPA identification number, valid driver's license, valid vehicle registration, insurance protection, and proper DOT labels for materials being shipped.
3. Check that destination address is correct.
4. Check that driver knows where shipment is going.
5. Check that the driver is aware of emergency procedures for spills and accidents.
6. Make certain driver signs for shipment.
7. Make certain one copy of executed manifest and shipping document is retained by shipper.

ATTACHMENT F

DOT SEGREGATION AND SEPARATION CHART

Class or Division	Notes	1.1-1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3 gas Zone A*	2.3 gas Zone B*	3	4.1	4.2	4.3	5.1	5.2	6.1 liquids PG-I Zone A*	7	8 liquids only
Explosives ..... 1.1 and 1.2	A	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X
Explosives 1.3		*	*	*	*	*	X		X	X	X		X	X	X	X	X		X
Explosives 1.4		*	*	*	*	*	O		O	O	O		O				O		O
Very insensitive explosives 1.5	A	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X
Extremely insensitive explosives 1.6		*	*	*	*	*													
Flammable gases 2.1		X	X	O	X				X	O							O	O	
Non-toxic, non-flammable gases 2.2		X			X														
Poisonous gas - Zone A** 2.3		X	X	O	X		X				X	X	X	X	X	X			X
Poisonous gas - Zone B** 2.3		X	X	O	X		O				O	O	O	O	O	O			O
Flammable liquids 3		X	X	O	X				X	O					O		X		
Flammable solids 4.1		X			X				X	O							X		O
Spontaneously combustible materials 4.2		X	X	O	X				X	O							X		X
Dangerous-when-wet materials 4.3		X	X		X				X	O							X		O
Oxidizers 5.1	A	X	X		X				X	O	O						X		O
Organic peroxides 5.2		X	X		X				X	O							X		O
Poisonous liquids PG I - Zone A** .. 6.1		X	X	O	X		O				X	X	X	X	X	X			X
Radioactive materials 7		X			X		O												
Corrosive liquids 8		X	X	O	X				X	O		O	X	O	O	O	X		

No entry means that the materials are compatible (have no restrictions).

X These materials may not be loaded, transported, or stored together in the same vehicle or facility.
O The materials may not be loaded, transported, or stored together in the same vehicle or facility unless they are separated for 4 feet on all sides.
* Check the explosives compatibility chart in 49 CFR 179.848(f).
A Ammonium nitrate fertilizers may be stored with Division 1.1 materials.
** Denotes inhalation hazardous for poisons; consult field team leader or project manager if you encounter a material in this class before shipment.

ATTACHMENT G
LITHIUM BATTERY SHIPPING PAPERS

3224637861

Two completed and signed copies of this Declaration must be handed to the operator.

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

TRANSPORT DETAILS

This shipment is within the limitations prescribed for: *(delete non applicable)*

PASSENGER AND CARGO AIRCRAFT | CARGO AIRCRAFT ONLY

Airport of Departure:

Airport of Destination: 19CYS

Shipment type: *(delete non-applicable)*

NON-RADIOACTIVE | RADIOACTIVE

NATURE AND QUANTITY OF DANGEROUS GOODS

Dangerous Goods Identification						
Proper Shipping Name	Class or Division	UN or ID No.	Subsidiary Risk	Quantity and type of packing	Packing Inst.	Authorization
LITHIUM BATTERIES CONTAINED IN EQUIPMENT	9	UN3091		1 PLASTIC BOX X 55 GRAMS	912 II	PER CA-9206009

Additional Handling Information

1 HERMIT SERIES DATALOGGER X 55 GRAMS (11 GRAMS/CELL)

I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in the proper condition for transport by air according to the applicable International and National Government Regulations.

Name/Title of Signatory

Place and Date

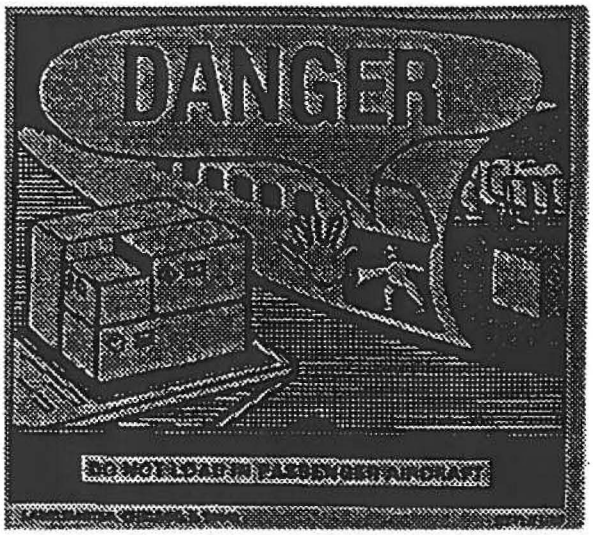
Signature *(see warning above)*

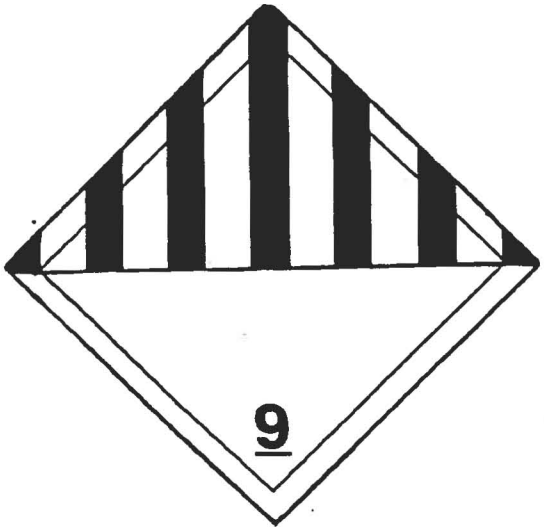
Emergency Telephone Number (Required for US Origin or Destination Shipments)

800-535-5053

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.

ATTACHMENT G (CONTINUED)
LITHIUM BATTERY SHIPPING PAPERS





LITHIUM BATTERIES CONTAINED IN EQUIPMENT.
UN-3091.
SHIPPED UNDER CA-9206009

APPENDIX B

QAPP

TtNUS SOP SA-6.3

BROWN & ROOT ENVIRONMENTAL	STANDARD OPERATING PROCEDURES	Number SA-6.3	Page 1 of 32
		Effective Date 03/01/96	Revision 0
		Applicability B&R Environmental, NE	
		Prepared Earth Sciences Department	
Subject FIELD DOCUMENTATION		Approved D. Senovich	

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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 Brown & Root Environmental field activities.

2.0 SCOPE

Documents presented within this procedure (or equivalents) shall be used for all Brown & Root Environmental field activities, as applicable. Other or additional documents may be required by specific client contracts.

3.0 GLOSSARY

None

4.0 RESPONSIBILITIES

Project Manager - 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 forms used in site activities (i.e., records, field reports, and upon the completion of field work, the site logbook) in the project's central file.

Field Operations Leader (FOL) - The Field Operations Leader is responsible for ensuring that the site logbook, notebooks, and all appropriate 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 (daily) in the site logbook:

- All field personnel present
- Arrival/departure of site visitors
- Arrival/departure of equipment
- Start or completion of borehole/trench/monitoring well installation or sampling activities
- 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 Brown & Root Environmental 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
- Brown & Root Environmental 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 site 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 entries. The name of the photographer, date, time, site location, site description, and weather conditions must be entered in the logbook 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. If possible, such techniques shall be avoided, since they can adversely affect the admissibility of photographs as evidence. 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. Adequate logbook notation and receipts must be compiled to account for routine film processing. Once processed, the slides of photographic prints shall be consecutively numbered and labeled according to the logbook descriptions. The site photographs and associated negatives must be docketed into the project's central file.

5.2 Site Notebooks

Key field team personnel may maintain a separate dedicated 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 site notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a site 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 and Request for Analysis

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 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 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 part of the completed COC form is retained by the field crew while the other two or three portions are sent to the laboratory. The original (top, signed copy) and extra carbonless copies of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the first cooler. The COC form should then state how many coolers are included with that shipment. An example of a Chain-of-Custody Record form is provided as Attachment B-6. A supply of these forms are purchased and stocked by the field department of the various Brown & Root Environmental offices. Alternately, COC forms supplied by the laboratory may be used. 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 Brown & Root Environmental Project Manager). The COC form is signed and one of the remaining two parts are retained by the laboratory while the last part becomes part of the samples' corresponding analytical data package. Internal laboratory chain-of-custody procedures are documented in the Laboratory Quality Assurance Plan (LQAP).

5.3.1.4 Chain-of-Custody Seal

Attachment B-7 is an example of a custody seal. The Custody seal is also 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 transit 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.

5.3.2 Geohydrological 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 following well installation.

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 (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 or cuttings from the borehole (using HNU or OVA detectors), these results must be entered on the boring log (under the "Remarks" column) at the appropriate depth. The "Remarks" column can also be used to subsequently enter the laboratory sample number and the concentration of a few key analytical results. 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. The Monitoring Well Construction Details Form is not a controlled document.

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.

5.3.3 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 Weekly Status Reports

To facilitate timely review by project management, Xeroxed copies of logbook/notebook entries may be made for internal use. To provide timely oversight of onsite contractors, Daily Activities Reports are completed and submitted as described below.

It should be noted that in addition to the summaries described herein, other summary reports may also be contractually required.

5.4.2 Daily Activities Report

5.4.2.1 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).

5.4.2.2 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.

5.4.2.3 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.

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 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-8A	EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK (FLUSHMOUNT)
Attachment C-9	EXAMPLE TEST PIT LOG
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:

BROWN & ROOT ENV.	DRILLER	EPA
_____	_____	_____
_____	_____	_____
_____	_____	_____

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
EXAMPLE GROUNDWATER SAMPLE LOG SHEET

GROUNDWATER

SAMPLE LOG SHEET

Page ____ of ____

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

☐ Domestic Well Data
☐ Monitoring Well Data
☐ Other Well Type: _____ Sampled By: _____
☐ QA Sample Type: _____ C.O.C. No.: _____

Sampling Data

Date: _____
Time: _____
Method: _____

pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD	TBD

Purge Data

Date: _____
Method: _____
Monitor Reading (ppm): _____
Well Casing Dia. & Material Type: _____
Total Well Depth (TD): _____
Static Water Level (WL): _____
TD-WL (ft.) = _____
One Casing Volume: (gal/L) _____
Start Purge (hrs.): _____
End Purge (hrs.): _____
Total Purge Time (min): _____
Total Amount Purged (gal/L): _____

Volume	pH	S.C.	Temp (°C)	Turbidity	Color	TBD	TBD
Initial							
1							
2							
3							
4							
5							

Analyte	Preservative	Container Requirements	Collected (✓)

Observations/Notes:

Circle if Applicable:

MS/MSD	Duplicate ID No:	Signature(s):

TBD: To Be Determined

ATTACHMENT B-2
EXAMPLE SURFACE WATER SAMPLING LOG SHEET

SURFACE WATER SAMPLING LOG SHEET

Page ___ of ___

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

☐ Spring ☐ Pond
☐ Stream ☐ Lake
☐ Other _____
☐ QA Sample Type: _____

Sampled By: _____

C.O.C. No.: _____

Sample Data							
Date and Time			Method			Depth	
pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD	TBD

Analysis	Preservative	Container Requirements	Collected (✓)

Observations/Notes:

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

TBD: To Be Determined

ATTACHMENT B-3
EXAMPLE SOIL/SEDIMENT SINGLE SAMPLE LOG SHEET

SOIL/SEDIMENT
SINGLE SAMPLE LOG SHEET

Page ____ of ____

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

☐ Surface Soil
☐ Subsurface Soil
☐ Sediment
☐ Other _____
☐ QA Sample Type: _____

Sampled By: _____

C.O.C. No.: _____

Sample Method:	Sample	Time	Color/Description
Depth Sampled:			
Sample Date and Time:			
Type of Sample ☐ Grab ☐ Composite ☐ Grab-Composite ☐ High Concentration ☐ Low Concentration			
	Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)	

			Map:

Observations/Notes:

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

ATTACHMENT B-4
CONTAINER SAMPLE LOG SHEET FORM

Brown & Root Environmental

Page ___ of _

☐ Container Data

Case #: _____

By: _____

Project Site Name: _____ Project Site No. _____

Brown & Root Env. Source No. _____ Source Location: _____

Container Source	Container Description
☐ Drum ☐ Bung Top ☐ Lever Lock ☐ Bolted Ring ☐ Other _____ _____ ☐ Bag/Sack ☐ Tank ☐ Other _____ _____	Color: _____ Condition: _____ Markings: _____ Vol. of Contents: _____ Other: _____

Disposition of Sample	Sample Description	Layer 1	Layer 2	Layer 3
☐ Container Sampled ☐ Container opened but not sampled. Reason: _____ _____ ☐ Container not opened. Reason: _____ _____	Phase	☐Sol. ☐Liq.	☐Sol. ☐Liq.	☐Sol. ☐Liq.
	Color	_____	_____	_____
	Viscosity	☐L ☐M ☐H	☐L ☐M ☐H	☐L ☐M ☐H
	% of Total Volume	_____	_____	_____
	Other	_____	_____	_____

Monitor Reading:	Type of Sample
Sample Method:	☐ Low Concentration ☐ High Concentration ☐ Grab ☐ Composite ☐ Grab-composite

Sample Date & Time:	Sample Identification	Organic	Inorganic
Sampled by:			
Signature(s):			
Analysis:	Date Shipped		
	Time Shipped		
	Lab		
	Volume		

ATTACHMENT B-5

SAMPLE LABEL

Brown & Root Environmental PROJECT: _____

STATION LOCATION: _____

DATE: ____/____/____ TIME: _____ hrs.

MEDIA: WATER ☐ SOIL ☐ SEDIMENT ☐ _____ ☐

CONCENTRATION: LOW ☐ MEDIUM ☐ HIGH ☐

TYPE: GRAB ☐ COMPOSITE ☐

ANALYSIS	PRESERVATION
VOA ☐ BNAs ☐	Cool to 4°C ☐
PCBs ☐ PESTICIDES ☐	HNO_3 to pH < 2 ☐
METALS: TOTAL ☐ DISSOLVED ☐	NaOH to pH > 12 ☐
CYANIDE ☐	_____ ☐
_____ ☐	

Sampled by: _____

Remarks:

ATTACHMENT B-6

CHAIN-OF-CUSTODY RECORD FORM
(Original is 8.5 x 11")

PROJECT NO. | PROJECT NAME

SAMPLERS: (Signature)

STA NO.	DATE	TIME	STATION LOCATION	NO. OF CONTAINERS	REMARKS

Relinquished by: (Signature) Date/Time — Received by: (Signature)

Relinquished by: (Signature) Date/Time — Received by: (Signature)

Relinquished by: (Signature) Date/Time — Received for Laboratory by: (Signature)

Relinquished by: (Signature) Date/Time — Received by: (Signature)

Relinquished by: (Signature) Date/Time — Received by: (Signature)

Remarks:

ATTACHMENT B-7

CHAIN-OF-CUSTODY SEAL

Signature	CUSTODY SEAL
Date	Date
CUSTODY SEAL	Signature

ATTACHMENT C-1
EXAMPLE GROUNDWATER LEVEL MEASUREMENT SHEET

GROUNDWATER LEVEL MEASUREMENT SHEET

Page ___ of ___

PROJECT NAME: _____ LOCATION: _____
PROJECT NUMBER: _____ MEASURING DEVICE: _____
PERSONNEL: _____ ADJUSTMENT FACTOR: _____
DATE: _____ REMARKS: _____
WEATHER CONDITIONS: _____

Well or Piezometer Number	Time	Elevation of Reference Point (Feet)*	Water Level Indicator Reading (Feet)*	Groundwater Elevation (Feet)*	Comments

*Measurements to nearest 0.01 foot.

Signature(s): _____

ATTACHMENT C-2
EXAMPLE PUMPING TEST DATA SHEET

PUMPING TEST DATA SHEET

Page ___ of ___

PROJECT NAME: _____
PROJECT NUMBER: _____
PUMPING TEST: [ ]
TEST NUMBER: _____
METHOD OF MEASUREMENT: _____
DATE(s): _____
STATIC H_2O LEVEL (ft) (SO) _____
PUMPING TEST PERFORMED BY: _____
REMARKS: _____

PUMPING WELL NUMBER: _____
MEASURED WELL NUMBER: _____
STEP DRAW DOWN TEST [ ]
MONITORING POINT: _____
DEPTH CORRECTION (ft) _____
PUMP SETTING (Ft. below monitoring point): _____
DISTANCE FROM PUMPING WELL (ft) (r): _____

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

SIGNATURE(s): _____

ATTACHMENT C-3

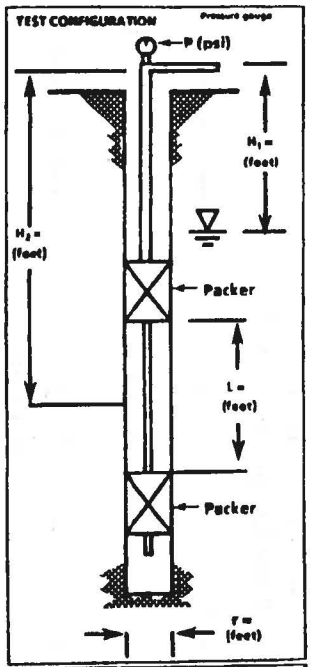
PACKER TEST REPORT FORM

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

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

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

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



Length of Test Section in feet, L	Cp			
	Drilling Bit Size			
	7⅞" (1 5")	6¾" (1 875")	5⅞" (1.75")	4¾" (1")
1	31,000	20,500	25,000	21,500
2 ...	10,400	10,100	10,200	10,500
5	9,500	9,300	9,800	9,700
8	6,800	6,400	6,100	5,900
10	5,700	5,400	5,200	4,900
15	4,100	3,900	3,700	3,600
20	3,200	3,100	3,000	2,800

CP = (1/(2 π L)) ln(L/r) (70,315 5)
7.48 Gallons = 1 Ft^3
1 psi = 2.31 ft head

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

Remarks: _____

ATTACHMENT C-4
EXAMPLE BORING LOG

BORING LOG

Page___ of___

PROJECT NAME: _____ BORING NUMBER: _____
PROJECT NUMBER: _____ DATE : _____
DRILLING COMPANY: _____ GEOLOGIST: _____
WATER LEVEL DATA: _____

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

*When rock coring enter rock brokeness.

CONVERTED TO WELL : ___ Yes ___ No; WELL I.D.#: _____
REMARKS: _____

Signature(s): _____

LEGEND

SOIL TERMS

UNIFIED SOIL CLASSIFICATION (USCS)

COARSE-GRAINED SOILS (More Than Half of Material is LARGER Than No. 200 Sieve Size)				
FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)			GROUP SYMBOL	TYPICAL NAMES
GRAVELS (50%(+)>1/4"Ø	CLEAN GRAVELS (Low % Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.
	GRAVELS W/FINES (High % Fines)	Non-plastic fines (for identification procedures, see ML)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
		Plastic fines (for identification procedures, see CL)	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.
SANDS 50%(+)<1/4"Ø	CLEAN SANDS (Low % Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	SW	Well graded sand, gravelly sands, little or no fines.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	Poorly graded sands, gravelly sands, little or no fines.
	SANDS W/FINES (High % Fines)	Non-plastic fines (for identification procedures, see MCL)	SM	Silty sands, poorly graded sand-silt mixtures.
		Plastic fines (for identification procedures, see CL)	SC	Clayey sands, poorly graded sand-clay mixtures.

FINE-GRAINED SOILS (More Than Half of Material is SMALLER Than No. 200 Sieve Size)						
FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)					GROUP SYMBOL	TYPICAL NAMES
	Identification Procedures on Fraction Smaller than No. 40 Sieve Size					
		DRY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to Shaking)	TOUGHNESS (Consistency Near Plastic Limit)		
SILTS AND CLAYS Liquid Limit <50		None to Slight	Quick to Slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity.
		Medium to High	None to Very Slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		Slight to Medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity.
SILTS AND CLAYS Liquid Limit >50		Slight to Medium	Slow to None	Slight to Medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		High to Very High	None	High	CH	Inorganic clays of high plasticity, fat clays.
		Medium to High	None to Very Slow	Slight to Medium	OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS		Readily identified by color, odor, spongy feel and frequently by fibrous texture.			Pt	Peat and other organic soils

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

DENSITY OF GRANULAR SOILS

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

CONSISTENCY OF COHESIVE SOILS

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

ROCK TERMS

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

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

LEGEND:

SOIL SAMPLES - TYPES

S-2" Split-Barrel Sample

ST-3" O.D. Undisturbed Sample

O - Other Samples, Specify in Remarks

ROCK SAMPLES - TYPES

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

Q-NQ (Wireline) Core (-1-7/8" O.D.)

Z - Other Core Sizes, Specify in Remarks

WATER LEVELS

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

12/18 ▼ 12.6' Stabilized Level w/Date & Depth

Subject: FIELD DOCUMENTATION

Number: SA-6.3

Revision: 0

Effective Date: 03/01/96

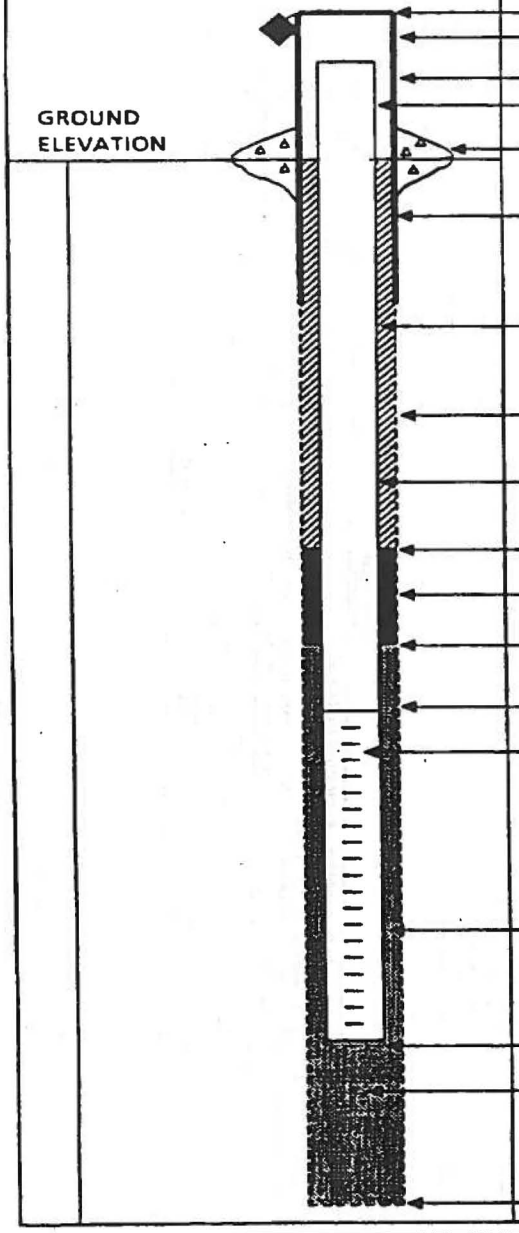
ATTACHMENT C-5
EXAMPLE OVERBURDEN MONITORING WELL SHEET

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: _____ /

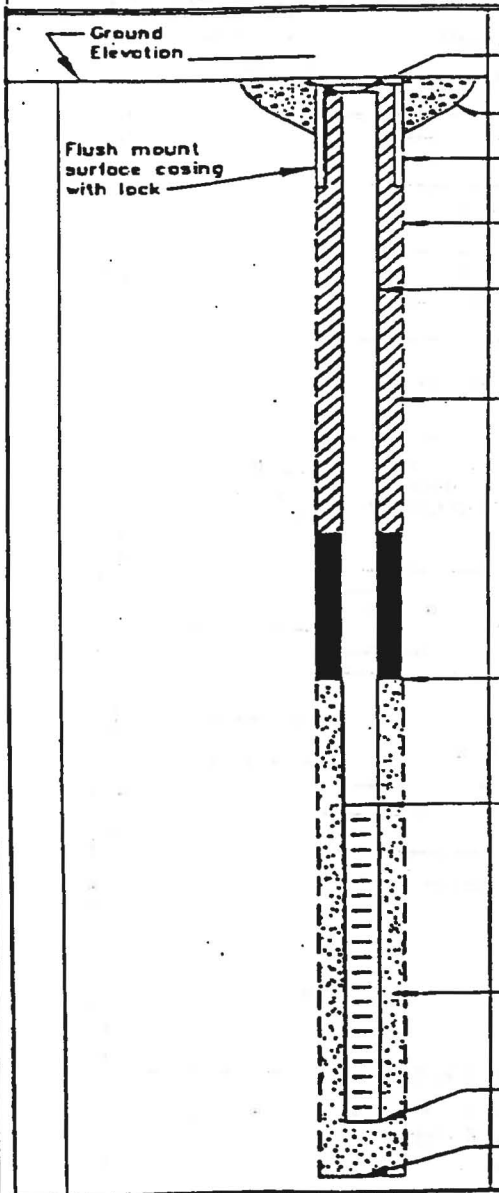
ATTACHMENT C-5A
EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)

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: _____

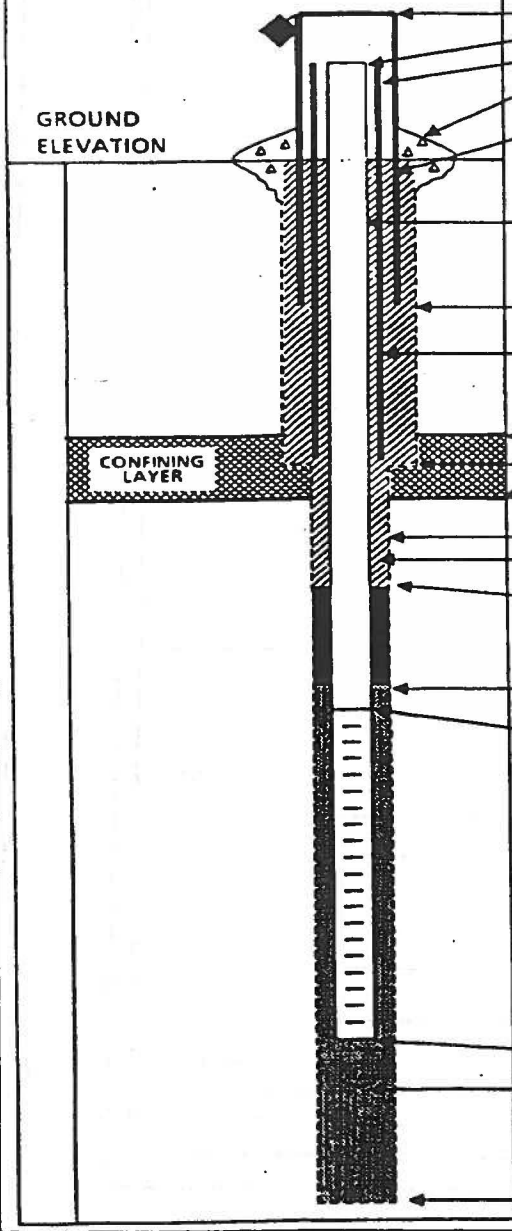
ATTACHMENT C-6
EXAMPLE CONFINING LAYER MONITORING WELL SHEET

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: _____

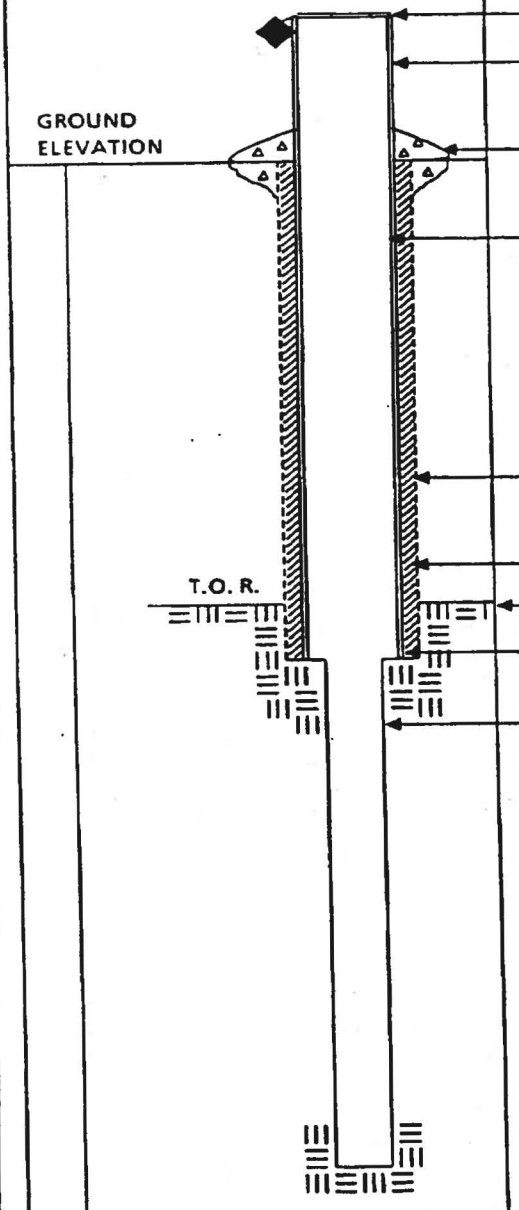
ATTACHMENT C-7
EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL

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: _____/_____

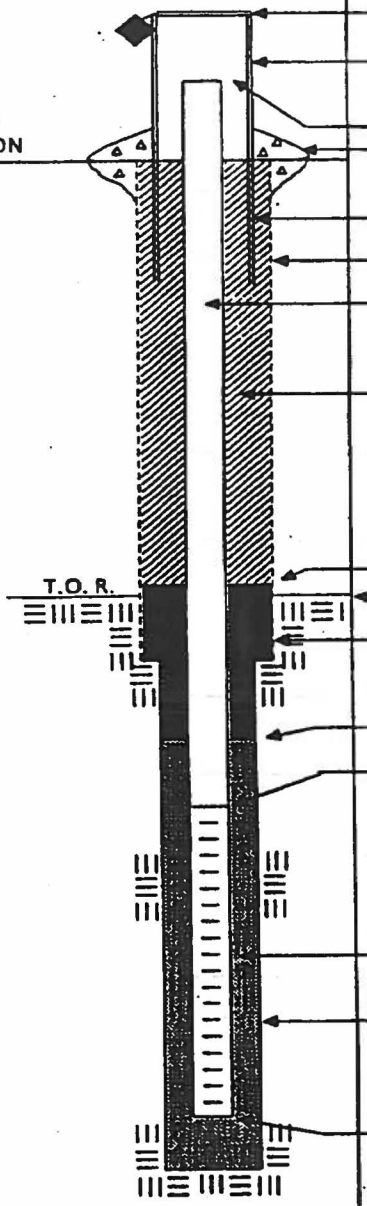
ATTACHMENT C-8
EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK

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: _____ /

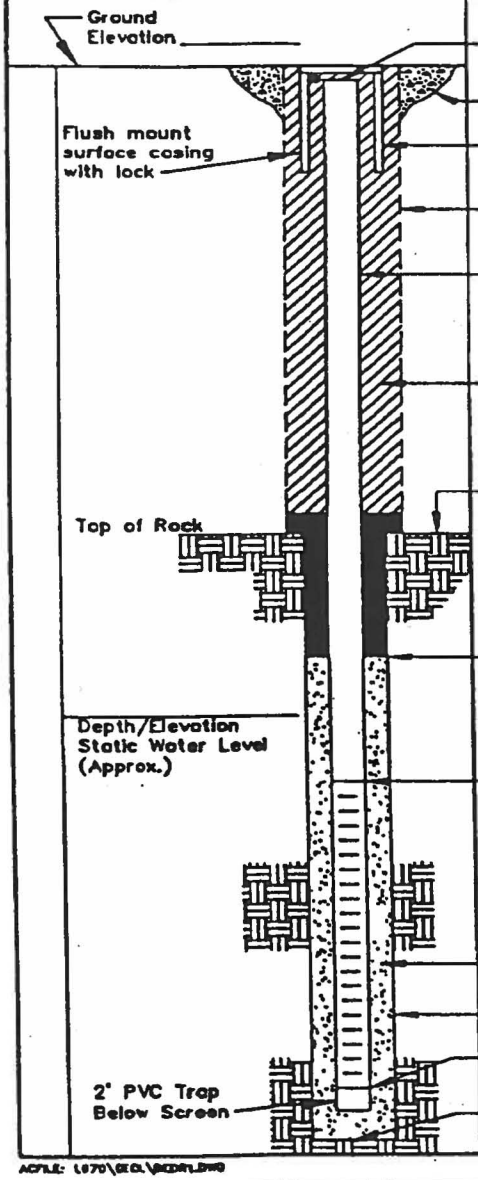
ELEVATION / DEPTH BOTTOM OF HOLE: _____ /

ATTACHMENT C-8A
EXAMPLE BEDROCK MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK (FLUSHMOUNT)

BORING NO.: _____

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

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



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

ACFILE: L070\GEO.\BEDRLDWG

ATTACHMENT C-9
EXAMPLE TEST PIT LOG

TEST PIT LOG

Brown & Root Environmental

PROJECT: _____ TEST PIT NO.:

PROJECT NO _____ DATE: _____

LOCATION: _____

FIELD GEOLOGIST: _____

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

Test Pit Cross Section and / or Plan View

REMARKS _____

PHOTO LOG _____ TEST PIT _____

PAGE ____ OF ____

ATTACHMENT D
EXAMPLE EQUIPMENT CALIBRATION LOG

Brown & Root Environmental

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME / MODEL : _____ JOB NAME : _____

MANUFACTURER : _____ JOB NUMBER : _____

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS

ATTACHMENT E
EXAMPLE DAILY ACTIVITIES RECORD

DAILY ACTIVITIES RECORD — **Brown & Root Environmental**

PROJECT _____ LOCATION _____
CLIENT _____ ARRIVAL TIME _____ JOB NO. _____
DATE _____ DEPARTURE TIME _____
CONTRACTOR _____ DRILLER _____
BORING NO. _____ HNUS REPRESENTATIVE _____

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

COMMENTS: _____

APPROVED BY:

_____ HNUS FIELD REPRESENTATIVE

_____ DRILLER OR REPRESENTATIVE

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 C

QAPP

USEPA REGION IV RECOMMENDED CONTAINERS, HOLDING TIMES, & PRESERVATION

RECOMMENDED CONTAINERS, HOLDING TIMES, & PRESERVATION

ANALYTICAL GROUP	Soil/Sediment			Water/Wastewater[1]			Waste		
	Cont	Pres	Hold	Cont	Pres	Hold	Cont	Pres	Hold
BIOLOGICAL									
Bacteriological*	--	--	--	B	I	6hr	--	--	--
Toxicity, Acute	--	--	--	CU	I	2	--	--	--
Toxicity, Chronic	--	--	--	CU	I	2	--	--	--
INORGANICS									
pH*	8G	NA	--	--	--	--	8G	NA	N
Dermal Corrosion	--	--	--	--	--	--	8G	NA	N
Flashpoint	--	--	--	--	--	--	8G	NA	N
BTU Content	--	--	--	--	--	--	8G	NA	N
Ash Content	--	--	--	--	--	--	8G	NA	N
Residual Chlorine*	--	--	--	SM	NA	I	--	--	--
Turbidity	--	--	--	SM	I	2	--	--	--
Conductivity	--	--	--	SM	I	28[11]	--	--	--
Temperature*	--	--	--	SM	NA	I	--	--	--
BOD5	--	--	--	HP[2]	I	2	--	--	--
Solids Series	--	--	--	HP	I	7	--	--	--
Settleable Solids	--	--	--	HP	I	2	--	--	--
Nutrients (N,P)	8G	I	NS	HP	S/I	28	--	--	--
Chloride	--	--	--	LP	NA	28	--	--	--
Ortho-P	8G	I	NS	LP	I[4]	2	--	--	--
Dissolved P	--	--	--	LP	S[4]/I	28	--	--	--
COD	8G	I	NS	LP	S/I	28	--	--	--
Alkalinity	--	--	--	LP	S/I	28	--	--	--
Color	--	--	--	GP	I	2	--	--	--
Oil & Grease*	--	--	--	LG	S/I	28	--	--	--
Metals	8G	I	180	LP	N	180	8G	NA	180

ANALYTICAL GROUP	Soil/Sediment			Water/Wastewater[1]			Waste		
	Cont	Pres	Hold	Cont	Pres	Hold	Cont	Pres	Hold
Mercury	8G	I	180	LP	N	28	8G	NA	180
Metals - TCLP	8G	I	360[12]	LP	I	360[12]	8G	NA	360[12]
Metals - EP	8G	I	360[12]	LP	I	360[12]	8G	NA	360[12]
Cromium VI	--	--	--	LP	I	1	--	--	--
Cyanide	--	--	--	LP	A[5]/C[6]/I	14	8G	NA	14
Sulfides	--	--	--	LP	Z/C[7]/I	7	--	--	--
Sulfates	--	--	--	LP	I	28	--	--	--
Nitrite	--	--	--	LP	I	2	--	--	--
Nitrate	--	--	--	HP	I	2	--	--	--
Hardness	--	--	--	LP	N	180	--	--	--
Fluoride	--	--	--	LP	NA	28	--	--	--
ORGANICS									
VOCs*	2G	I	14	V	B[8]/I	14/7[16]	8G	NA	14
VOCs - TCLP*	2G	I	28[13]	V	I	28[13]	8G	NA	28[13]
Extractables[19]	8G	I	54[18]	GG	I[9]	47[17]	8G	NA	54[18]
Extractables - TCLP	8G	I	61[14]	GG	I	61[14]	8G	NA	61[14]
Dioxins[20]	A	I	75[15]	LA[3]	I[10]	75[15]	A	I	75[19]
Percent Alcohol	8G	I	NS	GG	I	NS	8G	NA	NS
Phenols	--	--	--	LA	S/I	28	--	--	--
Org Halide (TOX)	8G	I	28	LA	S/I	28	--	--	--

General Footnotes:

Cont - Container
Pres - Preservation
Hold - Holding Time (days)
* - Grab sample only, unless indicated a grab or composite is acceptable.
1 - Consult 40 CFR Part 136 Table II. - Required-Containers, Preservation Techniques, and Holding Times for latest requirements.
19 - Including pesticides, herbicides and PCBs
20 - Consult local laboratory for most recent dioxin container and preservation requirements.

Containers:

B - Bateriological container
CU - Cubitainer: one gallon or 2 gallon
8G - 8 oz. widemouth glass (Teflon lid)
2G - 2 oz. widemouth glass (Teflon septum lid)
LP - One liter polyethylene
GG - One gallon amber glass (Teflon lid)
V - 40 ml glass (Teflon septum lid)
SM - Stormore 500 ml polyethylene
LG - One liter widemouth glass (Teflon lid)
GP - Gallon polyethylene
HP - Half-gallon polyethylene
LA - One liter amber glass (Teflon lid)
A - 500 ml widemouth amber glass (Teflon lid)

2 - Use GP for BOD with multiple parameters
3 - Collect 2 sample containers (LA) per sample plus 4 at one location for matrix spike

Preservatives:

A - Ascorbic acid
B - Sodium bisulfite
C - NaOH
H - HCl
I - Ice (4°C)
N - 50% HNO_3 (pH < 2.0 S.U.)
NA - Not applicable
S - 50% H_2SO_4 (pH < 2.0 S.U.)
Z - Zinc acetate

4 - Filter on-site
5 - Only with residual CL_2
6 - To pH > 12.0 S.U.
7 - To pH > 9.0 S.U.
8 - With residual CL_2 mix sample in 8 oz. glass container with 8 drops 25% ascorbic acid
9 - With residual CL_2 mix sample with 0.008% sodium thiosulfate
10 - With residual CL_2 mix sample with 80 mg of sodium thiosulfate per liter

Holding Times: in days unless noted otherwise:

NS - Not Specified
N - Indefinate
I - Immediate (within 15 minutes: 40 CFR 136 Table II)

11 - Determine on-site if possible
12 - 360 days: 180 days to extraction plus 180 days to analysis
13 - 28 days: 14 days to TCLP extraction plus 14 days to analysis (7 days if not preserved following extraction)
14 - 61 days: 14 days to TCLP extraction, 7 days to solvent extraction, 40 days to analysis
15 - Method 8290 specifies 30 days to extraction plus 45 days to analysis

16 - 7 days if not preserved
17 - 47 days: 7 days to extraction, 40 days to analysis
18 - 54 days: 14 days to extraction, 40 days to analysis

Shipping Note:

When samples are to be shipped by common carrier or sent through the United States mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of 40 CFR, Part 136, Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric Acid (HCL) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid ($HN0_3$) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium Hydroxide (NaOH) in water solutions at concentrations of 0.08% by weight or less (pH about 12.30 or less). This footnote is wholly reproduced from 40 CFR 136.3, which is definitive.

APPENDIX C

FORMS

EQUIPMENT REQUISITION

PROJECT: _____ **PROJECT NO.:** _____

PROJECT MANAGER: _____ **TODAY'S DATE:** _____

FIELD TECHNICIAN: _____ **DUE DATE:** _____

EQUIPMENT MANAGER: _____ **EST. RETURN DATE:** _____

LOCATION/
SHIP TO: _____

☐ Do not bill TtNUS equipment daily through the sign-out period. Billing procedures to be followed are noted below.

☐ Apply Industrial Billing Rate

☐ Shipped by: _____

☐ Apply Gov't Billing/Shipping Rates

☐ Load In: _____

☐ Apply Other Billing Rates _____

ID No.	EQUIPMENT	QUANTITY OUT	CONDITION OUT	QUANTITY IN	CONDITION IN	BILLING RATE	COMMENTS
	MONITORING EQUIPMENT						
	HNU/PID						
	HNu eV probe						
	Isobutylene Calibration gas						
	HORIBA water quality checker						
	pH 4 Calibration solution						
	Draeger pump						
	Draeger tubes						
	LEL/O2						
	Pentane Calibration gas						
	OVA/FID						
	Methane Calibration gas						
	Mini-alert Radiation meter						
	Conductivity meter						
	Thermometer						
	ORP meter						
	Span gas regulator						
	PPE						
	Latex Disposable Gloves (Size)						
	Viton Gloves						
	Butyl Gloves (Size)						
	Cotton Gloves						
	Nitrile Gloves						
	Neoprene Gloves						
	Silvershield Gloves (Size)						
	Butyl Rubber Boots						
	Neoprene Rubber Boots (Size)						
	Latex Disposable Boots (Size)						
	Hard Hat						

EQUIPMENT REQUISITION

PROJECT: _____ **PROJECT NO.:** _____

PROJECT MANAGER: _____ **TODAY'S DATE:** _____

FIELD TECHNICIAN: _____ **DUE DATE:** _____

EQUIPMENT MANAGER: _____ **EST. RETURN DATE:** _____

LOCATION/
SHIP TO: _____

☐ Do not bill TtNUS equipment daily through the sign-out period. Billing procedures to be followed are noted below.

☐ Shipped by: _____

☐ Load In: _____

☐ Apply Industrial Billing Rate

☐ Apply Gov't Billing/Shipping Rates

☐ Apply Other Billing Rates _____

ID No.	EQUIPMENT	QUANTITY OUT	CONDITION OUT	QUANTITY IN	CONDITION IN	BILLING RATE	COMMENTS
	Face shield						
	Tyvek Coveralls (Size)						
	PE Coveralls (Size)						
	Saranex Coveralls (Size)						
	PVC Coveralls (Size)						
	Safety Glasses - Clear / Tinted						
	Monogoggles						
	Earplugs						
	RESPIRATORY PROTECTION						
	Disposable Dust Mask						
	Ultra twins-full face (S / M / L)						
	MSA Cleaner Sanitizer II						
	Ultra Twin Cartridge (Type:)						
	Air escape packs						
	SCBA units w/ tanks						
	SCBA, spare tank						
	SCBA mask						
	WATER SAMPLING						
	Electronic water-level indicator (m-scope)						
	Popper						
	Oil/Water interface probe						
	Teflon Disposable Bailer						
	Stainless Steel Bailer						
	PVC disposable bailer						
	Polyrope 1000'						
	Peristaltic Pump						
	Silicon tubing						
	Teflon tubing	150'					
	0.45 micron filter						
	Teflon-coated stainless steel cable						

EQUIPMENT REQUISITION

PROJECT: _____ **PROJECT NO.:** _____

PROJECT MANAGER: _____ **TODAY'S DATE:** _____

FIELD TECHNICIAN: _____ **DUE DATE:** _____

EQUIPMENT MANAGER: _____ **EST. RETURN DATE:** _____

LOCATION/
SHIP TO: _____

☐ Do not bill TtNUS equipment daily through the sign-out period. Billing procedures to be followed are noted below.

☐ Apply Industrial Billing Rate

☐ Shipped by: _____

☐ Apply Gov't Billing/Shipping Rates

☐ Load In: _____

☐ Apply Other Billing Rates _____

ID No.	EQUIPMENT	QUANTITY OUT	CONDITION OUT	QUANTITY IN	CONDITION IN	BILLING RATE	COMMENTS
	MONITORING EQUIPMENT						
	HNU/PID						
	HNu eV probe						
	Isobutylene Calibration gas						
	HORIBA water quality checker						
	pH 4 Calibration solution						
	Draeger pump						
	Draeger tubes						
	LEL/O2						
	Pentane Calibration gas						
	OVA/FID						
	Methane Calibration gas						
	Mini-alert Radiation meter						
	Conductivity meter						
	Thermometer						
	ORP meter						
	Span gas regulator						
	PPE						
	Latex Disposable Gloves (Size)						
	Viton Gloves						
	Butyl Gloves (Size)						
	Cotton Gloves						
	Nitrile Gloves						
	Neoprene Gloves						
	Silvershield Gloves (Size)						
	Butyl Rubber Boots						
	Neoprene Rubber Boots (Size)						
	Latex Disposable Boots (Size)						
	Hard Hat						

EQUIPMENT REQUISITION

PROJECT: _____ **PROJECT NO.:** _____

PROJECT MANAGER: _____ **TODAY'S DATE:** _____

FIELD TECHNICIAN: _____ **DUE DATE:** _____

EQUIPMENT MANAGER: _____ **EST. RETURN DATE:** _____

LOCATION/ _____

SHIP TO: _____

_____

_____

_____

☐ Do not bill TtNUS equipment daily through the sign-out period. Billing procedures to be followed are noted below.

☐ Apply Industrial Billing Rate

☐ Shipped by: _____

☐ Apply Gov't Billing/Shipping Rates

☐ Load In: _____

☐ Apply Other Billing Rates _____

ID No.	EQUIPMENT	QUANTITY OUT	CONDITION OUT	QUANTITY IN	CONDITION IN	BILLING RATE	COMMENTS
	Face shield						
	Tyvek Coveralls (Size)						
	PE Coveralls (Size)						
	Saranex Coveralls (Size)						
	PVC Coveralls (Size)						
	Safety Glasses - Clear / Tinted						
	Monogoggles						
	Earplugs						
	RESPIRATORY PROTECTION						
	Disposable Dust Mask						
	Ultra twins-full face (S / M / L)						
	MSA Cleaner Sanitizer II						
	Ultra Twin Cartridge (Type:)						
	Air escape packs						
	SCBA units w/ tanks						
	SCBA, spare tank						
	SCBA mask						
	WATER SAMPLING						
	Electronic water-level indicator (m-scope)						
	Popper						
	Oil/Water interface probe						
	Teflon Disposable Bailer						
	Stainless Steel Bailer						
	PVC disposable bailer						
	Polyrope 1000'						
	Peristaltic Pump						
	Silicon tubing						
	Teflon tubing	150'					
	0.45 micron filter						
	Teflon-coated stainless steel cable						

EQUIPMENT REQUISITION

PROJECT: _____ **PROJECT NO.:** _____

PROJECT MANAGER: _____ **TODAY'S DATE:** _____

FIELD TECHNICIAN: _____ **DUE DATE:** _____

EQUIPMENT MANAGER: _____ **EST. RETURN DATE:** _____

LOCATION/
SHIP TO: _____

☐ Do not bill TtNUS equipment daily through the sign-out period. Billing procedures to be followed are noted below.

☐ Shipped by: _____

☐ Load In: _____

☐ Apply Industrial Billing Rate

☐ Apply Gov't Billing/Shipping Rates

☐ Apply Other Billing Rates _____

ID No.	EQUIPMENT	QUANTITY OUT	CONDITION OUT	QUANTITY IN	CONDITION IN	BILLING RATE	COMMENTS
	PE tubing 3/4" x 100'						
	PE tubing 1/4" x 100'						
	PE tubing 1/4" x 1000'						
	Tygon tubing 3/8"						
	PACKAGING						
	Strapping tape						
	Clear tape						
	Duct tape						
	Aluminum foil						
	Class 9 Labels						
	Electrical tape						
	GENERAL						
	4 mil Plastic Roll (10' x 25')						
	Motorola 2-way radio						
	200' tape measure						
	Garbage bags, 20 gal						
	Garbage bags, 30-40 gal						
	Ziplock bags, 1 quart						
	Ziplock bags, 1 gallon						
	Paper towel						
	Spray paint						
	Caution tape						
	Vinyl flagging						
	Wooden Survey stakes						
	Survey pin flags						
	Tedlar bag						
	pH paper						
	medicine dropper						
	Bolt cutters						
	First-aid kit						

EQUIPMENT REQUISITION

PROJECT: _____ **PROJECT NO.:** _____

PROJECT MANAGER: _____ **TODAY'S DATE:** _____

FIELD TECHNICIAN: _____ **DUE DATE:** _____

EQUIPMENT MANAGER: _____ **EST. RETURN DATE:** _____

LOCATION/ _____

SHIP TO: _____

_____

_____

_____

☐ Do not bill TtNUS equipment daily through the sign-out period. Billing procedures to be followed are noted below.

☐ Apply Industrial Billing Rate

☐ Shipped by: _____

☐ Apply Gov't Billing/Shipping Rates

☐ Load In: _____

☐ Apply Other Billing Rates _____

ID No.	EQUIPMENT	QUANTITY OUT	CONDITION OUT	QUANTITY IN	CONDITION IN	BILLING RATE	COMMENTS
	Paper towels						
	Eyewash						
	Toolbox						
	Thermometer						
	DECONTAMINATION EQUIPMENT						
	Bailer brush						
	Long handle decon brush						
	Liquinox detergent						
	Teflon wash bottle 500 mL						
	Spray bottle						
	Wash tub						
	5 gal. bucket						
	3 gal. poly sprayer						
	SOIL SAMPLING						
	Stainless steel trowel						
	shovel						
	Disposable trowel						
	stainless steel bowl (Size)						
	Stainless steel auger						
	Stainless steel threaded cross handle						
	WATER						
	Steam Distilled (5 gal cube)						
	Reagent grade 20 L						
	HPLC water						
	OTHER						
	Hermit 2000 Datalogger						
	Hermit 1000 Datalogger						
	Transducer 20						
	Transducer 50						
	RS232 cable						

EQUIPMENT REQUISITION

PROJECT: _____ **PROJECT NO.:** _____

PROJECT MANAGER: _____ **TODAY'S DATE:** _____

FIELD TECHNICIAN: _____ **DUE DATE:** _____

EQUIPMENT MANAGER: _____ **EST. RETURN DATE:** _____

LOCATION/
SHIP TO: _____

☐ Do not bill TtNUS equipment daily through the sign-out period. Billing procedures to be followed are noted below.

☐ Apply Industrial Billing Rate

☐ Shipped by: _____

☐ Apply Gov't Billing/Shipping Rates

☐ Load In: _____

☐ Apply Other Billing Rates _____

ID No.	EQUIPMENT	QUANTITY OUT	CONDITION OUT	QUANTITY IN	CONDITION IN	BILLING RATE	COMMENTS
	Printer						
	2" Teflon slug						
	4" Teflon slug						

UNDERGROUND UTILITY LOCATION

Date of Request : _____

BRE Project # : _____

BRE Job Name : _____

Job Location : _____

_____

_____

UNCLE NOTICICATION : _____ Work Start Date : _____
(REFERENCE # 12410)

UTILITY COMPANY	TICKET NUMBER	TELEPHONE NUMBER	DISPATCHER NAME	DATE CONTACTED	MEETING DATE	REMARKS
ELECTRIC :						
GAS :						
CABLE :						
WATER :						
SEWER :						
TELEPHONE :						

CLEAR.DOC

SOUTHERN DIVISION - NAVFACENGCOM
CERTIFICATE OF CONFORMANCE

Well Designation:_____
Site Name: _____
Date Installed: _____
Project Name: _____

Responsible Professional: _____
Drilling Company: _____
Driller:_____
Project Number: _____

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

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

Signature of Responsible Professional:_____

DAILY ACTIVITIES RECORD

PROJECT NAME:		**PROJECT NUMBER:**	
CLIENT:		**LOCATION:**	
DATE:		**ARRIVAL TIME:**	
B&RE PERSONNEL:		**DEPARTURE TIME:**	
CONTRACTOR:		**DRILLER:**	

ITEM	QUANTITY ESTIMATE	QUANTITY TODAY	PREVIOUS TOTAL QUANTITY	CUMULATIVE QUANTITY TO DATE
Mobiliztion/Demobilzation (each)				
4.25-inch HAS Drilling (foot)				
Rotary Wash Drilling (foot)				
Split-Spoon Samples (each)				
Shelby Tube Samples (each)				
2-inch MW Installation (foot)				
6-inch Surface Casing (foot)				
MW Development (hour)				
MW Surface Completion (each)				
IDW Containerization (drum)				
Decontamination (hour)				
Stand-by (hour)				

COMMENTS: _____

_____

_____

_____

APPROVED BY:

_____ _____

B&RE REPRESENTATIVE DRILLER

DATE: _____

DAILY ACTIVITIES RECORD

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

CLIENT: _____ **LOCATION:** _____

DATE: _____ **ARRIVAL TIME:** _____

B&RE PERSONNEL: _____ **DEPARTURE TIME:** _____

CONTRACTOR: _____ **DRILLER:** _____

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

COMMENTS: _____

_____

_____

_____

APPROVED BY:

_____ _____

B&RE REPRESENTATIVE DRILLER

DATE: _____

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME/MODE____________________ PROJECT NAME : ____________________

MANUFACTURER : ____________________ PROJECT NUMBER : ____________________

ALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS

BORING LOG

PROJECT NAME: ______________________ BORING NUMBER: ______________________
PROJECT NUMBER: ______________________ DATE: ______________________
)RILLING 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 (ppm): Sample	PID/FID (ppm): Sampler BZ	PID/FID (ppm): Borehole**	PID/FID (ppm): Driller BZ**

Vhen rock coring, enter rock brokeness.

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

Drilling Area Background (ppm): [ ]

Remarks: ____

Converted to Well: Yes ______ No ______ Well I.D. #: ______________________

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

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

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

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

GRAB SAMPLE DATA:

Date:	Depth	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):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

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 (odor, color, etc.)

GROUNDWATER LEVEL MEASUREMENT SHEET

Project: _____ Project No.: _____
Location: _____ Personnel: _____
Weather: _____ Measuring Device: _____
Date: _____ Remarks: _____

Well Number	Time	(A) Elevation of Reference Point (feet)*	(B) Water Level Indicator Reading (feet)*	=(A)-(B) Groundwater Elevation (feet)*	Total Well Depth (feet)*	Comments

Notes: _____

*All measurements to the nearest 0.01 foot

DEP Form # 62-770.900(3)

Form Title: Petroleum or Petroleum Products Water Sampling Log

Effective Date: September 23, 1997

Petroleum or Petroleum Products
Water Sampling Log

FDEP FACILITY NO.:	WELL NO.:	SAMPLE ID:	DATE: / /
SITE NAME:	SITE LOCATION:		

PURGE DATA

WELL DIAMETER (in):	TOTAL WELL DEPTH (ft):	DEPTH TO WATER (ft):	WELL CAPACITY (gal/ft):

1 WELL VOLUME (gal) = (TOTAL WELL DEPTH – DEPTH TO WATER) x WELL CAPACITY =

= (–) x =

PURGE METHOD:	PURGING INITIATED AT:	PURGING ENDED AT:
	PURGE RATE (gpm):	TOTAL VOLUME PURGED (gal):

WELL VOLS. PURGED	CUMUL. VOLUME PURGED (gal)	pH	TEMP. (°C)	COND. (µmhos)	COLOR	ODOR	APPEARANCE	OTHER

SAMPLING DATA

SAMPLED BY / 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 SPECIFICATIONS			SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD
NO.	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOLUME ADDED IN FIELD (ml)	FINAL pH	

REMARKS:

MATERIAL CODES: AG = AMBER GLASS; CG = CLEAR GLASS; HDP = HIGH DENSITY POLYETHYLENE; O = OTHER (SPECIFY)

WELL CAPACITY: 1.25" = 0.06 gal/ft; 2" = 0.16 gal/ft; 4" = 0.65 gal/ft; 6" = 1.47 gal/ft; 8" = 2.61 gal/ft; 12" = 5.88 gal/ft

NOTE: this does not constitute all the information required by Chapter 62-160, F.A.C.

SAMPLE LOG SHEET
NATURAL ATTENUTAION PARAMETERS

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

Sampled By: _____ Duplicate: ☐

SAMPLING DATA:

Date: / Time:	Color (Visual)	pH (SU)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (Meter, mg/l)	Sal. (%)	
Method: Peristaltic pump								

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Dissolved Oxygen:

Equipment: HACH Digital Titrator OX-DT 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	=
_____	x 0.02	=

Notes: _____

Alkalinity:

Equipment: HACH Digital Titrator AL-DT Analysis Time: _____

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	=
☐	40-160 mg/L	25 ml	0.1600 N	0.4	_____ & _____	x 0.4	=
☐	100-400 mg/L	100 ml	1.600 N	1.0	_____ & _____	x 1.0	=
☐	200-800 mg/L	50 ml	1.600 N	2.0	_____ & _____	x 2.0	=
☐	500-2000 mg/L	20 ml	1.600 N	5.0	_____ & _____	x 5.0	=
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	_____ & _____	x 10.0	=

Relationship	Hydroxide	Carbonate	Bicarbonate
Concentration	mg/L	mg/L	mg/L

Notes: _____

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

Carbon Dioxide:

Equipment: HACH Digital Titrator CA-DT 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	=
_____	x 0.2	=
_____	x 1.0	=
_____	x 2.0	=

Notes: _____

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

GROUNDWATER SAMPLE LOG SHEET
NATURAL ATTENUTAION PARAMETERS

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

Sampled By: _____ Duplicate: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Sulfide:

Equipment: HACH DR-890 Colorimeter HS-C Color Chart Analysis Time: _____

Program No.:

Concentration: _____ mg/L Filtered: ☐

Notes: _____

Ferrous Iron:

Equipment: HACH DR-890 Colorimeter IR-18C Color Wheel Analysis Time: _____

Program No.:

Concentration: _____ mg/L Filtered: ☐

Notes: _____

Nitrite:

Equipment: HACH DR-890 Colorimeter Analysis Time: _____

Program No.:

Concentration: _____ mg/L Reagent Blank Correction: ☐

Standard Solution: ☐ Results: _____

Notes: _____

Nitrate:

Equipment: HACH DR-890 Colorimeter Analysis Time: _____

Program No.:

Concentration: _____ mg/L

Nitrite Interference Treatment: ☐

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

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

Notes: _____

Chain of Custody Record

Company:		Page of
Address:		DEP Form #: 62-770.900(2) Form Title: Chain of Custody Record Effective Date: September 23, 1997
Phone: Fax:		FDEP Facility No.: Project Name:
Sampled by [Print Name(s)] / Affiliation	Preservatives (see codes)	Sampling CompQAP No.: Approval Date:
Sampler(s) Signature(s)	Analyses Requested	REQUESTED DUE DATE / /

Item No.	Field ID No.	Sampled Date	Sampled Time	Grab or Composite	Matrix (see codes)	Number of Containers	Remarks	Lab. No.

Shipment Method			← Total Number of Containers
Out: / /	Via:		
Returned: / /	Via:		

Item No.	Relinquished by / Affiliation	Date	Time	Accepted by / Affiliation	Date	Time

Additional Comments:

Cooler No.(s) / Temperature(s) (°C)	Sampling Kit No.	Equipment ID No.

MATRIX CODES: A = Air GW = Groundwater SE = Sediment SO = Soil SW = Surface Water W = Water (Blanks) O = Other (specify)

PRESERVATIVE CODES: H = Hydrochloric acid + ice I = Ice only N = Nitric acid + ice S = Sulfuric acid + ice O = Other (specify)

APPENDIX D

TETRA TECH NUS, INC. – STANDARD OPERATING PROCEDURES

BROWN & ROOT ENVIRONMENTAL	STANDARD OPERATING PROCEDURES	Number CT-04	Page 1 of 6
		Effective Date 03/01/96	Revision 0
		Applicability B&R Environmental, NE	
		Prepared Risk Assessment Department	
Subject SAMPLE NOMENCLATURE		Approved D. Senovich	

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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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		Prepared Earth Sciences Department	
Subject NON-RADIOLOGICAL SAMPLE HANDLING		Approved D. Senovich	

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1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide information on sample preservation, packaging, and shipping procedures to be used in handling environmental samples submitted for chemical constituent, biological, or geotechnical analysis. Sample chain-of-custody procedures and other aspects of field documentation are addressed in SOP SA-6.3. Sample identification is addressed in SOP CT-04.

2.0 SCOPE

This procedure:

- Describes the appropriate containers to be used for samples depending on the analyses to be performed, and the steps necessary to preserve the samples when shipped off site for chemical analysis.
- Provides instruction for sample packaging and shipping in accordance with current U.S. Department of Transportation (DOT) regulations.

3.0 GLOSSARY

Hazardous Material - A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. Under 49 CFR, the term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials, as well as materials designated as hazardous under the provisions of §172.101 and §172.102 and materials that meet the defining criteria for hazard classes and divisions in Part 173.

Hazardous Waste - Any substance listed in 40 CFR, Subpart D (§261.30 et seq.), or otherwise characterized as ignitable, corrosive, reactive, or toxic (as defined by Toxicity Characteristic Leaching Procedure, TCLP, analysis) as specified under 40 CFR, Subpart C (§261.20 et seq.), that would be subject to manifest requirements specified in 40 CFR 262. Such substances are defined and regulated by EPA.

Marking - A descriptive name, identification number, instructions, cautions, weight, specification or UN marks, or combination thereof required on outer packaging of hazardous materials.

n.o.i - Not otherwise indicated (may be used interchangeably with n.o.s.).

n.o.s. - Not otherwise specified.

ORM - Other regulated material (see DOT 49 CFR 173.144).

Packaging - A receptacle and any other components or materials necessary for compliance with the minimum packaging requirements of 49 CFR 174, including containers (other than freight containers or overpacks), portable tanks, cargo tanks, tank cars, and multi-unit tank-car tanks to perform a containment function in conformance with the minimum packaging requirements of 49 CFR 173.24(a) & (b).

Placard - Color-coded, pictorial sign which depicts the hazard class symbol and name and which is placed on the side of a vehicle transporting certain hazardous materials.

Common Preservatives:

- Hydrochloric Acid - HCl
- Sulfuric Acid - H_2SO_4
- Nitric Acid - HNO_3
- Sodium Hydroxide - NaOH

Other Preservatives

- Zinc Acetate
- Sodium Thiosulfate - $Na_2S_2O_3$

Normality (N) - Concentration of a solution expressed as equivalent per liter, an equivalent being the amount of a substance containing 1 gram-atom of replaceable hydrogen or its equivalent. Thus, a one-molar solution of HCl, containing 1 gram-atom of H, is "one normal," whereas a one-molar solution of H_2SO_4, containing 2 gram-atoms of H, is "two normal."

Reportable Quantity (RQ) - For the purposes of this SOP, means the quantity specified in column 3 of the Appendix to DOT 49 CFR §172.101 for any material identified in column 1 of the appendix. A spill greater than the amount specified must be reported to the National Response Center.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the location and time of collection.

4.0 RESPONSIBILITIES

Field Operations Leader - Directly responsible for the bottling, preservation, labeling, packaging, shipping, and custody of samples up to and including release to the shipper.

Field Samplers - Responsible for initiating the Chain-of-Custody Record (per SOP SA-6.3), implementing the packaging and shipping requirements, and maintaining custody of samples until they are relinquished to another custodian or to the common carrier.

5.0 PROCEDURES

Sample identification, labeling, documentation, and chain-of-custody are addressed by SOP SA-6.3.

5.1 Sample Containers

Different types of chemicals react differently with sample containers made of various materials. For example, trace metals adsorb more strongly to glass than to plastic, whereas many organic chemicals may dissolve various types of plastic containers. Attachments A and B show proper containers (as well as other information) per 40 CFR 136. In general, the sample container shall allow approximately 5-10 percent air space ("ullage") to allow for expansion/vaporization if the sample warms during transport. However, for collection of volatile organic compounds, head space shall be omitted. The analytical laboratory will generally provide certified-clean containers for samples to be analyzed for chemical constituents. Shelby tubes or other sample containers are generally provided by the driller for samples requiring geotechnical analysis. Sufficient lead time shall be allowed for a delivery of bottle orders. Therefore, it is critical to use the correct container to maintain the integrity of the sample prior to analysis.

Once opened, the container must be used at once for storage of a particular sample. Unused but opened containers are to be considered contaminated and must be discarded; because of the potential for introduction of contamination, they cannot be reclosed and saved for later use. Likewise, any unused containers which appear contaminated upon receipt, or which are found to have loose caps or a missing Teflon liner (if required for the container), shall be discarded.

5.2 Sample Preservation

Many water and soil samples are unstable and therefore require preservation to prevent changes in either the concentration or the physical condition of the constituent(s) requiring analysis. Although complete and irreversible preservation of samples is not possible, preservation does retard the chemical and biological changes that inevitably take place after the sample is collected. Preservation techniques are usually limited to pH control, chemical addition(s), and refrigeration/ freezing (certain biological samples only).

5.2.1 Overview

The preservation techniques to be used for various analytes are listed in Attachments A and B. Reagents required for sample preservation will either be added to the sample containers by the laboratory prior to their shipment to the field or be added in the field (in a clean environment). Only high purity reagents shall be used for preservation. In general, aqueous samples of low-concentration organics (or soil samples of low- or medium-concentration organics) are cooled to 4°C. Medium-concentration aqueous samples and high-hazard organics samples are typically not preserved. Low-concentration aqueous samples for metals are acidified with HNO_3, whereas medium-concentration and high-hazard aqueous metal samples are not preserved. Low- or medium-concentration soil samples for metals are cooled to 4°C, whereas high-hazard samples are not preserved.

The following subsections describe the procedures for preparing and adding chemical preservatives. Attachments A and B indicate the specific analytes which require these preservatives.

5.2.2 Preparation and Addition of Reagents

Addition of the following acids or bases may be specified for sample preservation; these reagents shall be analytical reagent (AR) grade or purer and shall be diluted to the required concentration with deionized water before field sampling commences. To avoid uncontrolled reactions, be sure to Add Acid to water (not vice versa). A dilutions guide is provided below.

Acid/Base	Dilution	Concentration	Estimated Amount Required for Preservation
Hydrochloric Acid (HCl)	1 part concentrated HCl: 1 part double-distilled, deionized water	6N	5-10 mL
Sulfuric Acid (H_2SO_4)	1 part concentrated H_2SO_4: 1 part double-distilled, deionized water	18N	2 - 5 mL
Nitric Acid (HNO_3)	Undiluted concentrated HNO_3	16N	2 - 5 mL
Sodium Hydroxide (NaOH)	400 grams solid NaOH dissolved in 870 mL double-distilled, deionized water; yields 1 liter of solution	10N	2 mL

The amounts required for preservation shown in the above table assumes proper preparation of the preservative and addition of the preservative to one liter of aqueous sample (assuming that the sample is initially at pH 7, is poorly buffered, and does not contain particulate matter; as these conditions vary, more preservative may be required). Consequently, the final sample pH must be checked using narrow-range pH paper, as described in the generalized procedure detailed below:

- Pour off 5-10 mL of sample into a dedicated, clean container. Use some of this sample to check the initial sample pH using wide range (0-14) pH paper. Never dip the pH paper into the sample; always apply a drop of sample to the pH paper using a clean stirring rod or pipette.

- Add about one-half of the estimated preservative required to the original sample bottle. Cap and invert gently several times to mix. Check pH (as described above) using medium range pH paper (pH 0-6 or pH 7.5-14, as applicable).

- Cap sample bottle and seal securely.

Additional considerations are discussed below:

- To test if ascorbic acid must be used to remove oxidizing agents present in the sample before it can be properly preserved, place a drop of sample on KI-starch paper. A blue color indicates the need for ascorbic acid addition.

  If required, add a few crystals of ascorbic acid to the sample and retest with the KI-starch paper. Repeat until a drop of sample produces no color on the KI-starch paper. Then add an additional 0.6 grams of ascorbic acid per each liter of sample volume.

  Continue with proper base preservation of the sample as described, generally, above.

- Samples for sulfide analysis must be treated by the addition of 4 drops (0.2 mL) of 2N zinc acetate solution per 100 ml of sample.

  The 2N zinc acetate solution is made by dissolving 220 grams of zinc acetate in 870 mL of double-distilled, deionized water to make 1 liter of solution.

  The sample pH is then raised to 9 using the NaOH preservative.

- To test of sodium thiosulfate must be added to remove residual chlorine from a sample, test the sample for residual chlorine using a field test kit especially made for this purpose.

  If residual chlorine is present, add 0.08 grams of sodium thiosulfate per liter of sample to remove the residual chlorine.

  Continue with proper acidification of the sample as described, generally, above.

For biological samples, 10% buffered formalin or isopropanol may also be required for preservation. Questions regarding preservation requirements should be resolved through communication with the laboratory before sampling begins.

5.3 Field Filtration

At times, field-filtration may be required to provide for the analysis of dissolved chemical constituents. Field-filtration must be performed prior to the preservation of samples as described above. General procedures for field filtration are described below:

- The sample shall be filtered through a non-metallic, 0.45-micron membrane filter, immediately after collection. The filtration system shall consist of dedicated filter canister, dedicated silicon tubing, and a peristaltic pump with pressure or vacuum pumping squeeze action (since the sample is filtered by mechanical peristalsis, the sample travels only through the tubing).

- To perform filtration, thread the silicon tubing through the peristaltic pump head. Attach the filter canister to the discharge end of the silicon tubing (note flow direction arrow); attach the aqueous sample container to the intake end of the silicon tubing. Turn the peristaltic pump on and perform filtration.

- Continue by preserving the filtrate (contained in the filter canister), as applicable and generally described above.

5.4 Sample Packaging and Shipping

Samples collected for shipment from a site shall be classified as either environmental or hazardous material samples. Samples from drums containing materials other than Investigative Derived Waste (IDW) and samples obtained from waste piles or bulk storage tanks are generally shipped as hazardous materials. A distinction must be made between the two types of samples in order to:

- Determine appropriate procedures for transportation of samples (if there is any doubt, a sample shall be considered hazardous and shipped accordingly.)

- Protect the health and safety of transport and laboratory personnel receiving the samples (special precautions are used by the shipper and at laboratories when hazardous materials are received.)

Detailed procedures for packaging environmental and hazardous material samples are outlined in the remainder of this section.

5.4.1 Environmental Samples

Environmental samples are packaged as follows:

- Place sample container, properly identified and with lid securely fastened in a plastic bag (e.g. Ziploc baggie), and seal the bag.

- Place sample in a cooler constructed of sturdy material which has been lined with a large, plastic (e.g. "garbage" bag).

- Pack with enough noncombustible, absorbent, cushioning materials such as vermiculite (shoulders of bottles must be iced if required) to minimize the possibility of the container breaking.

- If cooling is required (see Attachments A and B), double-bag ice in Ziploc baggies and place around container shoulders, and on top of absorbent packing material (minimum of 8 pounds of ice for a medium-size cooler).

- Seal (i.e., tape or tie top in knot) large liner bag.

- The original (top, signed copy) and extra carbonless copies of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the first cooler. The COC form should then state how many coolers are included with that shipment.

- Close and seal outside of cooler as described in SOP SA-6.3. Signed custody seals must be used.

Coolers must be marked as containing "Environmental Samples." The appropriate side of the container must be marked "This End Up" and arrows placed appropriately. No DOT marking or labeling is required; there are no DOT restrictions on mode of transportation.

5.4.2 Determination of Shipping Classification for Hazardous Material Samples

Samples not determined to be environmental samples, or samples known or expected to contain hazardous materials, must be considered hazardous material samples and transported according to the requirements listed below.

5.4.2.1 Known Substances

If the substance in the sample is known or can be identified, package, mark, label, and ship according to the specific instructions for that material (if it is listed) in the DOT Hazardous Materials Table, 49 CFR 172.101. (DOT Guide for shippers can be found in Attachment D of this document.)

To determine the proper shipping name, use the following steps to help locate the shipping name on the Hazardous Materials Table, DOT 49 CFR 172.101.

1. Look first for the chemical or technical name of the material, for example, ethyl alcohol. Note that many chemicals have more than one technical name, for example, perchloroethylene (not listed in 172.101) is listed as tetrachloroethylene (listed 172.101). It may be useful to consult a chemist for all possible technical names a material can have. If your material is not listed by its technical name, then . . .

2. Look for the chemical family name For example, pentyl alcohol is not listed but the chemical family name is: alcohol, n.o.s. (not otherwise specified). If the chemical family name is not listed, then . . .

3. Look for a generic name based on end use. For example, Paint, n.o.s or Fireworks, n.o.s. If a generic name based on end use is not listed, then . . .

4. Look for a generic family name based on end use, for example, drugs, n.o.s. or cosmetics, n.o.s. Finally, if your material is not listed by a generic family name but you suspect or know the material is hazardous because it meets the definition of one or more hazardous classes, then . . .

5. You will have to use the general hazard class for a proper shipping name. For example, Flammable Liquid, n.o.s, or Oxidizer, n.o.s.

5.4.2.2 Unknown Substances

For samples of hazardous substances of unknown content, select the appropriate transportation category according to the DOT hazardous materials classification of a material having more than one hazard. This procedure is outlined in DOT Regulation 49 CFR 173.2a. (This can be found in Attachment C of this SOP.)

The correct shipping classification for an unknown sample is selected through a process of elimination, as outlined in DOT Regulation 49 CFR 172.101(c)(11). By using the provisions in this paragraph, the proper shipping name and description will be determined. A step-by-step guide is provided by the Department of Transportation (DOT) and can be found in Attachment D of this SOP.

5.4.3 Packaging and Shipping of Samples Classified as Flammable Liquid (or Solid)

5.4.3.1 Packaging

Applying the word "flammable" to a sample does not imply that it is in fact flammable. The word prescribes the class of packaging according to DOT regulations.

1. Containerize sample as required (see Attachments A and B). To prevent leakage, fill container no more than 90 percent full. Seal lid with teflon tape or wire.

2. Complete sample label and attach securely to sample container.

3. Seal container and place in 2-mil-thick (or thicker) polyethylene bag (e.g., Ziploc baggie), one sample per bag. Position sample identification label so that it can be read through bag. Seal bag.

4. For soil jars, place sealed bag inside metal can (available from laboratory or laboratory supplier) and cushion it with enough noncombustible, absorbent material (for example, vermiculite or diatomaceous earth) between the bottom and sides of the can and bag to prevent breakage and absorb leakage. Pack one bag per can. Use clips, tape, or other positive means to hold can lid securely, tightly and permanently. Mark can as indicated in Paragraph 1 of Section 5.3.4.2, below. Single 1-gallon bottles do not need to be placed in metal cans.

5. Place one or more metal cans (or a single 1-gallon bottle) into a strong outside container, such as a metal picnic cooler or a DOT-approved fiberboard box. Surround cans (or bottle) with noncombustible, absorbent cushioning materials for stability during transport. The absorbent material should be able to absorb the entire contents of the container. Mark container as indicated in Paragraph 2 below.

5.4.3.2 Marking/Labeling

1. Use abbreviations only where specified. Place the following information, either hand-printed or in label form, on the metal can (or 1-gallon bottle):

   - Laboratory name and address.

- Proper shipping name from the hazardous materials table (DOT Regulation CFR 49 172.101). Example: "Flammable Liquid, n.o.s. UN1993" or "Flammable Solid, n.o.s. UN1325." This will include packing group (see Section 5.3.4.2, No. 2.)

Not otherwise specified (n.o.s) is not used if the flammable liquid (or solid) is identified. If identified, the name of the specific material is listed before the category (for example, Acetone, Flammable Liquid), followed by its appropriate UN number found in the DOT Hazardous Materials table (49 CFR 172.101).

2. Determine packing group. The packing group is part of the proper shipping name and must be included on the shipping papers in the description section.

I. Most Hazardous
II. Medium Hazard
III. Least Hazardous

The packing group will be listed in the hazardous materials table, column 5.

3. Place all information on outside shipping container as on can (or bottle), specifically:

- Proper shipping name
- UN or NA number
- Proper label(s)
- Addressee and sender

Place the following labels on the outside shipping container: "Cargo Aircraft Only" and DOT label such as: "Flammable Liquid" (or "Flammable Solid"). "Dangerous When Wet" label shall be used if the Flammable Solid has not been exposed to a wet environment. "Laboratory Samples" and "THIS SIDE UP" or "THIS END UP" shall also be marked on the top of the outside container, and upward-pointing arrows shall be placed on all four sides of the container.

5.4.3.3 Shipping Papers

1. Use abbreviations only where specified. Complete the carrier-provided bill of lading and sign certification statement. Provide the following information in the order listed (one form may be used for more than one exterior container):

- Proper shipping name. (Example: "Flammable Liquid, n.o.s. UN1993" or "Flammable Solid, n.o.s. UN1325 Packing Group I, II, III").

- "Limited Quantity" (or "Ltd. Qty."). (See No. 3, below.)

- "Cargo Aircraft Only."

- Net weight (wt) or net volume (vol), just before or just after "Flammable Liquid, n.o.s." or "Flammable Solid, n.o.s.," by item, if more than one metal can is inside an exterior container.

- "Laboratory Samples" (if applicable).

2. Include Chain-of-Custody Record, properly executed in outside container; use custody seals.

3. "Limited Quantity" means the maximum amount of a hazardous material for which there is a specific labeling or packaging exception (DOT CFR 49 171.8). This may mean that packages are exempted from labeling requirements. To determine if your sample meets the Limited Quantity Exception, refer to DOT Regulation CFR 49 Subpart C 173.50 through 173.156. First, determine the proper classification and shipping name for the material; then refer to the exception requirements for that particular class of material beginning with 173.50.

   Example: "Flammable Liquid n.o.s. UN1993 Packing Group 1." The outer package can weigh no more than 66 pounds gross weight. The inner package or container can weigh no more than 0.1 gallon net capacity for each container.

   To determine whether the material can be shipped as a "Limited Quantity," you must check the specific requirement for that class of material.

5.4.3.4 Transportation

1. The majority of unknown hazardous substance samples will be classified as flammable liquids. The samples will be transported by rented or common carrier truck, railroad, or express overnight package services. Do not transport samples on any passenger-carrying air transport system, even if the system has cargo-only aircraft. DOT regulations permit regular airline cargo-only aircraft, but difficulties with most suggest avoiding them. Instead, ship by airline carriers that carry only cargo. If unsure of what mode of transportation to use, consult the FOL or Project Manager.[1]

2. For transport by government-owned vehicle, including aircraft, DOT regulations do not apply. However, procedures described above, with the exception of execution of the bill of lading with certification, shall still be followed.

3. Use the hazardous materials shipping check list (Attachment E) as a guidance to ensure that all sample-handling requirements are satisfied.

4. In some cases, various materials may react if they break during shipment. To determine if you are shipping such materials, refer to the DOT compatibility chart in Attachment F.

5.5 Shipment of Lithium Batteries

Monitoring well data are analyzed using either the Hermit SE 1000 or the Hermit SE 2000 environmental data logger. These instruments are powered by lithium batteries. The Department of Transportation has determined that lithium batteries are a hazardous material and are to be shipped using the following information:

---

[1] Note: If you are unsure as how to ship the sample (hazardous or environmental sample), contact the FOL or Project Manager so that a decision can be made as to the proper shipping practices. The DOT penalties for improper shipment of a hazardous material are stringent and may include a prison term for intentional violations.

- Product Designation
  - Hermit SE 1000
  - Hermit SE 2000

- DOT Proper Shipping Name
  - Lithium batteries, contained in equipment, UN3091

- Classification or Division
  - Class 9

Shipment of equipment containing lithium batteries must be accompanied by shipping papers completed as indicated in Attachment G. The instrument will be shipped by Federal Express as a Hazardous Material. Place the instrument in the same container in which it was received. This container or case is a DOT-approved shipping container. For Federal Express procedures to ship hazardous materials, call 1-800-238-5355, extension 922-1666. In most cases, the return shipping papers and DOT labels will be shipped to you from the company warehouse or the vendor. An example of the types of labels used for shipment and the wording are shown in Attachment G. These labels will be attached to the outside container with the following wording:

- Lithium Batteries Contained in Equipment
  - UN-3091
  - Shipped Under CA-9206009

6.0 REFERENCES

American Public Health Association, 1981. Standard Methods for the Examination of Water and Wastewater, 15th Edition. APHA, Washington, D.C.

U.S. Department of Transportation, 1993. Hazardous Materials Regulations, 49 CFR 171-177.

U.S. EPA, 1984. "Guidelines Establishing Test Procedures for the Analysis of Pollutants under Clean Water Act." Federal Register, Volume 49 (209), October 26, 1984, p. 43234.

U.S. EPA, 1979. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020, U.S. EPA-EMSL, Cincinnati, Ohio.

ATTACHMENT A

GENERAL SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Sample Type and Concentration		Container[1]	Sample Size	Preservation[2]	Holding Time[2]
WATER					
Organics (GC&GC/MS)	VOC Low	Borosilicate glass	2 x 40 mL	Cool to 4°C HCl to ≤ 2	14 days[8]
	Extractables (Low SVOCs and pesticide/PCBs)	Amber glass	2x2 L or 4x1 L	Cool to 4°C	7 days to extraction; 40 days after extraction
	Extractables (Medium SVOCs and pesticide/PCBs)	Amber glass	2x2 L or 4x1 L	None	7 days to extraction; 40 days after extraction
Inorganics	Metals Low	High-density polyethylene	1 L	HNO_3 to pH ≤2	6 months (Hg-28 days)
	Medium	Wide-mouth glass	16 oz.	None	6 months
	Cyanide Low	High-density polyethylene	1 L	NaOH to pH>12	14 days
	Cyanide Medium	Wide-mouth glass	16 oz.	None	14 days
Organic/ Inorganic	High Hazard	Wide-mouth glass	8 oz.	None	14 days
SOIL					
Organics (GC&GC/MS)	VOC	Wide-mouth glass with teflon liner	2 x 4 oz.	Cool to 4°C	14 days
	Extractables (Low SVOCs and pesticides/PCBs)	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
	Extractables (Medium SVOCs and pesticides/PCBs)	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
Inorganics	Low/Medium	Wide-mouth glass	8 oz.	Cool to 4°C	6 months (Hg - 28 days) Cyanide (14 days)
Organic/ Inorganic	High Hazard	Wide-mouth glass	8 oz.	None	NA
Dioxin/Furan	All	Wide-mouth glass	4 oz.	None	7 days until extraction; 40 days after extraction
TCLP	All	Wide-mouth glass	8 oz.	None	7 days until preparation; analysis as per fraction
AIR					
Volatile Organics	Low/Medium	Charcoal tube – 7 cm long, 6 mm OD, 4 mm ID	100 L air	Cool to 4°C	5 days recommended

(1) All glass containers should have Teflon cap liners or septa.
(2) See Attachment E. Preservation and maximum holding time allowances per 40 CFR 136.

ATTACHMENT B

ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter Number/Name	Container(1)	Preservation(2)(3)	Maximum Holding Time(4)
INORGANIC TESTS:			
Acidity	P, G	Cool, 4°C	14 days
Alkalinity	P, G	Cool, 4°C	14 days
Ammonia - Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Biochemical Oxygen Demand (BOD)	P, G	Cool, 4°C	48 hours
Bromide	P, G	None required	28 days
Chemical Oxygen Demand (COD)	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Chloride	P, G	None required	28 days
Chlorine, Total Residual	P, G	None required	Analyze immediately
Color	P, G	Cool, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination	P, G	Cool, 4°C; NaOH to pH 12; 0.6 g ascorbic acid(5)	14 days(6)
Fluoride	P	None required	28 days
Hardness	P, G	HNO_3 to pH 2; H_2SO_4 to pH 2	6 months
Total Kjeldahl and Organic Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Nitrate - Nitrogen	P, G	None required	48 hours
Nitrate-Nitrite - Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Nitrite - Nitrogen	P, G	Cool, 4°C	48 hours
Oil & Grease	G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Total Organic Carbon (TOC)	P, G	Cool, 4°C; HCl or H_2SO_4 to pH 2	28 days
Orthophosphate	P, G	Filter immediately; Cool, 4°C	48 hours
Oxygen, Dissolved-Probe	G Bottle & top	None required	Analyze immediately
Oxygen, Dissolved-Winkler	G Bottle & top	Fix on site and store in dark	8 hours
Phenols	G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Phosphorus, Total	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Residue, Total	P, G	Cool, 4°C	7 days
Residue, Filterable (TDS)	P, G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS)	P, G	Cool, 4°C	7 days
Residue, Settleable	P, G	Cool, 4°C	48 hours
Residue, Volatile (Ash Content)	P, G	Cool, 4°C	7 days
Silica	P	Cool, 4°C	28 days
Specific Conductance	P, G	Cool, 4°C	28 days
Sulfate	P, G	Cool, 4°C	28 days

ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
PAGE TWO

Parameter Number/Name	Container(1)	Preservation(2)(3)	Maximum Holding Time(4)
INORGANIC TESTS (Cont'd):			
Sulfide	P, G	Cool, 4°C; add zinc acetate plus sodium hydroxide to pH 9	7 days
Sulfite	P, G	None required	Analyze immediately
Turbidity	P, G	Cool, 4°C	48 hours
METALS:(7)			
Chromium VI (Hexachrome)	P, G	Cool, 4°C	24 hours
Mercury (Hg)	P, G	HNO_3 to pH 2	28 days
Metals, except Chromium VI and Mercury	P, G	HNO_3 to pH 2	6 months
ORGANIC TESTS:(8)			
Purgeable Halocarbons	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$(5)	14 days
Purgeable Aromatic Hydrocarbons	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$(5) HCl to pH 2 (9)	14 days
Acrolein and Acrylonitrile	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$(5) adjust pH to 4-5 (10)	14 days
Phenols(11)	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction
Benzidines(11), (12)	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$(5)	7 days until extraction(13)
Phthalate esters(11)	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
Nitrosamines(11), (14)	G, Teflon-lined cap	Cool, 4°C; store in dark; 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction
PCBs(11)	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
Nitroaromatics & Isophorone(11)	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$(5); store in dark	7 days until extraction; 40 days after extraction
Polynuclear Aromatic Hydrocarbons (PAHs)(11),(14)	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$(5); store in dark	7 days until extraction; 40 days after extraction
Haloethers(11)	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction
Dioxin/Furan (TCDD/TCDF)(11)	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction

ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
PAGE THREE

Parameter Number/Name	Container(1)	Preservation(2)(3)	Maximum Holding Time(4)
RADIOLOGICAL TESTS:			
1-5 Alpha, beta and radium	P, G	HNO_3 to pH 2	6 months

(1) Polyethylene (P): generally 500 ml or Glass (G): generally 1L.
(2) Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
(3) When any sample is to be shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172).
(4) Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer periods, and has received a variance from the Regional Administrator.
(5) Should only be used in the presence of residual chlorine.
(6) Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustments are made to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.
(7) Samples should be filtered immediately on site before adding preservative for dissolved metals.
(8) Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.
(9) Sample receiving no pH adjustment must be analyzed within 7 days of sampling.
(10) The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.
(11) When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re: the requirement for thiosulfate reduction of residual chlorine) and footnotes 12, 13 (re: the analysis of benzidine).
(12) If 1,2-diphenylthydrazine is likely to be present, adjust the pH of the sample to 4.0±0.2 to prevent rearrangement to benzidine.
(13) Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.
(14) For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.
(15) The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

ATTACHMENT C

DOT HAZARDOUS MATERIAL CLASSIFICATION
(49 CFR 173.2a)

1. Radioactive material (except a limited quantity)
2. Division 2.3, Poisonous Gases
3. Division 2.1, Flammable Gas
4. Division 2.2, Nonflammable gas
5. Division 6.1, Poisonous Liquids, Packing Group 1 (poison by inhalation only)
6. Division 4.2, Pyrophoric Material
7. Division 4.1, Self-Reactive Material
8. Class 3, Flammable Liquids*
9. Class 8, Corrosive Material
10. Division 4.1, Flammable Solid*
11. Division 4.2, Spontaneously Combustible Materials*
12. Division 4.3, Dangerous When Wet Materials*
13. Division 5.1, Oxidizers*
14. Division 6.1, Poisonous Liquids or Solids (other than Packing Group 1)*
15. Combustible liquid
16. Class 9, Miscellaneous Hazardous Materials

* If a material has or meets the criteria for more than one hazard class, use the precedence of hazardous table on the following page for Classes 3 and 8 and Divisions 4.1, 4.2, 4.3, 5.1, and 6.1. The following table ranks those materials that meet the definition of Classes 3 and 8 and Divisions 4.1, 4.2, 4.3, 5.1, and 6.1.

ATTACHMENT C (Continued)

PRECEDENCE OF HAZARD TABLE

(Hazard Class and Packing Group)

Class	Packing Group	4.2	4.3	5.1 I[a]	5.1 II[a]	5.1 III[a]	6.1 I (Dermal)	6.1 I (Oral)	6.1 II	6.1 III	8 I (Liquid)	8 I (Solid)	8 II (Liquid)	8 II (Solid)	8 III (Liquid)	8 III (Solid)
3	I						3	3	3	3	3	[c]	3	[c]	3	[c]
3	II						3	3	3	3	8	[c]	3	[c]	3	[c]
3	III						6.1	6.1	6.1	3[d]	8	[c]	8	[c]	3	[c]
4.1	II[b]	4.2	4.3	5.1	4.1	4.1	6.1	6.1	4.1	4.1	[c]	8	[c]	4.1	[c]	4.1
4.1	III[b]	4.2	4.3	5.1	4.1	4.1	6.1	6.1	6.1	4.1	[c]	8	[c]	8	[c]	4.1
4.2	II		4.3	5.1	4.2	4.2	6.1	6.1	4.2	4.2	[c]	8	[c]	4.2	[c]	4.2
4.2	III		4.3	5.1	4.2	4.2	6.1	6.1	6.1	4.2	[c]	8	[c]	8	[c]	4.2
4.3	I			5.1	4.3	4.3	6.1	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
4.3	II			5.1	4.3	4.3	6.1	4.3	4.3	4.3	8	8	8	4.3	4.3	4.3
4.3	III			5.1	4.3	4.3	6.1	6.1	6.1	4.3	8	8	8	8	4.3	4.3
5.1	I[e]						5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
5.1	II[e]						6.1	5.1	5.1	5.1	8	8	8	5.1	5.1	5.1
5.1	III[e]						6.1	6.1	6.1	5.1	8	8	8	8	5.1	5.1
6.1	I, Dermal										8	6.1	6.1	6.1	6.1	6.1
6.1	I, Oral										8	6.1	6.1	6.1	6.1	6.1
6.1	II, Inhalation										8	6.1	6.1	6.1	6.1	6.1
6.1	II, Dermal										8	6.1	8	6.1	6.1	6.1
6.1	II, Oral										8	8	8	6.1	6.1	6.1
6.1	III										8	8	8	8	8	8

[a] There are at present no established criteria for determining Packing Groups for liquids in Division 5.1. At present, the degree of hazard is to be assessed by analogy with listed substances, allocating the substances to Packing Group I, Great; Group II, Medium; or Group III, Minor Danger.

[b] Substances of Division 4.1 other than self-reactive substances.

[c] Denotes an impossible combination.

[d] For pesticides only, where a material has the hazards of Class 3, Packing Group III, and Division 6.1, Packing Group III, the primary hazard is Division 6.1, Packing Group III.

ATTACHMENT D

GUIDE FOR HAZARDOUS MATERIALS SHIPPERS

USE OF GUIDE - This guide is presented as an aid to shippers of hazardous materials. It does not contain or refer to all of the DOT requirements for shipping hazardous materials. For specific details, refer to all of the DOT requirements for shipping hazardous materials, as provided in the Code of Federal Regulations (CFR), Title 49, Transportation, Parts 100-199.

The following is offered as a step-by-step procedure to aid in compliance with the applicable DOT regulations.

STEP 1 - DETERMINE THE PROPER SHIPPING NAME. The shipper must determine the proper shipping name of the materials as listed in the Hazardous Materials Table, 49 CFR 172.101, Column (2).

STEP 2 - DETERMINE THE HAZARD CLASS OR CLASSES.

a. Refer to the Table, 49 CFR 172.101, Column (3), and locate the hazard class of the material.
b. If more than one class is shown for the proper shipping name, determine the proper class by definition.
c. If the materials have more than one hazard, classify the material based on the order of hazards in 49 CFR 173.2.

STEP 3 - SELECT THE PROPER IDENTIFICATION NUMBERS.

a. Refer to the Table, 49 CFR 172.101, Column (3a), and select the Identification Number (ID) that corresponds to the proper shipping name and hazard class.
b. Enter the ID number(s) on the shipping papers and display them, as required, on packagings, placards and/or orange panels.

STEP 4 - DETERMINE THE MODE(S) OF TRANSPORT TO ULTIMATE DESTINATION.

a. As a shipper, you must assure yourself that the shipment complies with various modal requirements.
b. The modal requirements may affect the following: (1) Packaging; (2) Quantity per Package; (3) Marking; (4) Labeling; (5) Shipping Papers; and (6) Certification.

STEP 5 - SELECT THE PROPER LABEL(S) AND APPLY AS REQUIRED.

a. Refer to the Table, 49 CFR 172.101, Column (4) for required labels.
b. For details on labeling refer to (1) Additional Labels, 49 CFR 172.402; (2) Placement of Labels, 49 CFR 172.406; (3) Packagings (Mixed or Consolidated), 49 CFR 172.404(a) and (h); (4) Packages Containing Samples, 49 CFR 172.402(h); (5) Radioactive Materials, 49 CFR 172.403; and (6) Authorized Label Modifications, 49 CFR 172.405.

STEP 6 - DETERMINE AND SELECT THE PROPER PACKAGES.

a. Refer to the Table, 49 CFR 172.101, Column (5a) for exceptions and Column (5b) for specification packagings. Consider the following when selecting an authorized package: Quantity per Package; Cushioning Material, if required; Proper Closure and Reinforcement; Proper Pressure; Outage; etc., as required.
b. If packaged by a prior shipper, make sure the packaging is correct and in proper condition for transportation.

ATTACHMENT D (Continued)
GUIDE FOR HAZARDOUS MATERIALS SHIPPERS

STEP 7 - MARK THE PACKAGING (INCLUDING OVERPACKS).

a. Apply the required markings (49 CFR 172.300); Proper shipping name and ID number, when required (49 CFR 172.301); Name and address of Consignee or Consignor (49 CFR 172.306).
b. For details and other required markings, see 49 CFR 172.300 through 172.338.

STEP 8 - PREPARE THE SHIPPING PAPERS.

a. The basic requirements for preparing shipping papers include Proper Shipping Name; Hazard Class; ID Number; Total Quantity; Shipper's Certification; and Emergency Response Telephone Number.
b. Make all entries on the shipping papers using the information required and in proper sequence (49 CFR 172.202).

STEP 9 - CERTIFICATION.

a. Each shipper must certify by printing (manually or mechanically) on the shipping papers that the materials being offered for shipment are properly classified, described, packaged, marked and labeled, and in proper condition for transportation according to the applicable DOT Regulations (49 CFR 172.202).

STEP 10 - LOADING, BLOCKING, AND BRACING. When hazardous materials are loaded into the transport vehicle or freight container, each package must be loaded, blocked, and braced in accordance with the requirements for mode of transport.

a. If the shipper loads the freight container or transport vehicle, the shipper is responsible for the proper loading, blocking, and bracing of the materials.
b. If the carrier does the loading, the carrier is responsible.

STEP 11 - DETERMINE THE PROPER PLACARD(S). Each person who offers hazardous materials for transportation must determine that the placarding requirements have been met.

a. For Highway, unless the vehicle is already correctly placarded, the shipper must provide the required placard(s) and required ID number(s) (49 CFR 172.506).
b. For Rail, if loaded by the shipper, the shipper must placard the rail car if placards are required (49 CFR 172.508).
c. For Air and Water shipments, the shipper has the responsibility to apply the proper placards.

STEP 12 - HAZARDOUS WASTE/HAZARDOUS SUBSTANCE.

a. If the material is classed as a hazardous waste or hazardous substance, most of the above steps will be applicable.
b. Pertinent Environmental Protection Agency regulations are found in the Code of Federal Regulations, Title 40, Part 262.

As a final check and before offering the shipment for transportation, visually inspect your shipment. The shipper should ensure that emergency response information is on the vehicle for transportation of hazardous materials.

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Revised March 1995.

ATTACHMENT E

HAZARDOUS MATERIALS SHIPPING CHECK LIST

PACKAGING

1. Check DOT 173.24 for appropriate type of package for hazardous substance.
2. Check for container integrity, especially the closure.
3. Check for sufficient absorbent material in package.
4. Check for sample tags and log sheets for each sample and for chain-of-custody record.

SHIPPING PAPERS

1. Check that entries contain only approved DOT abbreviations.
2. Check that entries are in English.
3. Check that hazardous material entries are specially marked to differentiate them from any nonhazardous materials being sent using same shipping paper.
4. Be careful that all hazardous classes are shown for multiclass materials.
5. Check total amounts by weight, quantity, or other measures used.
6. Check that any limited-quantity exemptions are so designated on the shipping paper.
7. Check that certification is signed by shipper.
8. Make certain driver signs for shipment.

RCRA MANIFEST

1. Check that approved state/federal manifests are prepared.
2. Check that transporter has the following: valid EPA identification number, valid driver's license, valid vehicle registration, insurance protection, and proper DOT labels for materials being shipped.
3. Check that destination address is correct.
4. Check that driver knows where shipment is going.
5. Check that the driver is aware of emergency procedures for spills and accidents.
6. Make certain driver signs for shipment.
7. Make certain one copy of executed manifest and shipping document is retained by shipper.

ATTACHMENT F

DOT SEGREGATION AND SEPARATION CHART

Class or Division	Notes	1.1-1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3 gas Zone A*	2.3 gas Zone B*	3	4.1	4.2	4.3	5.1	5.2	6.1 liquids PG-I Zone A*	7	8 liquids only
Explosives ..... 1.1 and 1.2	A	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X
Explosives 1.3		*	*	*	*	*	X		X	X	X		X	X	X	X	X		X
Explosives 1.4		*	*	*	*	*	O		O	O	O		O				O		O
Very insensitive explosives 1.5	A	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X
Extremely insensitive explosives 1.6		*	*	*	*	*													
Flammable gases 2.1		X	X	O	X				X	O							O	O	
Non-toxic, non-flammable gases 2.2		X			X														
Poisonous gas - Zone A** 2.3		X	X	O	X		X				X	X	X	X	X	X			X
Poisonous gas - Zone B** 2.3		X	X	O	X		O				O	O	O	O	O	O			O
Flammable liquids 3		X	X	O	X				X	O					O		X		
Flammable solids 4.1		X			X				X	O							X		O
Spontaneously combustible materials 4.2		X	X	O	X				X	O							X		X
Dangerous-when-wet materials 4.3		X	X		X				X	O							X		O
Oxidizers 5.1	A	X	X		X				X	O	O						X		O
Organic peroxides 5.2		X	X		X				X	O							X		O
Poisonous liquids PG I - Zone A** .. 6.1		X	X	O	X		O				X	X	X	X	X	X			X
Radioactive materials 7		X			X		O												
Corrosive liquids 8		X	X	O	X				X	O		O	X	O	O	O	X		

No entry means that the materials are compatible (have no restrictions).

X These materials may not be loaded, transported, or stored together in the same vehicle or facility.
O The materials may not be loaded, transported, or stored together in the same vehicle or facility unless they are separated for 4 feet on all sides.
* Check the explosives compatibility chart in 49 CFR 179.848(f).
A Ammonium nitrate fertilizers may be stored with Division 1.1 materials.
** Denotes inhalation hazardous for poisons; consult field team leader or project manager if you encounter a material in this class before shipment.

ATTACHMENT G
LITHIUM BATTERY SHIPPING PAPERS

3224637861

Two completed and signed copies of this Declaration must be handed to the operator.

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

TRANSPORT DETAILS

This shipment is within the limitations prescribed for: *(delete non-applicable)*

[redacted] | CARGO AIRCRAFT ONLY

Airport of Departure:

Airport of Destination:
19CYS

Shipment type: *(delete non-applicable)*

NON-RADIOACTIVE | [redacted]

NATURE AND QUANTITY OF DANGEROUS GOODS

Dangerous Goods Identification						
Proper Shipping Name	Class or Division	UN or ID No.	Subsidiary Risk	Quantity and type of packing	Packing Inst.	Authorization
LITHIUM BATTERIES CONTAINED IN EQUIPMENT	9	UN3091		1 PLASTIC BOX X 55 GRAMS	912 II	PER CA-9206009

Additional Handling Information

1 HERMIT SERIES DATALOGGER X 55 GRAMS (11 GRAMS/CELL)

I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in the proper condition for transport by air according to the applicable International and National Government Regulations.

Name/Title of Signatory

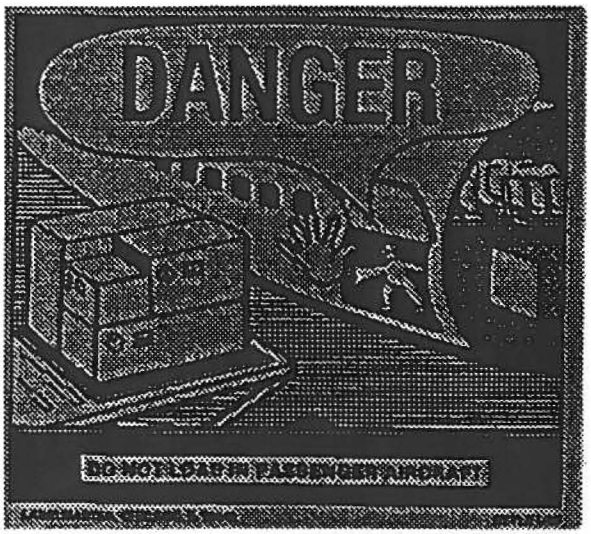
Place and Date

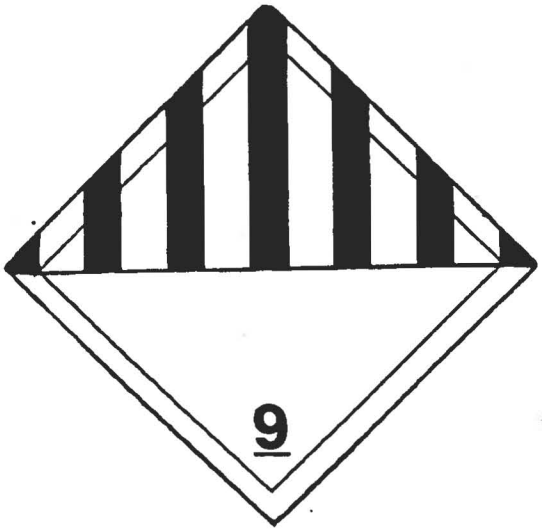
Signature
(see warning above)

Emergency Telephone Number (Required for US Origin or Destination Shipments)
800-535-5053

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.

ATTACHMENT G (CONTINUED)
LITHIUM BATTERY SHIPPING PAPERS





LITHIUM BATTERIES CONTAINED IN EQUIPMENT.
UN-3091.
SHIPPED UNDER CA-9206009

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1.0 PURPOSE

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

2.0 SCOPE

Documents presented within this procedure (or equivalents) shall be used for all Brown & Root Environmental field activities, as applicable. Other or additional documents may be required by specific client contracts.

3.0 GLOSSARY

None

4.0 RESPONSIBILITIES

Project Manager - 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 forms used in site activities (i.e., records, field reports, and upon the completion of field work, the site logbook) in the project's central file.

Field Operations Leader (FOL) - The Field Operations Leader is responsible for ensuring that the site logbook, notebooks, and all appropriate 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 (daily) in the site logbook:

- All field personnel present
- Arrival/departure of site visitors
- Arrival/departure of equipment
- Start or completion of borehole/trench/monitoring well installation or sampling activities
- 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 Brown & Root Environmental 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
- Brown & Root Environmental 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 site 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 entries. The name of the photographer, date, time, site location, site description, and weather conditions must be entered in the logbook 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. If possible, such techniques shall be avoided, since they can adversely affect the admissibility of photographs as evidence. 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. Adequate logbook notation and receipts must be compiled to account for routine film processing. Once processed, the slides of photographic prints shall be consecutively numbered and labeled according to the logbook descriptions. The site photographs and associated negatives must be docketed into the project's central file.

5.2 Site Notebooks

Key field team personnel may maintain a separate dedicated 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 site notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a site 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 and Request for Analysis

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 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 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 part of the completed COC form is retained by the field crew while the other two or three portions are sent to the laboratory. The original (top, signed copy) and extra carbonless copies of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the first cooler. The COC form should then state how many coolers are included with that shipment. An example of a Chain-of-Custody Record form is provided as Attachment B-6. A supply of these forms are purchased and stocked by the field department of the various Brown & Root Environmental offices. Alternately, COC forms supplied by the laboratory may be used. 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 Brown & Root Environmental Project Manager). The COC form is signed and one of the remaining two parts are retained by the laboratory while the last part becomes part of the samples' corresponding analytical data package. Internal laboratory chain-of-custody procedures are documented in the Laboratory Quality Assurance Plan (LQAP).

5.3.1.4 Chain-of-Custody Seal

Attachment B-7 is an example of a custody seal. The Custody seal is also 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 transit 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.

5.3.2 Geohydrological 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 following well installation.

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 (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 or cuttings from the borehole (using HNU or OVA detectors), these results must be entered on the boring log (under the "Remarks" column) at the appropriate depth. The "Remarks" column can also be used to subsequently enter the laboratory sample number and the concentration of a few key analytical results. 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. The Monitoring Well Construction Details Form is not a controlled document.

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.

5.3.3 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 Weekly Status Reports

To facilitate timely review by project management, Xeroxed copies of logbook/notebook entries may be made for internal use. To provide timely oversight of onsite contractors, Daily Activities Reports are completed and submitted as described below.

It should be noted that in addition to the summaries described herein, other summary reports may also be contractually required.

5.4.2 Daily Activities Report

5.4.2.1 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).

5.4.2.2 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.

5.4.2.3 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.

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 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-8A	EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK (FLUSHMOUNT)
Attachment C-9	EXAMPLE TEST PIT LOG
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:

BROWN & ROOT ENV.	DRILLER	EPA
_____	_____	_____
_____	_____	_____
_____	_____	_____

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
EXAMPLE GROUNDWATER SAMPLE LOG SHEET

GROUNDWATER

SAMPLE LOG SHEET

Page ____ of ____

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

☐ Domestic Well Data
☐ Monitoring Well Data
☐ Other Well Type: _____ Sampled By: _____
☐ QA Sample Type: _____ C.O.C. No.: _____

Sampling Data

Date: / Time: / Method:	pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD	TBD

Purge Data

Date: / Method:	Volume	pH	S.C.	Temp.(°C)	Turbidity	Color	TBD	TBD
	Initial							
Monitor Reading (ppm):	1							
Well Casing Dia. & Material Type:	2							
	3							
Total Well Depth (TD):	4							
Static Water Level (WL):	5							
TD-WL (ft.) =								
One Casing Volume: (gal/L)								
Start Purge (hrs.):								
End Purge (hrs.):								
Total Purge Time (min):								
Total Amount Purged (gal/L):								

Analyses	Preservative	Container Requirements	Collected (✓)

Observations/Notes:

Circle if Applicable: MS/MSD | Duplicate ID No:

Signature(s):

TBD: To Be Determined

ATTACHMENT B-2
EXAMPLE SURFACE WATER SAMPLING LOG SHEET

SURFACE WATER SAMPLING LOG SHEET

Page ___ of ___

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

☐ Spring ☐ Pond Sampled By: _____

☐ Stream ☐ Lake

☐ Other _____

☐ QA Sample Type: _____ C.O.C. No.: _____

Sample Data		
Date and Time	Method	Depth

pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD	TBD

Analysis	Preservative	Container Requirements	Collected (✓)

Observations/Notes:

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

TBD: To Be Determined

ATTACHMENT B-3
EXAMPLE SOIL/SEDIMENT SINGLE SAMPLE LOG SHEET

SOIL/SEDIMENT
SINGLE SAMPLE LOG SHEET

Page ___ of ___

Project Site Name: _____ **Sample ID No.:** _____

Project No.: _____ **Sample Location:** _____

☐ Surface Soil
☐ Subsurface Soil
☐ Sediment
☐ Other _____
☐ QA Sample Type: _____

Sampled By: _____

C.O.C. No.: _____

Sample Method:	Sample	Time	Color/Description
Depth Sampled:			
Sample Date and Time:			
Type of Sample ☐ Grab ☐ Composite ☐ Grab-Composite ☐ High Concentration ☐ Low Concentration			

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)

			Map:

Observations/Notes:

QA/QC If Applicable		Signature(s):
MS/MSD	Duplicate ID No:	

ATTACHMENT B-4
CONTAINER SAMPLE LOG SHEET FORM

Brown & Root Environmental

Page ___ of _

☐ Container Data

Case #: _____

By: _____

Project Site Name: _____ Project Site No. _____

Brown & Root Env. Source No. _____ Source Location: _____

Container Source	Container Description
☐ Drum ☐ Bung Top ☐ Lever Lock ☐ Bolted Ring ☐ Other _____ _____ ☐ Bag/Sack ☐ Tank ☐ Other _____ _____	Color: _____ Condition: _____ Markings: _____ Vol. of Contents: _____ Other: _____

Disposition of Sample	Sample Description			
		Layer 1	Layer 2	Layer 3
☐ Container Sampled ☐ Container opened but not sampled. Reason: _____ _____ ☐ Container not opened. Reason: _____ _____	Phase Color Viscosity % of Total Volume Other	☐Sol. ☐Liq. _____ ☐L ☐M ☐H _____ _____	☐Sol. ☐Liq. _____ ☐L ☐M ☐H _____ _____	☐Sol. ☐Liq. _____ ☐L ☐M ☐H _____ _____

Monitor Reading:	Type of Sample
Sample Method:	☐ Low Concentration ☐ High Concentration ☐ Grab ☐ Composite ☐ Grab-composite

Sample Date & Time:	Sample Identification	Organic	Inorganic
Sampled by:			
Signature(s):			
	Date Shipped		
Analysis:	Time Shipped		
	Lab		
	Volume		

ATTACHMENT B-5

SAMPLE LABEL

Brown & Root Environmental PROJECT:_____

STATION LOCATION: _____

DATE: ____/____/_____ TIME: _____ hrs.

MEDIA: WATER ☐ SOIL ☐ SEDIMENT ☐ _____ ☐

CONCENTRATION: LOW ☐ MEDIUM ☐ HIGH ☐

TYPE: GRAB ☐ COMPOSITE ☐

ANALYSIS	PRESERVATION
VOA ☐ BNAs ☐ PCBs ☐ PESTICIDES ☐ METALS: TOTAL ☐ DISSOLVED ☐ CYANIDE ☐ _____ ☐	Cool to 4°C ☐ HNO_3 to pH < 2 ☐ NaOH to pH > 12 ☐ _____ ☐

Sampled by:_____

Remarks:

ATTACHMENT B-6

CHAIN-OF-CUSTODY RECORD FORM
(Original is 8.5 x 11")

PROJECT NO.	PROJECT NAME					NO. OF CONTAINERS							REMARKS
SAMPLERS: (Signature)													
STA NO.	DATE	TIME			STATION LOCATION								

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks:	

ATTACHMENT B-7

CHAIN-OF-CUSTODY SEAL

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

ATTACHMENT C-1
EXAMPLE GROUNDWATER LEVEL MEASUREMENT SHEET

GROUNDWATER LEVEL MEASUREMENT SHEET

Page ___ of ___

PROJECT NAME: _____ LOCATION: _____
PROJECT NUMBER: _____ MEASURING DEVICE: _____
PERSONNEL: _____ ADJUSTMENT FACTOR: _____
DATE: _____ REMARKS: _____
WEATHER CONDITIONS: _____

Well or Piezometer Number	Time	Elevation of Reference Point (Feet)*	Water Level Indicator Reading (Feet)*	Groundwater Elevation (Feet)*	Comments

*Measurements to nearest 0.01 foot.

Signature(s): _____

ATTACHMENT C-2
EXAMPLE PUMPING TEST DATA SHEET

PUMPING TEST DATA SHEET

Page ___ of ___

PROJECT NAME: _____
PROJECT NUMBER: _____
PUMPING TEST: [ ]
TEST NUMBER: _____
METHOD OF MEASUREMENT: _____
DATE(s): _____
STATIC H_2O LEVEL (ft) (SO) _____

PUMPING WELL NUMBER: _____
MEASURED WELL NUMBER: _____
STEP DRAW DOWN TEST [ ]
MONITORING POINT: _____
DEPTH CORRECTION (ft) _____
PUMP SETTING (Ft. below monitoring point): _____
DISTANCE FROM PUMPING WELL (ft) (r): _____

PUMPING TEST PERFORMED BY: _____
REMARKS: _____

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

SIGNATURE(s): _____

ATTACHMENT C-3

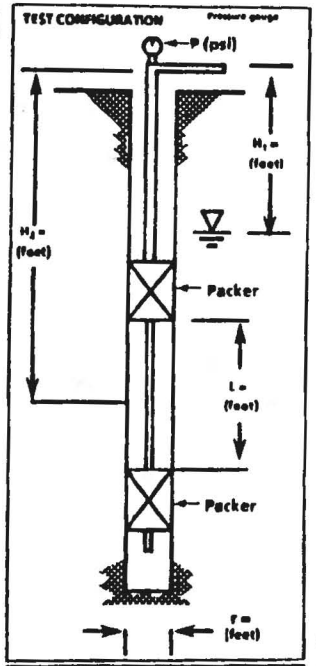
PACKER TEST REPORT FORM

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)	$H_2O(ft) = 2.31 \cdot (psi)$	H_2* (ft)	H = Hp + (H1 or H2)	Cp	K (ft/yr) = Cp·Q/H	K (cm/sec) = 9.67 x 10^{-3} · K (ft/yr)



Length or Test Increment in feet, ℓ	Cp — Drilling Bit Size			
	Tri (1 5/8")	AW (1 7/8")	BW (2 3/8")	NW (3")
1	31,000	28,100	25,000	21,100
3	12,400	10,100	10,000	11,100
5	9,000	9,100	8,000	8,100
8	6,000	6,100	6,100	5,000
10	5,700	5,000	5,000	4,900
15	4,100	3,900	3,800	3,600
20	3,200	3,100	3,000	2,000

CP = (1/(2 π L)) ln(L/r) (70,315 S)
7.48 Gallons = 1 Ft^3
1 psi = 2.31 ft head

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

Remarks: _____

Subject: FIELD DOCUMENTATION

Number: SA-6.3

Revision: 0

Effective Date: 03/01/96

Page: 19 of 32

ATTACHMENT C-4
EXAMPLE BORING LOG

BORING LOG

Page___ of___

PROJECT NAME: _____ BORING NUMBER: _____
PROJECT NUMBER: _____ DATE : _____
DRILLING COMPANY: _____ GEOLOGIST: _____
WATER LEVEL DATA: _____

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			USCS	Remarks	PID or FID Reading (ppm)
					Soil Density/ Consistency or Rock Hardness*	Color	Material Classification			

*When rock coring enter rock brokeness.

CONVERTED TO WELL : ___ Yes ___ No; WELL I.D.#: _____
REMARKS: _____

Signature(s): _____

LEGEND

SOIL TERMS

UNIFIED SOIL CLASSIFICATION (USCS)

COARSE-GRAINED SOILS — More Than Half of Material is LARGER Than No. 200 Sieve Size

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

FINE-GRAINED SOILS — More Than Half of Material is SMALLER Than No. 200 Sieve Size

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

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

DENSITY OF GRANULAR SOILS

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

CONSISTENCY OF COHESIVE SOILS

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

ROCK TERMS

ROCK HARDNESS (FROM CORE SAMPLES)

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

ROCK BROKENESS

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

LEGEND:

SOIL SAMPLES - TYPES

S-2" Split-Barrel Sample

ST-3" O.D. Undisturbed Sample

O - Other Samples, Specify in Remarks

ROCK SAMPLES - TYPES

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

Q-NQ (Wireline) Core (~1-7/8" O.D.)

Z - Other Core Sizes, Specify in Remarks

WATER LEVELS

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

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

Subject: FIELD DOCUMENTATION

Number: SA-6.3

Revision: 0

Effective Date: 03/01/96

Page: 21 of 32

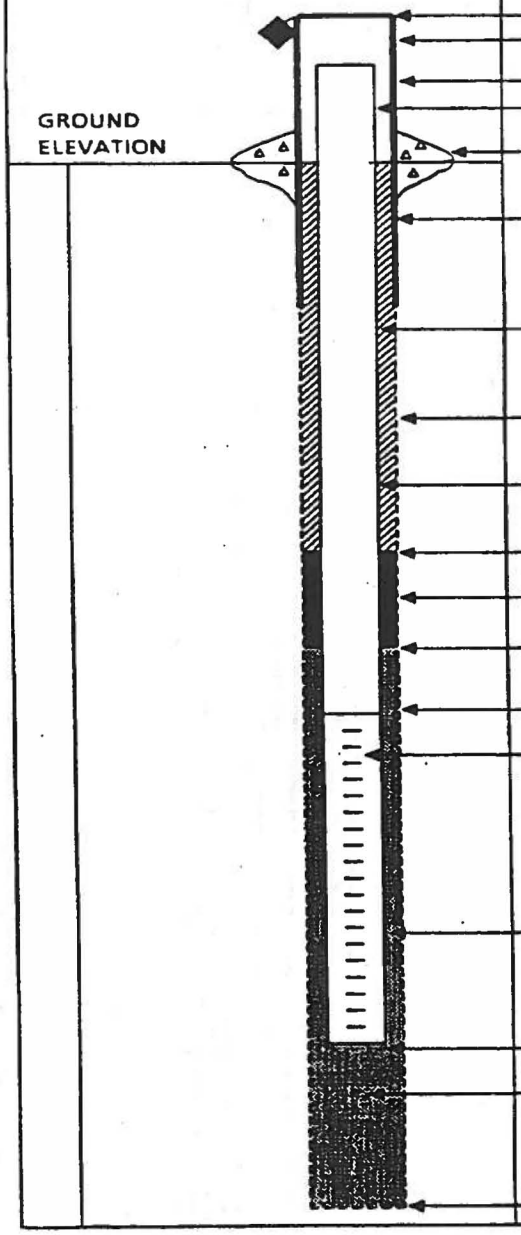
ATTACHMENT C-5
EXAMPLE OVERBURDEN MONITORING WELL SHEET

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: _____ /

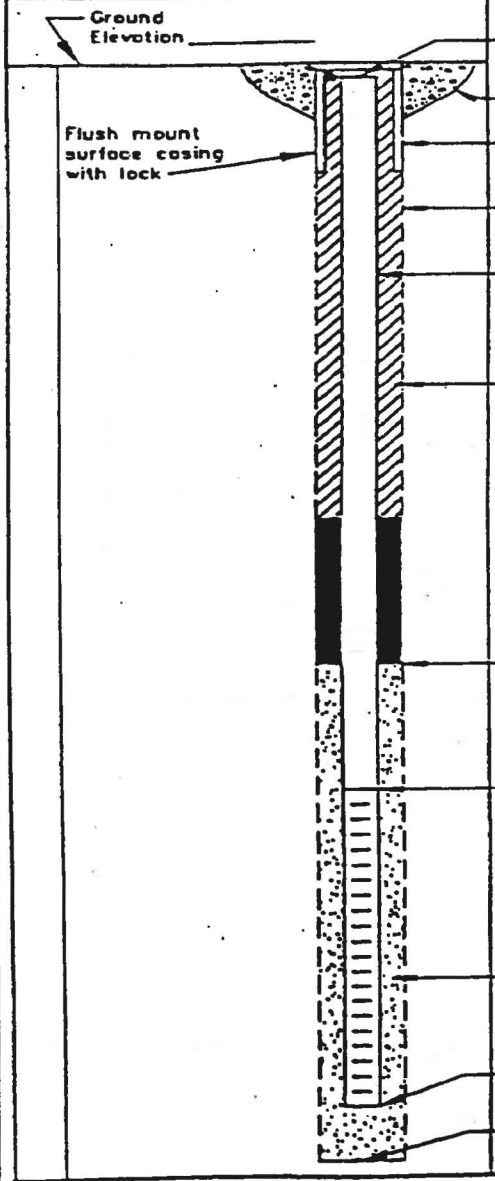
ATTACHMENT C-5A
EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)

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: _____

NOTES: [illegible]

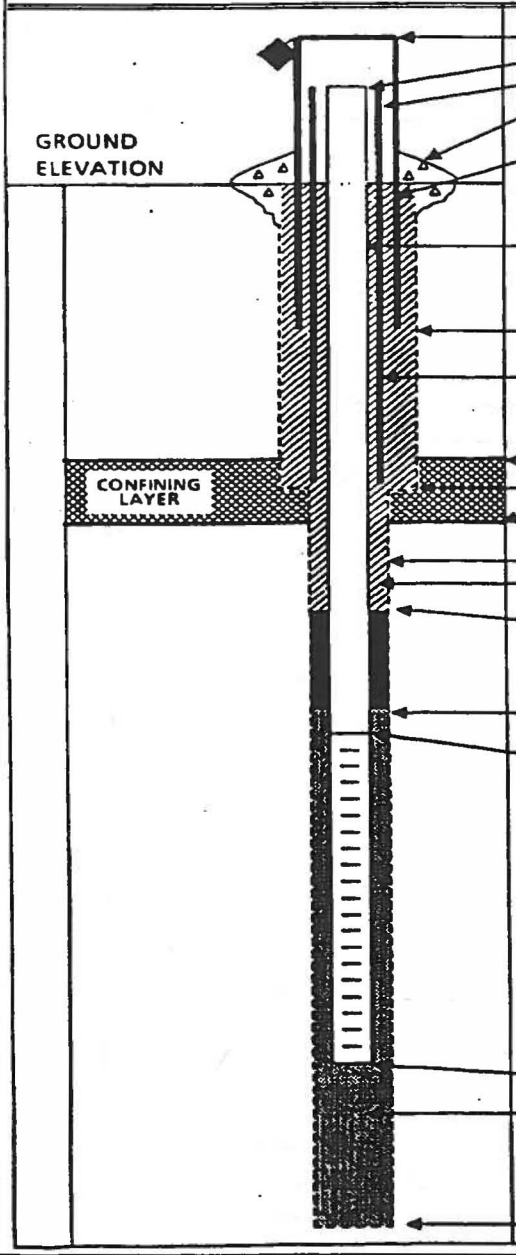
ATTACHMENT C-6
EXAMPLE CONFINING LAYER MONITORING WELL SHEET

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: _____

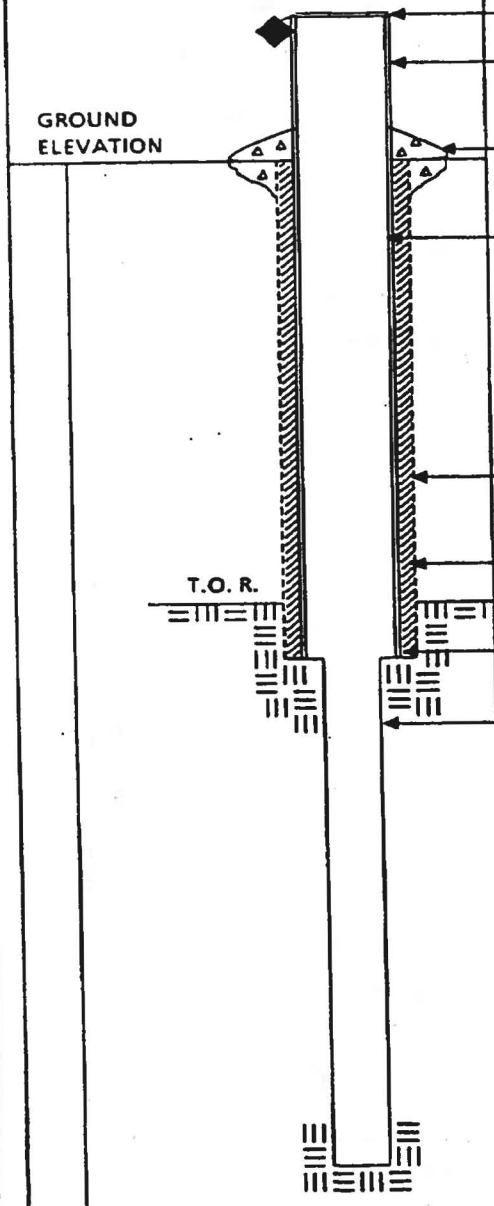
ATTACHMENT C-7
EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL

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: _____/_____

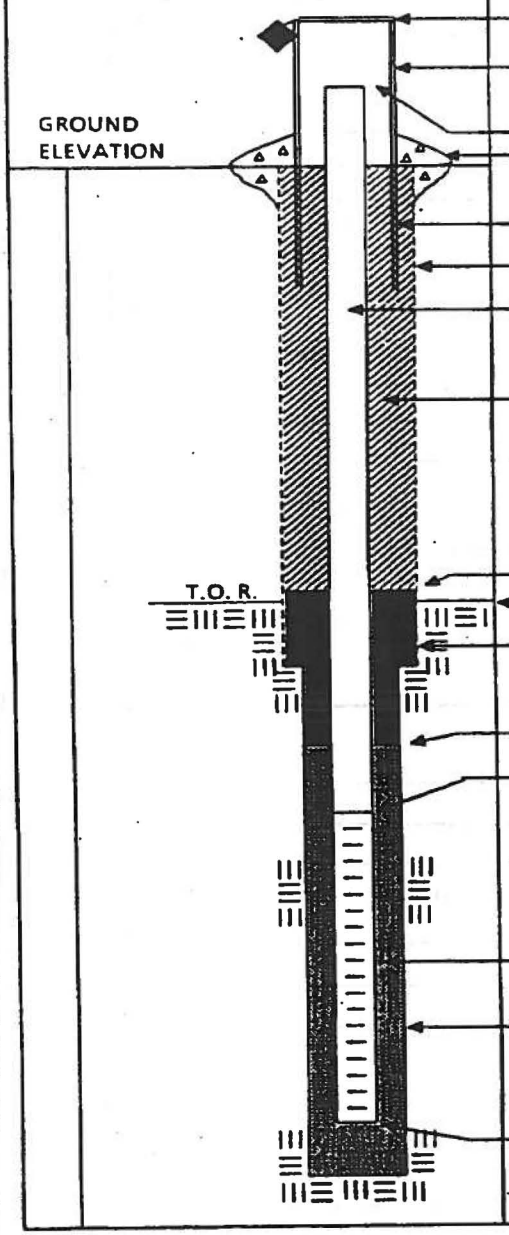
ATTACHMENT C-8
EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK

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: _____/_____

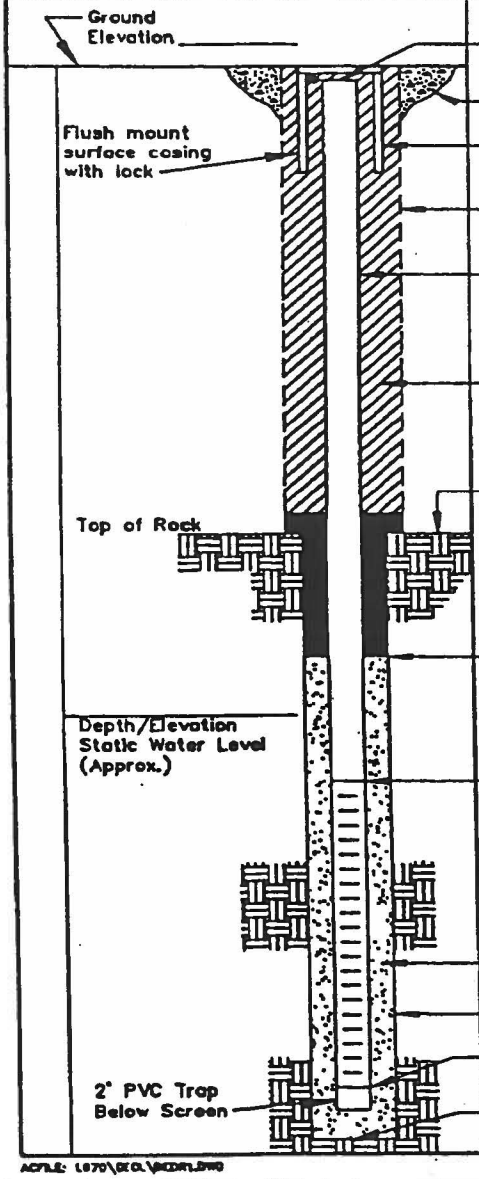
ELEVATION / DEPTH BOTTOM OF HOLE: _____/_____

ATTACHMENT C-8A
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: _____

ACAD: L:\670\GEO\MONWELL.DWG

ATTACHMENT C-9
EXAMPLE TEST PIT LOG

TEST PIT LOG

Brown & Root Environmental

PROJECT: _____ TEST PIT NO.:

PROJECT NO _____ DATE: _____

LOCATION: _____

FIELD GEOLOGIST: _____

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

Test Pit Cross Section and / or Plan View

REMARKS _____

PHOTO LOG _____ TEST PIT _____

PAGE ____ OF ____

ATTACHMENT D
EXAMPLE EQUIPMENT CALIBRATION LOG

Brown & Root Environmental

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME / MODEL : _____

MANUFACTURER : _____

JOB NAME : _____

JOB NUMBER : _____

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS

ATTACHMENT E
EXAMPLE DAILY ACTIVITIES RECORD

DAILY ACTIVITIES RECORD

Brown & Root Environmental

PROJECT _____ LOCATION _____
CLIENT _____ ARRIVAL TIME _____ JOB NO. _____
DATE _____ DEPARTURE TIME _____
CONTRACTOR _____ DRILLER _____
BORING NO. _____ HNUS REPRESENTATIVE _____

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

COMMENTS: _____

APPROVED BY:

_____ HNUS FIELD REPRESENTATIVE

_____ DRILLER OR REPRESENTATIVE

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 E

RELEASE REPORT

5090
Ser N4E2/ 0U110

26 AUG 1993

Mr. Ernest Frey
Northeast District
Florida Department of Environmental Protection
7825 Bay Meadows Way, Suite B-200
Jacksonville, FL 32256

Subj: DRY CLEANING FLUID SPILL

Dear Mr. Frey:

On May 4, 1993, while re-locating drums of tetrachloroethylene, a 55-gallon drum was punctured spilling 25-30 gallons of dry cleaning fluid. This spill occurred when the forklift operator was attempting to pick up a pallet of drums in the materials handling area beside Building 191A, Fleet and Industrial Supply Center Jacksonville, Fleet Support Center Mayport. The location of the spill is shown on the enclosed map. Our spill response team acted immediately to contain and remove the spill material from the concrete and spill samples were taken for analysis. Copies of the analysis results are enclosed.

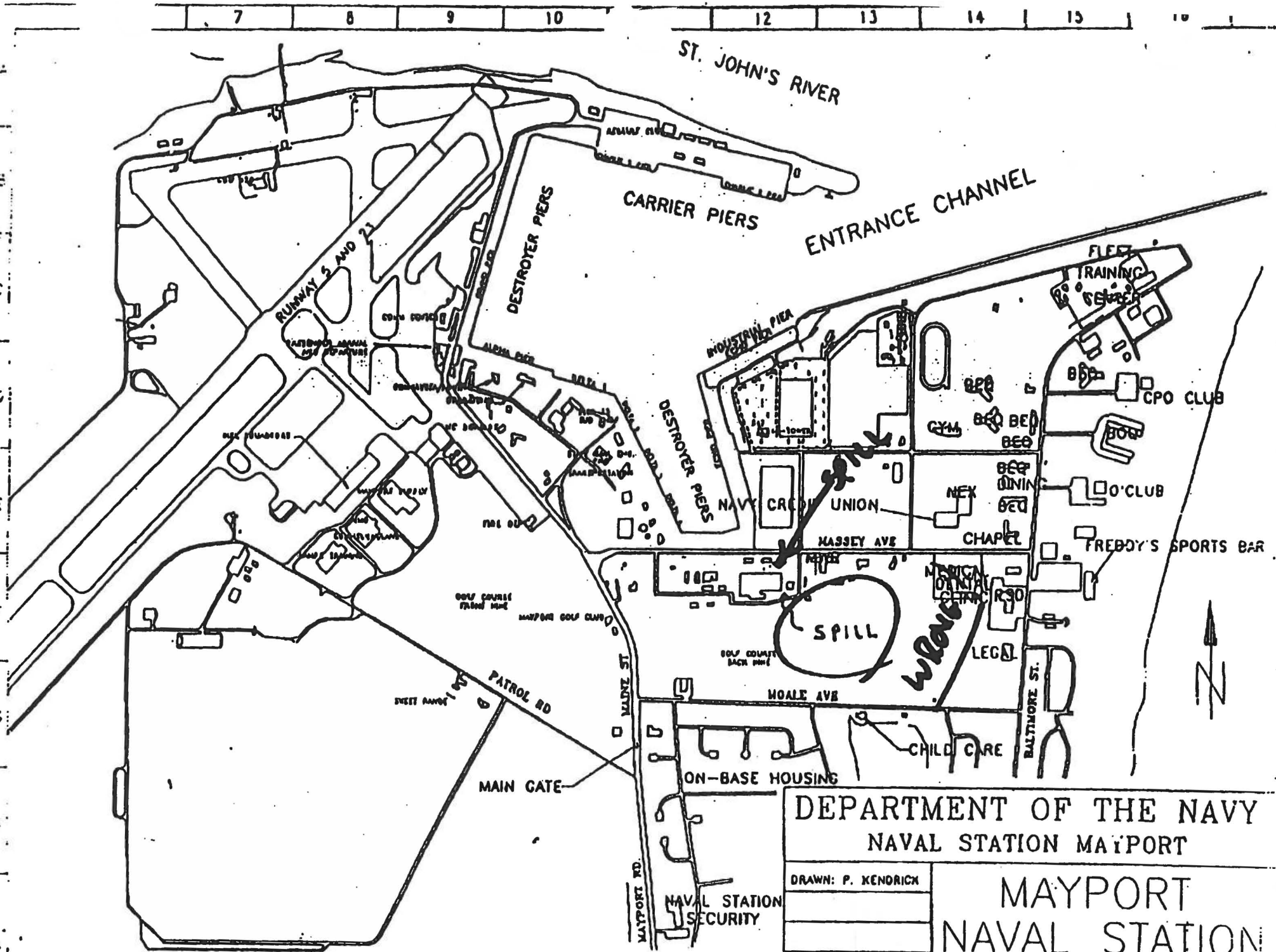
Please respond if there is any further action required by Naval Station Mayport. If you have any questions, please contact Mr. Michael Davenport, of my Environmental Staff, at (904) 270-6730.

Sincerely,

DOUGLAS P. TOMLINSON
Lieutenant Commander, CEC, U.S. Nav
Staff Civil Engineer
By direction of
the Commanding Officer

Encl:
(1) Site Map
(2) Analysis Results
93-06-188 and 93-06-189

Copy to:
FDEP Tallahassee (Mr. Eric Nuzie)
FDEP Northeast District (Mr. Kenton Brown)
FISC Jacksonville
FISC Jacksonville FSC Mayport
COMNAVAVNACTS Jacksonville (N3)
COMNAVAIRLANT (N442C)
bc: N4E Chron c:\wpdocs\Spill-TE.FIS/pl/8-11



DEPARTMENT OF THE NAVY
NAVAL STATION MAYPORT

DRAWN: P. KENDRICK	MAYPORT NAVAL STATION
FILE: SITE.DWG	
DRAWING NO. 91-000-005	NOT TO SCALE

FIRST COAST ENVIRONMENTAL LABORATORY, INC.

July 21, 1993

Client: Navy Public Work — Lab #: 9307-106-1

Sample I.D.: 93-06-186 — Date Received: 7-15-93

Sample Matrix: Solid — Date Completed: 7-19-93

Date Extraction: 7-16-93

Volatile Organic Compounds
Toxicity Characteristic Leaching Procedure SW-846 Method 1311
USEPA Method 8240 - GC/MS (8260)

Parameter	CAS #	Detection Limit(mg/L)	RESULT(mg/L)	Max. Cont. Level(mg/L)
Benzene	71-43-2	0.005	< 0.005	0.5
Carbon tetrachloride	56-23-5	0.005	< 0.005	0.5
Chlorobenzene	108-90-7	0.005	< 0.005	100.0
Chloroform	67-66-3	0.005	< 0.005	6.0
1,4-Dichlorobenzene	106-46-7	0.005	< 0.005	7.5
1,2-Dichloroethane	107-06-2	0.005	< 0.005	0.5
1,1-Dichloroethene	75-35-4	0.005	< 0.005	0.7
Methyl ethyl ketone	78-93-3	0.05	< 0.05	200.0
→ Tetrachloroethene	127-18-4	0.005	0.558	0.7
Trichloroethene	79-01-6	0.005	< 0.005	0.5
Vinyl chloride	75-01-4	0.005	< 0.005	0.2

SW-846 -- "Test Methods for Evaluating Solid Waste", Third Edition, November, 1986, and Revision 1, December, 1987, and 55 FR (61) 11862 - 11875.

Surrogate Standards Recovery Percentage

	Recovey %	Acceptance Limits
Toluene - d_8	95.8	86 - 110
4-Bromofluorobenzene	106.9	86 - 115
1,2 Dichlorobenzene - d_4	102.4	87 - 112

Respectfully submitted:

Barry C. Byrd Jr., MS
Technical Director

ECB/tb

FIRST COAST ENVIRONMENTAL LABORATORY, INC.

July 23, 1993

Client: Navy Public Works — Lab #: 9307-106-1

Sample I.C.: 93-06-188 — Date Received: 7-15-93

Sample Matrix: Solid — Date Completed: 7-22-93

Date Extraction 7-21-93

Analytical Report
TCLP - Contaminant List (Partial) Method 1311
Methods EPA 8250 (8270)

Parameter	Regulatory Level	Results mg/L
Cresols	200.0	ND *
2,4-Dinitrotoluene	0.13	ND *
Hexachlorobenzene	0.13	ND
Hexachlorobutadiene	0.5	ND
Hexachloroethane	3.0	ND
Nitrobenzene	2.0	ND
Pentachlorophenol	100.0	ND *
Pyridine	5.0	ND *
2,4,5-Trichlorophenol	400.0	ND *
2,4,6-Trichlorophenol	2.0	ND *

Note: ND = (None detected, lower detectable limit - 0.010 mg/L)
ND * = (None detected, lower detectable limit - 0.025 mg/L)
J = (Detected but below quantitive limit, quantition suspect)
B = (this compound also detected in the blank)

Respectfully submitted:

Barry C. Byrd, Jr., MS
Technical Director

BCB/tb

FIRST COAST ENVIRONMENTAL LABORATORY INC.

July 20, 1993

Client: Navy Public Works (93-06-188) Lab #: 9307-106-1

Sample I.D.: MYP1 Date Received: 7-15-93

Sample Matrix: Water Date Completed: 7-20-93

Metals Analytical Summary
Toxicity Characteristic Leaching Procedure SW-846 Method 1311

Parameter	SW-846 Method	CAS #	Detection Limit(mg/L)		RESULT(mg/L)	Max. Cont. Level(mg/L)
Arsenic	6010	7440-38-2	0.0394		0.053	5.0
Barium	6010	7440-39-3	0.00454		0.122	100.0
Cadmium	6010	7440-43-9	0.00836	<	0.00836	1.0
Chromium	6010	7440-47-3	0.0140		0.036	5.0
Lead	6010	7439-92-1	0.0600	<	0.060	5.0
Mercury	7470,1	7439-97-6	0.0000917		0.176	0.2
Selenium	6010	7782-49-2	0.0452		0.076	1.0
Silver	6010	7440-22-4	0.00414		0.008	5.0

SW-846 -- "Test Methods for Evaluating Solid Waste", Third Edition, November, 1986, and Revision 1, December, 1987, and 55 FR (61) 11862 - 11875.

Respectfully submitted,

Adolph W. Wollitz
Laboratory Director
FHRS Lab #E82102
FHRS Lab #82110
EPA #FL062
DER Comp QAPP # 870222G

AWW/tb

8318 Arlington Expressway
(904) 725-4847

July 21, 1993

Client: [illegible] Public Work Lab #: [illegible]

Sample I.D: 93-06-20 Date Received: 7-15-93

Sample Matrix: Soils Date Completed: 7-20-93

Date Extracted: 7-19-93

Volatile Organic Compounds
Toxicity Characteristic Leaching Procedure SW-846 Method 1311
USEPA Method 8240 - GC/MS (8260)

Parameter	CAS #	Detection Limit(mg/L)	RESULT(mg/L)	Max. Cont. Level(mg/L)
Benzene	71-43-	0.005	< 0.005	0.5
Carbon tetrachloride	56-23-	0.005	< 0.005	0.5
Chlorobenzene	108-90-	0.005	< 0.005	100.0
Chloroform	67-66-	0.005	< 0.005	6.0
1,4-Dichlorobenzene	106-46-7	0.005	< 0.005	7.5
1,2-Dichloroethane	107-06-	0.005	< 0.005	0.5
1,1-Dichloroethene	75-35-4	0.005	< 0.005	0.7
Methyl ethyl ketone	78-93-	0.05	< 0.05	200.0
Tetrachloroethene	127-18-	0.005	< 0.005	0.7
Trichloroethene	79-01-6	0.005	< 0.005	0.5
Vinyl chloride	75-01-4	0.005	< 0.005	0.2

SW-846 -- "Test Methods for Evaluating Solid Waste", Third Edition, November, 1986, and Revision 1, December, 1987, and 55 FR (61) 11862 - 11875.

Surrogate Standards Recovery Percentage

	Recovery %	Acceptance Limits
Toluene - d_8	1[illegible]	88 - 110
4-Bromofluorobenzene	10[illegible]	86 - 115
1,2 Dichlorobenzene - d_4	11[illegible]	87 - 112

Respectfully submitted,

Barry C. Byrd, Jr., MS
Technical Director

BCB/tb

FIRST COAST ENVIRONMENTAL ... INC.

Client:	Navy Public Works	Job #:	9307-106-2
Sample I.D.	93-06-182	Date Received:	7-15-93
Sample Matrix:	Solid	Date Completed:	7-22-93
		Date Extracted:	7-21-93

Analytical Report
TCLP Contaminant List (Partial) Method 1311
Methods EPA 8150 (8270)

Parameter	Regulatory Level	Results mg/L
Cresol	200.0	ND *
[illegible]	0.13	ND *
Hexachlorobenzene	0.13	ND
Hexachlorobutadiene	0.5	ND
Hexachloroethane	3.0	ND
Nitrobenzene	2.0	ND
Pentachlorophenol	100.0	ND *
Pyridine	5.0	ND *
[illegible]	400.0	ND *
[illegible]	2.0	ND *

Note ND = (None detected, lower detectable limit - 0.010 mg/l
ND * = (None detected, lower detectable limit - 0.025 mg/L
J = (Detected but below quantitive limit, quantition suspect)
B = (this compound also detected in the blank)

Respectfully submitted:

Barry [illegible], MS
Technical Director

BCB/...

[illegible]

COAST ENVIRONMENTAL

July 20, 1993

Client: Navy Public Works (93-06-189) Lab #: 9307-106-2

Sample I.D.: MYPT Date Received: 7-15-93

Sample Matrix: Water Date Completed: 7-20-93

Metals Analytical Summary
Toxicity Characteristic Leaching Procedure SW-846 Method 1311

Parameter	SW-846 Method	CAS #	Detection Limit(mg/L)		RESULT(mg/L)	Max. Cont. Level(mg/L)
Arsenic	6010	7440-38-2	0.0394		0.093	5.0
Barium	6010	7440-39-3	0.00454		0.028	100.0
Cadmium	6010	7440-43-9	0.00838	<	0.00838	1.0
Chromium	6010	7440-47-3	0.0140		0.017	5.0
Lead	6010	7439-92-1	0.0600	<	0.060	5.0
Mercury	7470,1	7439-97-6	0.0000917		0.00016	0.2
Selenium	6010	7782-49-2	0.0452	<	0.0452	1.0
Silver	6010	7440-22-4	0.00414	<	0.00414	5.0

SW-846 -- "Test Methods for Evaluating Solid Waste", Third Edition, November, 1986, and Revision 1, December, 1987, and 55 FR (61) 11862 - 11875.

Respectfully submitted,

Adolph W. Wollitz
Laboratory Director
FHRS Lab #E82102
FHRS Lab #42110
EPA #FL062
DER Comp QAPP # 870222G

AWW/tb

12 July 93

From: 320.2
To: 240

Subj: ANALYTICAL TESTING

1. Request the following samples be tested for the parameters indicated.

Sample No.	Media	Test (Clin)	COST	Source
93-06-188	Solid, SAND	TCLP (full no pesticides)	$.	Mypt
93-06-189	Solid, black top	TCLP (full no pesticides)	$.	Mypt
93-06-190	Liquid	TCLP (full no pesticides)	$.	Bldg 171
		Total	$ .00	

2. All analysis shall conform to Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA Publication SW-846.

3. Job Order number to be used this project is 1243006 and a 24-hour turn around is requested on analytical results.

4. Please contact Gail Fallon or Andy Long at 772-4551 if there are any questions.

Andy Long
ANDY LONG

RC# 00186
To 240 7/13/93
To AB 7/15/93

FIRST COAST ENVIRONMENTAL LABORATORY, INC.

July 21, 1993

Client: Navy Public Works — Lab #: 9307-106

Sample I.D.: See Below (NYP1) — Date Received: 7-15-93

Sample Matrix: See Below — Date Completed: 7-20-93

Metals Analytical Summary

FCEL Lab #	Sample I.D. Station	Sample Matrix	Parameter	Method	Results
9307-106-1	93-06-188	Solid	Chromium	6010	7.97 mg/Kg
9307-106-2	93-06-189	Solid	Chromium	6010	5.56 mg/Kg

Respectfully submitted,

Adolph W. Wollitz
Laboratory Director
FHRS Lab #E82102
FHRS Lab #82110
EPA #FL062
DER Comp QAPP # 8702226

AWW/tb

8818 Arlington Expressway • Jacksonville, Florida 32211
(904) 725-1847 • Fax (904) 725-2315

APPENDIX F

DRAFT INVESTIGATIVE DERIVED WASTE MANAGEMENT PLAN

DRAFT

RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION (RFI) WORKPLAN

ADDENDUM 1
INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN

U.S. NAVAL STATION MAYPORT
MAYPORT, FLORIDA

UIC: N60201

Contract No. N62467-89-D-0317

Prepared by:

ABB Environmental Services, Inc.
2590 Executive Center Circle, East
Tallahassee, Florida 32301

Prepared for:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
Charleston, South Carolina 29411-0068

Jim Reed, Engineer-in-Charge

December 1992

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NAVSTA Mayport Investigation-Derived
Waste Management Plan

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Attachment A - Individual Drum Tracking Form

LIST OF FIGURES

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Waste Management Plan

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NAVSTA Mayport Investigation-Derived
Waste Management Plan

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GLOSSARY

CFR	Code of Federal Regulations
IDW	investigation-derived wastes
NAVSTA	naval station
PPE	personal protective equipment
PVC	polyvinyl chloride
RCRA	Resource Conservation And Recovery Act
RFA	Resource Conservation And Recovery Act Facility Assessment
RFI	Resource Conservation And Recovery Act Facility Investigation
SWMU	Solid Waste Management Unit
TCLP	toxicity characteristic leaching procedure
TSD	treatment, storage, and disposal
WWTP	Waste Water Treatment Plant

1.0 MAYPORT INVESTIGATION-DERIVED (IDW) MANAGEMENT PLAN

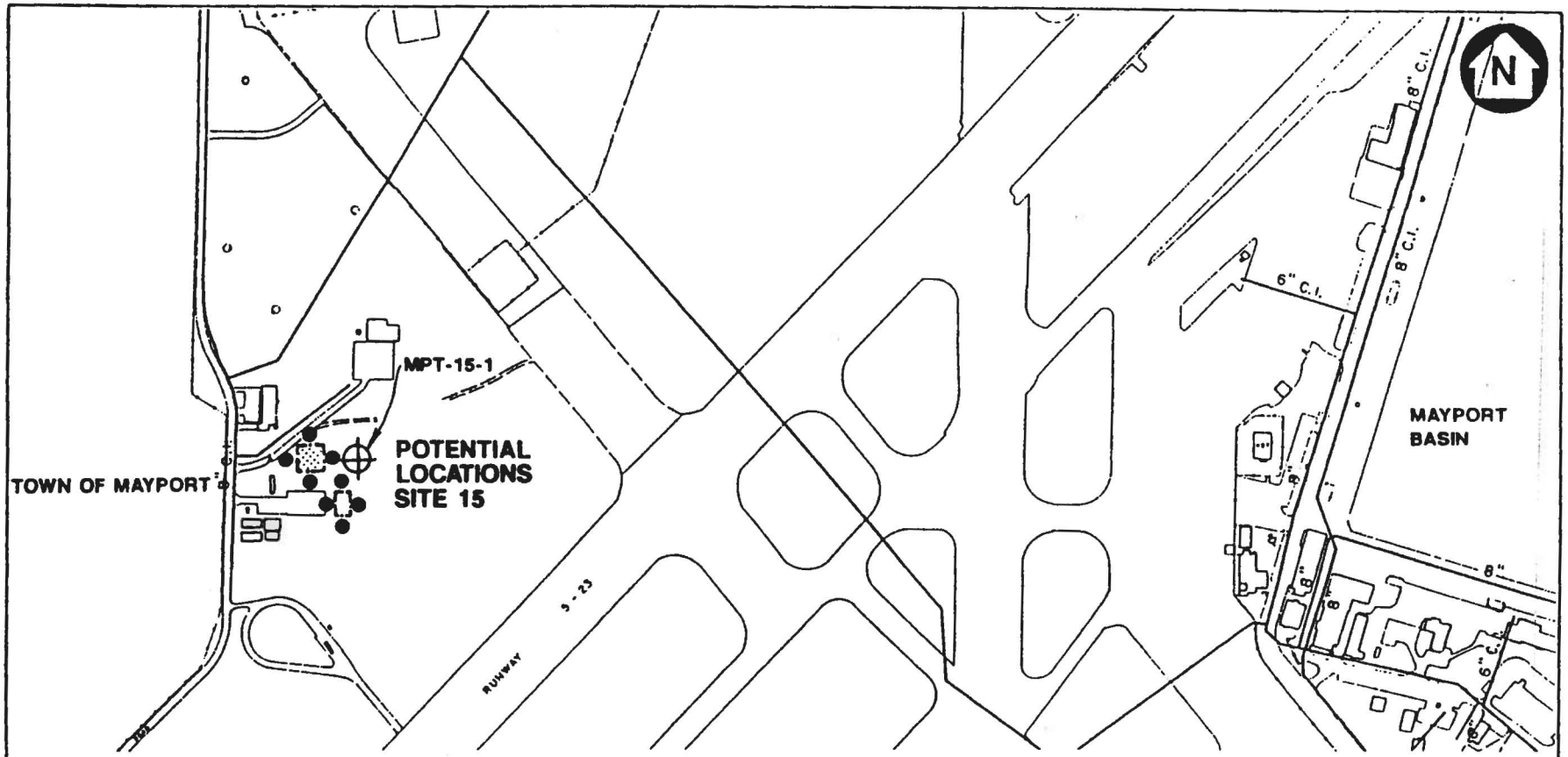
This plan details the handling of all investigation-derived wastes (IDW) expected to be generated during Phase 2 Resource Conservation and Recovery Act (RCRA) Facility Investigation/RCRA Facility Assessment (RFI/RFA) activities at U.S. Naval Station (NAVSTA) Mayport, Florida. The first section describes the types of IDW expected to be generated and the disposal options available for each. The second section describes the procedures that will be used to determine whether each IDW is an RCRA hazardous or nonhazardous waste. Finally, an IDW management decision tree is presented to follow the IDW from point of generation all the way through to proper disposal.

There are five types of IDW expected to be generated. These include soil cuttings, drilling fluids, decontamination fluids, development and purge groundwater, and disposable sampling equipment such as personal protective equipment (PPE). The following is a description of each type of IDW and their respective disposal options.

1.1 SOIL CUTTINGS. Soil or drill cuttings generated during soil boring investigations and well installation are handled depending on proximity and location of the site.

For remote or isolated sites such as Solid Waste Management Unit (SWMU) 15 (See Figure 1-1), the cuttings will be drummed, labeled, and left onsite while laboratory analyses of the media samples are completed. After identifying the soil as an RCRA hazardous or nonhazardous waste (see Section 2.0), it will be handled appropriately. Nonhazardous soils will be spread out on the ground to prevent a nuisance condition, physical hazard, or drainage problem near the well or boring where they were generated. The cuttings will be placed so that they will not be eroded by surface water and rainfall and create sediment loads to nearby surface waterways such as ditches, curbs, and swales.

For populated sites or heavy traffic areas such as SWMUs 6, 7, 8, 9, 10, 11, and 16 (Figure 1-2), the cuttings will be drummed, labeled, and transported to a



LEGEND

- APPROX. AREA OF SITE LOCATION
- APPROX. LOCATION OF PROPOSED SHALLOW SOIL SAMPLING
- APPROX. LOCATION OF PROPOSED MONITORING WELL

SCALE IN FEET

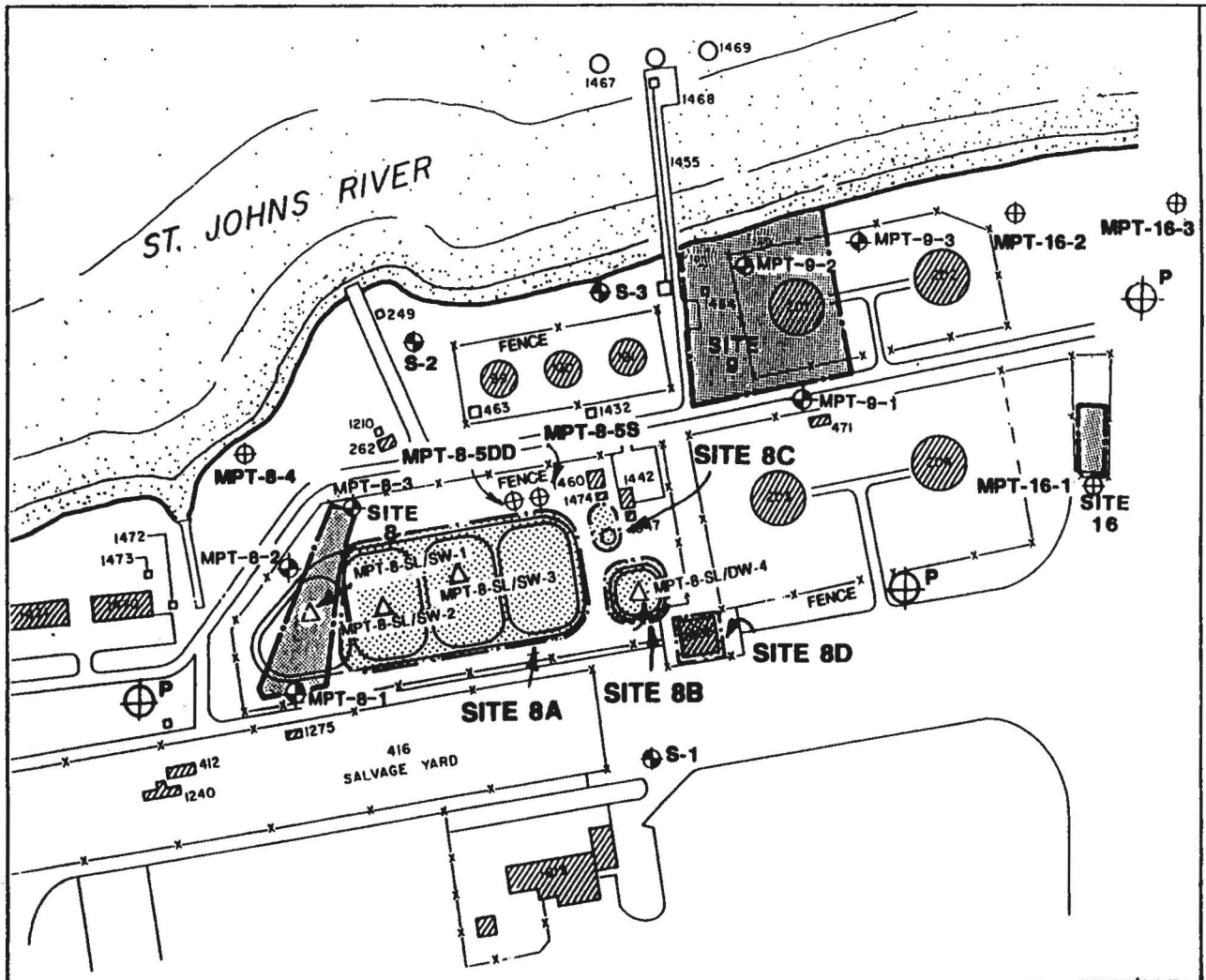
0 250 500

FIGURE 1-1

LOCATION OF EXPLORATIONS (SITE 15) SWMU 15

RCRA FACILITY INVESTIGATION PHASE II WORKPLAN

U.S. NAVAL STATION MAYPORT, FLORIDA



N

LEGEND

- APPROX. LOCATION OF EXISTING MONITORING WELLS
- APPROX. LOCATION OF PREVIOUS SOIL SAMPLING
- APPROX. AREA OF SITE LOCATION
- APPROX. LOCATION OF PROPOSED MONITORING WELL
- APPROX. LOCATION OF PROPOSED SOIL AND SLUDGE SAMPLING
- P APPROX. LOCATION OF PROPOSED TEMPORARY PIEZOMETER

APPROX. SCALE

0 225 450 FT

FIGURE 1-2

LOCATIONS OF EXPLORATIONS (SITE 8, 8A, 8B, 8C, 8D, 9, AND 16) SWMU 6, 7, 8, 9, 10, 11, AND 16

RCRA FACILITY INVESTIGATION PHASE II WORKPLAN
U.S. NAVAL STATION
MAYPORT, FLORIDA

temporary storage facility to be designated by base Navy personnel. The drummed soils will remain in storage until laboratory analyses of the media samples are completed. Drummed, nonhazardous soil cuttings will be transported back to the site from which they were generated and spread out on the ground as for the remote or isolated sites.

Drummed soil cuttings generated at both remote sites and populated areas that have been identified as hazardous will be transported offsite to a hazardous waste facility for proper storage and disposal. Management of hazardous IDW will be the responsibility of the Navy.

The volume of soil cuttings expected to generated during Phase II activities is approximately 29 55-gallon drums.

1.2 DRILLING FLUIDS. Drilling fluids or muds generated during well installation will be drummed and labeled. The drummed fluids at both remote and populated sites will be handled in the same manner as the drummed soil cuttings. After identifying the fluid as an RCRA hazardous or nonhazardous waste, it will be handled appropriately. Nonhazardous fluids will be disposed of in a shallow excavation pit approximately 15 feet square by 3 feet deep which will be constructed at a location to be designated by the base Navy personnel. Ideally, the disposal pit will be constructed as close to the original point of generation as possible. Nonhazardous drilling fluids from all Phase 2 sites will be transported to the excavation pit location by the subcontractor.

Hazardous drilling fluids will be transported offsite to a hazardous waste facility. Management of hazardous IDW will be the responsibility of the Navy.

The approximate volume of drilling fluid expected to be generated is 14 55-gallon drums.

1.3 DECONTAMINATION FLUIDS. Decontamination fluids are generated from two sources. Decontamination fluids generated from steam cleaning of drilling equipment (augers, rod, split-spoons, etc.) and well material (polyvinyl chloride [PVC]) will be collected and drummed at the designated decontamination area or

pad. This fluid will left on-site while laboratory analyses of the media samples is completed. After identifying the fluid as an RCRA hazardous or nonhazardous waste, it will be handled appropriately. Decontamination fluids generated from decontamination of sampling equipment (bowls, spoons, bailers, etc.) will be collected and drummed at the designated decontamination area unless onsite decontamination is required. In this case, decontamination fluids will be collected and transported to the decontamination area where they will be drummed.

All decontamination fluids generated from sampling equipment will be treated as waste water and will be discharged to the base Waste Water Treatment Plant (WWTP) via the sanitary sewer system.

The approximate volume of decontamination fluid expected to be generated is 10 55-gallon drums.

1.4 DEVELOPMENT AND PURGE GROUNDWATER. Well water generated from well development and well purging will be drummed and labeled. The drummed well water at both remote and populated sites will be handled in the same manner as the drummed soil cuttings. After identifying the well water as an RCRA hazardous or nonhazardous waste it will be handled appropriately. Nonhazardous well water will be disposed of as near as possible to the well location from which it was generated. This will be accomplished by pouring the well water on the ground and allowing the water to percolate into the soil. Care will be taken to assure that the well water does not flow into surface waterways such as ditches, curbs, or swales.

Hazardous well water will be transported to the base Hazardous Waste storage facility in coordination with the base Navy personnel for proper storage and disposal. Management of hazardous IDW will be the responsibility of the Navy.

The approximate volume of well development and purge water expected to be generated is 17 55-gallon drums.

1.5 DISPOSABLE SAMPLING EQUIPMENT (PERSONAL PROTECTION EQUIPMENT [PPE]). Miscellaneous used sampling equipment such as gloves, tyvek overalls, booties and other PPE will be placed in drums onsite. Drummed disposable sampling equipment at both remote and populated sites will be handled in the same manner as the drummed soil cuttings. When it is determined whether or not these items are likely to be contaminated with an RCRA hazardous waste, they will be handled appropriately. If these items are not likely to be contaminated, they will be disposed as non-contaminated solid waste. The materials will be collected and placed in double heavy duty polyethylene bags (e.g., "hefty trash bags") and disposed of in a base dumpster used for nonhazardous industrial waste. The dumpster will be designated by base Navy personnel.

Disposable sampling equipment likely to be contaminated with an RCRA hazardous waste will be drummed and transported offsite for proper storage and disposal. Management of hazardous IDW will be the responsibility of the Navy.

2.0 DETERMINATION OF RCRA HAZARDOUS OR NONHAZARDOUS IDW

The following procedure will be used for each type of IDW previously described. This will allow waste to be easily identified as an RCRA hazardous or nonhazardous waste and handled appropriately.

All IDW generated onsite will be characterized, drummed, and labeled at the point of generation. All IDW will remain drummed until chemical analysis results of the media samples have been received. While the results are pending, proper storage of the IDW will be determined depending on site location (See section 1.0). After receiving laboratory results for the media samples, the respective IDW will be identified as an RCRA hazardous or nonhazardous waste using the following criteria.

Media samples will be analyzed, by an approved laboratory, for RCRA hazardous waste characteristics in accordance with 40 Code of Federal Regulations (CFR), Part 261. The four characteristics are ignitability, corrosivity, reactivity, and toxicity. For expected Phase II IDW, there is adequate knowledge, based on information from previous investigations, that toxicity is the only characteristic of concern. Thus, toxicity analysis will be the basis for the determination of hazardous and nonhazardous wastes unless site-specific observations indicate otherwise.

For soils. If the media sample is shown to have greater than 20 times the regulatory threshold level for toxicity of any regulated compound (see "*Management of Investigation-Derived Wastes During Site Inspections*" EPA/540/G-91/009), a sample of the corresponding, drummed IDW will be analyzed for toxicity characteristic leaching procedure (TCLP) toxicity to determine the extract concentration. If the IDW extract contains a regulated compound above its threshold level, the soil is identified as an RCRA hazardous waste and must be disposed of offsite. If the media sample is less than 20 times all regulated levels or if the IDW TCLP sample concentration is below all regulated levels, the IDW is an RCRA nonhazardous waste and will be disposed of onsite at the point of generation.

For water. If the media sample is shown to have greater than the regulatory threshold level for toxicity of any regulated compound, the corresponding IDW is identified as an RCRA hazardous waste and must be disposed of offsite. If the media sample is below all regulated levels, the IDW is an RCRA nonhazardous waste and will be disposed of onsite at the point of generation.

The following step-by-step procedures and corresponding decision tree presented in Figure 2-1 takes the IDW from generation through disposal and should be used as a quick reference guide.

1. Characterize generated IDW

   - soil cuttings
   - drilling fluids
   - decontamination fluids
   - development and purge groundwater
   - disposable sampling equipment

2. Drum IDW as it is generated and fill out drum tracking log (Attachment A).

3. Determine where IDW should be stored while waiting for laboratory analysis of media samples.

   - if site is in remote location, store onsite
   - if site is in populated area, store offsite (at base storage facility)

4. After receiving laboratory analysis results for media samples, identify IDW as an RCRA hazardous or nonhazardous waste using the following criteria.

For soils. If laboratory results are less than 20 times the regulatory threshold level for any regulated compound, the soil is an RCRA nonhazardous waste. If laboratory results of media samples show greater than 20 times the regulatory

MAYPORT PHASE II IDW MANAGEMENT

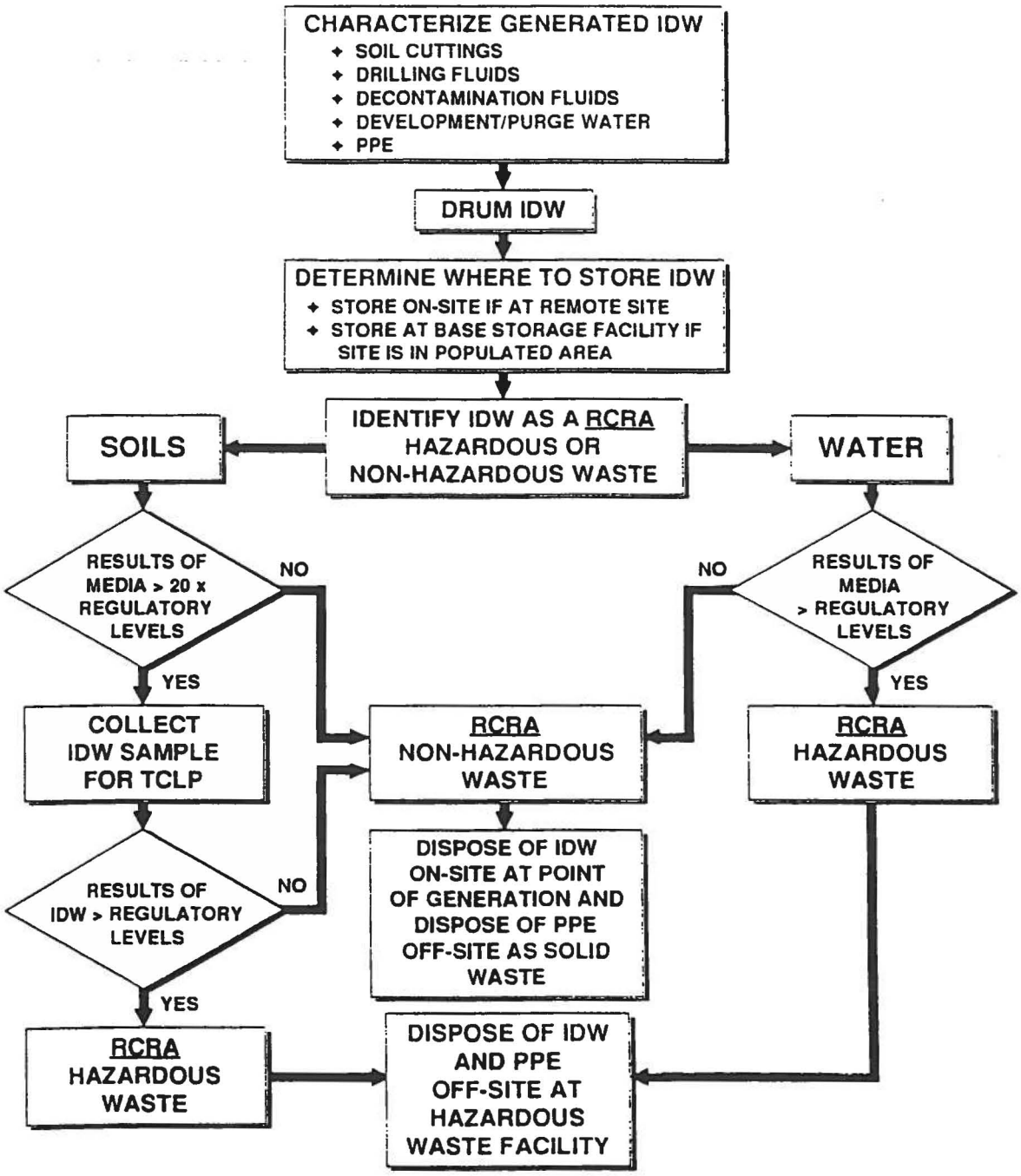


FIGURE 2-1

MAYPORT PHASE II
IDW MANAGEMENT

RCRA FACILITY
INVESTIGATION WORKPLAN
ADDENDUM 1
IDW MANAGEMENT PLAN
U.S. NAVAL STATION
MAYPORT, FLORIDA

threshold level for any regulated compound, collect a sample of the drummed soil for TCLP analysis.

If the TCLP analysis yields a value greater than the regulatory threshold level for any regulated compound, the soil is an RCRA hazardous waste,

If the TCLP analysis yields a value less than the regulatory threshold level for any regulatory compound, the soil is an RCRA nonhazardous waste.

For water. If results of media samples show greater than the regulatory threshold level for any regulated compound, the water is an RCRA hazardous waste.

If results of sampling show less than the regulatory threshold level for any regulated compound, the water is an RCRA nonhazardous waste.

5. Dispose of IDW appropriately as follows.

For soils. If IDW is identified as an RCRA hazardous waste, dispose of offsite at RCRA treatment, storage, and disposal (TSD) Facility.

If IDW is identified as an RCRA nonhazardous waste, spread soil on ground at point of generation as previously described.

For water. If IDW is identified as an RCRA hazardous waste, dispose of offsite at RCRA TSD Facility.

If IDW is identified as an RCRA nonhazardous waste, pour water on ground near point of generation as previously described.

A summary of the anticipated disposal methods for each type of IDW at each SWMU is presented in Table 2-1. The table is based on the assumption that no IDW will be identified as an RCRA hazardous waste at any of the Phase II SWMUs.

Table 2-1
Anticipated Investigation-Derived Wastes (IDW)[1] and Disposal Methods

NAVSTA Mayport
Mayport, Florida

SWMU	Soil Cuttings	Drilling Fluids	Decontamination Fluids	Development and Purge Water	PPE and DE
6	Spread on ground	Transport to excavation pit.	Discharge to Mayport WWTP.	Pour on ground near well.	Deposit in Mayport dumpster.
7	Spread on ground	Transport to excavation pit.	Discharge to Mayport WWTP.	Pour on ground near well.	Deposit in Mayport dumpster.
8	Spread on ground	Transport to excavation pit.	Discharge to Mayport WWTP.	Pour on ground near well.	Deposit in Mayport dumpster.
9	Spread on ground	Transport to excavation pit.	Discharge to Mayport WWTP.	Pour on ground near well.	Deposit in Mayport dumpster.
10	Spread on ground	Transport to excavation pit.	Discharge to Mayport WWTP.	Pour on ground near well.	Deposit in Mayport dumpster.
11	N/A	N/A	Discharge to Mayport WWTP.	Pour on ground near well.	Deposit in Mayport dumpster.
12	N/A	N/A	Discharge to Mayport WWTP.	Pour on ground near well.	Deposit in Mayport dumpster.
15	Spread on ground	N/A	Discharge to Mayport WWTP.	Pour on ground near well.	Deposit in Mayport dumpster.
16	Spread on ground	N/A	Discharge to Mayport WWTP.	Pour on ground near well.	Deposit in Mayport dumpster.

[1] Assuming non-hazardous IDW at each SWMU.

Notes: SWMU = solid waste management unit.
PPE = personal protection equipment.
DE = disposable equipment.
WWTP = wastewater treatment plant.
N/A = not applicable.

ATTACHMENT A

INDIVIDUAL DRUM TRACKING FORM

ABB ENVIRONMENTAL SERVICES, INC.
INVESTIGATION–DERIVED WASTES (IDW) MANAGEMENT
INDIVIDUAL DRUM TRACKING
NAVAL STATION MAYPORT
MAYPORT, FLORIDA

SOIL BORING /
MONITORING WELL I.D.:

PIEZOMETER I.D.:

TOTAL DEPTH:

SOIL DRUM #	DATE	DEPTH INTERVAL	FID/OVA READINGS	VISUAL OBSERVATIONS

'ATER DRUM #	DATE	DEPTH INTERVAL	FID/OVA READINGS	VISUAL OBSERVATIONS

ABB–ES REPRESENTATIVE: _____

COMMENTS: _____

DATE: _____

APPENDIX G

RESPONSE TO COMMENTS

South Div Comments to draft RFI & Confirmation Assessment
Work Plan for Area of Concern C
NS Mayport, FL
4/99

1. *Pg. 1-6, Please be sure to include the latest CAMP in final version*

RESPONSE:

The text has been corrected to include the latest CAMP issued in August of 1999, and a copy included as an Appendix.

2. *Pg. 3-1, Please spell out confirmation assessment prior to using CA the first time .*

RESPONSE:

The text has been corrected.

3. *Pg. 3-7, are shallow soil samples 0"-12"?*

RESPONSE:

The text has been corrected to state ....shallow soil samples from 0 to 2 feet bls ....for use in the risk assessment.

4. *What lab(s) will be used for this work?*

RESPONSE:

At this time an analytical laboratory subcontract has not been issued. Whatever lab is selected will be capable of achieving the detection levels required for this project.

5. *Pg. 3-8 please define HAS the first time the acronym is used.*

RESPONSE:

The text has been corrected.

Activity Comments to draft RFI & Confirmation Assessment
Work Plan for Area of Concern C
NS Mayport, FL
4/99

1. *Section 1.3 pg. 1-4 section 3.2.1, page 3-22: The current structures include one Quonset building (bldg. 2023), an open sided covered structure with*

concrete (bldg. 191-A) and the main building (bldg. 191). Bldg. 281 is now 2023 and bldg. 264 was demolished. Bldg. 191-C is the environmental trailer.

RESPONSE:

The text has been corrected to reflect this.

2. *Section 3.1.3.5.3: Liquids from the decontamination area should be collected and sampled per the IDW plan in appendix F. Not sent to the sanitary sewer.*

RESPONSE:

Decontamination fluids will be collected and sampled per the IDW plan. The text has been corrected to indicate this.

3. *Section 3.1.3.12: Typo last sentence: should read "care will be used".*

RESPONSE:

The text has been corrected.

July 14, 1999

4WD-FFB

Ms. Adrienne Wilson
Southern Division
Naval Facilities Engineering Command
P.O. Box 190010
Charleston, South Carolina 29419-9010

SUBJ: NAVSTA Mayport, Florida
EPA ID# FL9 170 024 260

Dear Ms. Wilson:

The United States Environmental Protection Agency (EPA) has received and reviewed the following document:

- **RCRA Facility Investigation and Confirmation Assessment Work Plan for Area of Concern C** (Tetra Tech NUS, April 1999).

Enclosed are EPA's review comments based on a general technical review as well as a human health and ecological risk assessment review. If you have any questions, please contact me at (404) 562-8555.

Sincerely,

Craig A. Benedikt
Remedial Project Manager
Federal Facilities Branch

Enclosure

cc: Jim Cason, FDEP
Randy Bishop, NAVSTA Mayport
Terry Hansen, TtNUS

EPA REVIEW COMMENTS
RFI/CS WORK PLAN FOR
AOC-C
NAVSTA MAYPORT, DATED APRIL 1999

GENERAL COMMENTS

1 *Section 3.0, Technical Approach, contains numerous deficiencies and inadequacies in the monitoring well installation and sampling activities as indicated in the specific comments below. Section 3.0 should be carefully reviewed to ensure EPA Region IV standard operating procedures are followed.*

RESPONSE:

Please see the responses below. The EPA Region IV SOPs have been reviewed and changes identified below.

2 *In Section 3.1.3.4, there appears to be discrepancies concerning which monitoring wells will have surface casings installed and how the determination of the depths at which the casings will be installed will be made. These concerns are reflected in specific comments 6 and 7.*

RESPONSE:

Please see the responses to comments 6 & 7 below.

SPECIFIC COMMENTS

3 ***Cover Spline, Outside Cover Page and Inside Cover Page**. The cover spline is titled, "Resource Conservation and Recovery Act Facility Investigation and Confirmation Assessment Work Plan for Area of Concern C, NAVSTA Mayport Mayport, Florida." The outside cover page is titled, "RCRA Facility Investigation and Confirmation Assessment Work Plan for Area of Concern C Naval Station Mayport Mayport, Florida." The inside cover page is titled, "Resource Conservation and Recovery Act (RCRA) Confirmation Assessment and RCRA Facility Investigation Work Plan for Area of Concern C U.S. Naval Station Mayport Mayport, Florida." The cover spline, the outside cover page and the inside cover page should all be consistent titled. This discrepancy in titles should be addressed.*

RESPONSE:

The text was revised to reflect this comment.

4 ***Page 3-1, Section 3.0**. The last sentence in the first paragraph of this section states that the RFI will determine recommendations to remediate AOC C. It is a function of the Corrective Measures Study (CMS) to present remedial alternatives not the RFI. The text*

should be clarified on this point.

RESPONSE:

The text was revised to reflect this comment.

5 ***Page 3-7, Section 3.1.3.1, Fourth Paragraph***. *The text states, "If a liner is used, it is separated into four 6-inch-long sections (along perforations in the brass liners), and the exposed soil is screened with a flame ionization detector (FID). Samples selected for laboratory analyses will immediately be placed into laboratory-supplied containers. 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." The preceding statements, concerning using liners for sample collection, are contradictory. Either the samples collected in liners will be separated into 6-inch sections and screened with an FID and then placed in laboratory containers or the samples will remain in the liners and the open ends will be sealed with Teflon™ tape, capped and sealed with exterior tape and shipped to the laboratory. The text should clarify which method shall be used during soil sample collection.*

RESPONSE:

Samples will be collected in liners, screened with a FID and then placed in laboratory containers for transport to the laboratory.

6 ***Page 3-9, Section 3.1.3.4.***. *The text states, "A fine sand seal at least 4 feet thick, will be installed on top of the 20/30 silica sand. The remainder of the annulus of the borehole will be grouted by pumping a cement/bentonite slurry through a tremie pipe up to 2 feet bls." According to Region IV EPA standard operating procedures, a minimum two-foot vertical thick bentonite seal shall be placed on top of the filter pack. This seal shall consist of 30 % solids bentonite pellets which should be allowed to hydrate for a minimum of hours or the manufacturer's recommended hydration time, whichever is greater. This bentonite seal prevents grout from contaminating the sand packed screened interval of the monitoring well. The monitoring well installation procedure in the text should be changed to include the installation of a bentonite seal in all shallow, intermediate and deep wells installed at the facility.*

RESPONSE:

A minimum two-foot vertical thick bentonite seal will be used on all wells.

7 ***Page 3-9, Last Paragraph***. *The text states, "The need for 6-inch PVC surface casings will be evaluated from data collected during the CA. If necessary, the intermediate and deep well locations will be completed with surface casings to prevent cross*

contamination of dissolved constituents from the upper to lower zones." However, the text does not provide sufficient information concerning the lithologic data that will be evaluated. Additionally, the text does not describe the manner of soil data collection. Soil test borings should be drilled to determine subsurface lithology, such as confining units and abandoned upon completion. The text should provide further information concerning the use of surface casing for intermediate and deep wells.

RESPONSE:

The workplan will state that the lithologic data (soil boring logs and monitoring well logs) collected during the investigations conducted by ABB/HLA and the NELP investigation will be evaluated for pertinent geologic information. The need for 6-inch PVC surface casings will be based on this data as well as lithologic information gathered during this RFI.

8 ***Page 3-10, Section 3.1.3.4.4, Bullet 6****. The text states, "At each well nest location, lithologic soil samples will be taken continuously by using 5-foot continuous samplers or at 5-foot intervals using 2-foot split spoons at the deep well location only. Installation of the shallow and intermediate surface casings wells will then be based on the lithologic description of the deep boring." However, on Page 3-9, the text states, "If necessary, the intermediate and deep well locations will be completed with surface casings to prevent cross contamination of dissolved constituents from the upper and lower zones." The discrepancy between installing surface casings in the shallow and intermediate well in one statement and installing surface casings in the intermediate and deep well in the other statement should be addressed. Both statements should state that surface casings will be installed in the intermediate and deep wells. An exploratory boring should be drilled to characterize the subsurface lithology, such as confining units, to determine the depths to install the surface casings for the intermediate and deep monitoring wells.*

RESPONSE:

The workplan will be revised to state: Based on existing groundwater analytical data surface casings will be installed in the intermediate and deep wells if it is deemed necessary for the prevention of the downward migration of contamination.

9 ***Page 3-11, Section 3.1.3.4.5****. The text states, "Wells will be developed until the following criteria are achieved:*

- *Stabilization of the following parameters occurs:*
  - temperature plus or minus 1 ℃,
  - 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 2 consecutive readings;*

- *Accumulated sediment is removed from the well.*

The Region IV EPA standard operating procedures recommend that, in addition to stabilization of these parameters, a minimum of 3 well volumes should be removed from the monitoring well during development. The text should include these items as part of the well development procedure.

RESPONSE:

The text was revised to reflect this comment.

10 ***Page 3-14, Section 3.4.3.7****. The text states, "All measurements will be collected within a 48-hour period of consistent weather conditions to minimize atmospheric/precipitation effects on groundwater conditions." However, groundwater levels should all be collected within a time frame as short as possible, such as within an 8-hour workday or less to allow for the accurate representation of the potentiometric surface. Since the site is adjacent to the St. Johns River and the Atlantic Ocean, groundwater is most likely under tidal influence. Therefore, tidal influence should be taken into consideration when water levels are measured at the site. Section 3.4.3.7 should be amended to address the potential impact of tidal influences on water level measurements.*

RESPONSE:

Groundwater level measurements will be taken within an 8-hour workday. However, this 8-hour workday will also fall within a 48-hour period of consistent weather to minimize atmospheric/ precipitation on groundwater conditions. Previous tidal information collected by ABB/HLA will be used to minimize the potential impact of tidal influences.

Additionally, the text states, "If floating hydrocarbon is detected in the monitoring wells, the thickness of free product will be measured with an electronic interface probe." The text should also state that if free product is detected, a corrected water level will be calculated for the well in which the free product is discovered.

RESPONSE:

The text was revised to reflect this comment.

11 ***Page 3-16, Section 3.1.3.13****. The text states, "Soil samples will be analyzed for their total hydrocarbon content using an organic vapor analyzer (OVA) equipped with an FID." However, according to the instrument description in this section, the FID measures response to general organic vapors in parts per million but is not capable of detecting total hydrocarbon content solely. The text should be changed to address this discrepancy.*

RESPONSE:

A FID equipped with a charcoal filter will be used. Measurements will be taken with and without the filter to differentiate between methane and petroleum hydrocarbon vapors.

12 ***Page 3-28, Section 3.3.1.2****. The first bulleted item of this section suggests that the CA will serve to identify the source of 1,1-DCA; however, the second part of the sentence implies that only a site walkover inspection will be conducted with no sampling. The text should be revised to clarify this task for the CA.*

RESPONSE:

The workplan will be revised to state - The CA will consist of a site walkover to visually identify any possible sources of 1,1-DCA. The site walkover will look for areas of exposed soil, cracked or repaired concrete, USTs or ASTs, drum storage areas, and locations where the solvent may have been used or stored.

13 ***Page 3-36, Section 3.3.3****. The table contained in Section 3.3.3 indicates that one trip blank per cooler will be included in the sample shipment to the laboratory only if ten or more groundwater samples are collected for VOC analysis and shipped. Therefore, if nine or less samples are collected and shipped to the laboratory no trip blanks are required. However, according to EPA Region IV standard operating procedures, at least one trip blank per shipment should be included in the coolers if ground water samples are to be analyzed for VOCs. The text should be revised to reflect this guidance.*

RESPONSE:

The text was revised to reflect this comment.

The following comments relate to the human health and ecological risk review:

GENERAL COMMENTS

14 Section 5.1.3.2 presents the identification of the exposure pathways and receptors. The text says that the human receptors that will be considered include a recreational user who may come into contact with either contaminated surface water or sediment while swimming or wading. The work plan, however, does not discuss plans to sample either the surface water or the sediment. Since surface water and sediments near the pier may have been impacted by contaminants, it seems reasonable to sample these media in the areas around the pier. The work plan should be modified to include sampling of the surface water and sediments, or a rationale should be given for not sampling these media. For consistency, Tables 5-1 and 5-2 should also be expanded to include the recreational receptor.

In addition, a resident may also come into contact with the waters around the pier area,

the surface water and sediment pathways should also be considered for the current and future residents.

Also, according to the Work Plan, the only environmental media that will be evaluated in the Ecological Risk Assessment (ERA) are soil and groundwater. It is unclear why surface water and sediment samples are not being analyzed at this site. According to Figure 1-2, Mayport Turning Basin is very close to AOC C and migration of contaminants from the site to the water in the basin and from the water to the sediment in the basin seems highly possible. In addition, Section 5.2.4.1 on page 2-22 states that aquatic organisms may be exposed to groundwater discharging into the Turning Basin. This indicates that surface water and sediment contamination may be occurring. Therefore surface water and sediment should be sampled and analyzed in support of the ERA.

RESPONSE:

Although potential chemical migration from AOC C to the Turning Point Basin will be investigated in this study and addressed in the uncertainties section of the risk assessment portion of the report; surface water and sediment risk assessment is beyond the scope of this ERA. This is primarily because the basin is dredged every 2 to 3 years for safe berthing of Navy ships. Dredged sediments are transferred through a slurry pipeline to SWMU 50, the Western Dredge Spoil area. Data from any surface water or sediment samples that would be collected for this study, and subsequent evaluation of ecological risks, would be unusable the next time the basin is dredged.

15 *A figure presenting the "conceptual site model" for AOC C has not been prepared for this work plan. A graphical presentation of exposure pathways and exposure scenarios by media is a useful tool to present and evaluate human health risk assessment information at a given site. Section 5.1.3.2 discusses the exposure scenarios and pathways that will be evaluated in the human health risk assessment. Many of the specific comments generated may have been eliminated if the basis for pathway selection were made clear. A conceptual site model figure may help to describe the process used to select pathways for evaluation. A conceptual site model figure should be prepared for this work plan that identifies all human health receptors, exposure pathways, and rationale for selecting/eliminating exposure pathways.*

RESPONSE:

Agree - A figure showing the conceptual site model will be added to the work plan.

16 *As per the December 22, 1998 memo from Dr. Ted Simon on implementing the ecological risk assessment process in EPA Region 4, a screening level ecological risk assessment should be developed prior to the development of the work plan for an RFI. This memo can be obtained from at: http://www.epa.gov/region4/wastepgs/oftecser/otsguid.htm*

Therefore, if data from prior sampling rounds are available, a screening-level ERA should be developed as an addendum to this work plan, and included in the next version of this document. The Screening-Level ERA should be limited to Step 1, the preliminary problem formulation and ecological effects evaluation and to Step 2, the preliminary exposure estimate and preliminary risk calculation, which includes a direct comparison of the maximum concentration of each chemical in each abiotic medium to the Region 4 screening values. Chemicals exceeding their screening values should be carried through to Step 3, Problem Formulation. Chemicals without screening values should also be carried through to Step 3. These chemicals will represent the COPCs for the site. Toxicity profiles should be developed for the screening level ERA. These toxicity profiles should be developed for classes of chemicals rather than individual COPCs and should indicate whether any of the selected COPCs will tend to bioaccumulate, or whether direct toxicity would be the major environmental concern. The Screening-Level ERA should be used to focus RFI field sampling efforts.

RESPONSE:

The December 22, 1998 ecorisk memorandum from Region 4 will be cited in this Work Plan.

While it is preferable that the screening assessment be performed as part of the Work Plan and the Work Plan contain the methods to be followed for a baseline ERA (if necessary), no historical surface soil data are available for AOC C. Thus, no screening can be performed for this medium as part of the Work Plan.

It should be noted that as stated in a Department of the Navy ecorisk policy memorandum (DON, 1999), the Navy prefers that Steps 1, 2, and "3A" be performed initially. Step 3A, Refinement of Contaminants of Potential Concern, is performed to determine if any COPCs from Steps 1 and 2 might pose unacceptable risks and, if so, if a baseline ERA is necessary or a risk management option should be undertaken instead. In Step 3A, COPCs from the screening are re-evaluated with the use of less conservative information and other data, such as background concentrations, frequency of detection, and so forth.

In this ERA chemicals with maximum concentrations in surface soil and groundwater that exceed screening levels and those with no screening levels will be carried over into Step 3A. The usefulness of toxicity profiles at the screening level is questionable because of the generalized nature of the screening assessment. Also, as per previous discussions with Region 4, it is not anticipated that toxicity information (i.e., profiles) for classes of contaminants will be presented at the screening phase because this information is readily available from any number of sources.

17 *As per the December 22, 1998 memo from Dr. Ted Simon on implementing the ecological risk assessment process in EPA Region 4, Steps 3 and 4 of the ERA process should also be performed prior to the development of the work plan for the RFI. In practice, a general version of these steps should be developed and included in the work plan as part*

of the scoping process for field activities. Step 3 should represent the thought process for scoping the RFI field activities, which takes into account the ecotoxicity and potential ecological receptor information for the site. Step 4 is the actual work plan, as it relates to ecological risk assessment concerns. The Step 3, Problem Formulation, to be included in the work plan, should discuss whether the COPC list, determined from the screening level ERA, should be modified, or may potentially be modified based on factors such as background. A discussion of fate and transport including the linkage of potential source areas through drainage pathways to surrounding surface water complexes should be developed. Generic assessment endpoints should be developed. Finally, the Work Plan-level Step 3 to be included in the work plan should present a provisional conceptual site model, to be refined in the RI with receptor groups such as "aquatic receptors" or "terrestrial receptors" listed. It is not anticipated that the Step 3 to be included in the work plan would include foodchain modeling. For sites such as AOC C where little data are available prior to the RFI, Step 4 may be limited to defining the abiotic media sampling needs.

RESPONSE:

As discussed in response to Comment #15, the paucity of historical data precludes the conduct of a screening assessment, and any other subsequent steps in the ERA process, in this Work Plan. Thus, the screening cannot be performed until the samples described in the Work Plan have been collected and their data can be analyzed. If additional ecological study may be warranted by the results of those data, the remainder of Step 3 (Baseline ERA Problem Formulation) will be undertaken at that time, which would include specific fate and transport information and a focused conceptual model. As per the EPA's *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (the "Process Document")(USEPA, 1997), generic assessment endpoints should be developed during the screening, as described in Section 5.2.2.5 of the Work Plan. These assessment endpoints can be refined for a baseline ERA, if necessary.

18 *As per the December 22, 1998 memo from Dr. Ted Simon on implementing the ecological risk assessment process in EPA Region 4, food chain modeling should not be performed in a screening-level ecological risk assessment. If food chain modeling is warranted, it should be conducted as part of Step 3 of the ERA process, and included in the RFI report. COPC screening, as described in Steps 1 and 2 of the 8-step process, should be performed on the data collected from this sampling effort in order to determine the site COPCs. Generic toxicity profiles will be need for any classes of COPCs which were not identified in the Screening-Level ERA for this site. Food chain modeling should only be performed on bioaccumulative chemicals. The tasks listed under sections 5.2.2.4 through 5.2.2.6 and 5.2.3.2, 5.2.4 and 5.2.5 should be performed in Step 3 of the ERA in the RFI report. This work plan should be re-formatted to correspond with Region 4 guidance on implementing EPA's 1997 Process for Designing and Conducting Ecological Risk Assessments document.*

RESPONSE:

As stated in the Process Document, foodchain modeling can be performed as part of the screening. This is done because the common screening that is performed (e.g., sediment chemical concentration compared to a screening level) is based on risks to organisms that can be found in a specific medium (e.g., earthworms) and generally does not account for risks to higher-level organisms. A simple foodchain model is used in Steps 1 and 2, in which calculated chemical doses for representative receptors are compared to doses associated with toxicity (e.g., NOAELs). This modeling is performed only on chemicals that are known to bioaccumulate or biomagnify. For example, Region 4 has stated in the past that VOCs be excluded from the modeling.

It should be noted that this comment states that the screening should be performed on data collected as part of the proposed sampling in this Work Plan, while Comments 15 and 16 say that the screening should be performed now and included in this Work Plan. As mentioned earlier, the screening will be performed after the sampling described in this Work Plan is performed.

The tasks described in Sections 5.2.2.4 through 5.2.2.6, 5.2.3.2, 5.2.4, and 5.2.5 are presented in this Work Plan accordance with the Process Document and are not out of compliance with Region 4 guidance.

SPECIFIC COMMENTS

19 ***Table of Contents, Page iii****. A reference section is provided in the Work Plan after Section 7.0. However, the reference section is not included in the Table of Contents. References should be added in the Table of Contents after Section 7.0.*

RESPONSE:

The text was revised to reflect this comment.

20 ***Section 1.3, Page 1-4 and Figure 1-2****. Section 1.3 is a description of the AOC C site. Figure 1-2 is referred to in this section when describing AOC C, Echo Pier, Building 191 and the SIMA Building (Building 1488). However, AOC C and the SIMA Building (Building 1488) are not marked on Figure 1-2. This discrepancy should be addressed.*

In addition, many of the items described in section 1.3 are not marked on Figure 1-2 or any other figure. The following items discussed in Section 1.3 should be marked on Figure 1-2: AOC C, the two Quonset Buildings (Buildings 264 and 281), the SIMA Building (Building 1488), Building 191-A, and Building 191-C. Since these buildings are discussed in Section 1.3 they should also be clearly identified in Figure 1-2.

RESPONSE:

The figures were revised to reflect this comment.

21 ***Section 5.1.2, Page 5-4****. This section discusses the identification of human health chemicals of potential concern (COPCs). The text of this section states that USEPA risk based comparison values (RBCs) along with other Florida values (like FDEP Soil Cleanup target Values and Florida guidance concentrations for groundwater) will be used for the screening process. The text, however, does not identify which set of values will be used to screen each media. The most conservative screening values for each contaminant should be used for COPC screening, and this should be reflected in the text of this section.*

RESPONSE:

Agree - The second bullet on page 5-4 will be changed to read "The maximum detected concentration in a medium is the lessor of the USEPA Region III RBCs or the State of Florida criteria and guidance values."

22 ***Section 5.1.3.2, Page 5-6, First Bullet.*** *In this section, the military resident receptor is only considered for the groundwater pathway. It is reasonable to assume that these receptors may also be exposed to contaminants in soil. Soil exposure pathways should be evaluated for the military resident exposure scenario. The text along with Table 5-1 should be changed to include soil exposure pathways. If this pathway is not to be evaluated in the risk assessment, a rationale for excluding the pathway should be presented in the text.*

RESPONSE:

Disagree – To be consistent with RAGS the future resident risk associated with soil and groundwater will be evaluated in the report. However, there are currently no residents residing on or adjacent to AOC C. AOC C includes buildings and facilities around the southern portion of Echo Pier, Building 191, and the SIMA Building. The closest residential area is located approximately a quarter mile south of AOC C and a golf course is located between AOC C and the closest residential area. Consequently, there are no exposures to AOC C soils by current military residents. The following sentence will be added to the end of the first bullet on page 5-6: "There are no residential areas located adjacent to AOC C, therefore, potential exposures to soil by current military residents will not be evaluated in the risk assessment. The future resident risk associated with soil and groundwater will be evaluated in the risk assessment "

23 ***Section 5.1.3.2, Page 5-6, Second Bullet.*** *The text states, "future residents are individuals that may currently reside near AOC C or may do so in the future." This definition is confusing and appears to actually define two specific exposure groups,*

current residents and future residents. Current residents appear to be accounted for in the military resident scenario, i.e. those that "currently reside" near AOC C. Future residents are, by definition, those who may live in or near the area in the future. The text should be clarified.

RESPONSE:

Agree - The text will be revised as follows: "**Future Residents** are individuals who may reside in or near AOC C in the future

24 ***Section 5.1.3.2, Page 5-6, Third Bullet.*** *The text indicates that trespassers are "individuals who may from time to time enter a contaminated site without proper authorization and come into contact with contaminated soil." It seems reasonable that trespassers may also contact contaminated surface water and sediments. Surface water and sediment pathways should be evaluated for the trespasser scenario. If surface water and sediment pathways will not be considered for this exposure scenario in the risk assessment, a compelling rationale for not evaluating the pathway should be presented in the text.*

Disagree – AOC C includes buildings and facilities around the southern portion of Echo Pier, Building 191, the SIMA Building, and the turning basin in this area. The turning basin is dredged every 2 to 3 years for safe berthing of Navy ships. Dredged sediments are transferred through a slurry pipeline to SWMU 50, the Western Dredge Spoil area or transported offshore for disposal. Data from any surface water or sediment samples that would be collected for this study, and subsequent evaluation of risks, would be unusable the next time the basin is dredged. The sediments and surface water in this area are in a dynamic state constantly being effected both by tidal actions, and the mouth of the turning basin being directly exposed to the Atlantic Ocean. In addition to a constantly changing environment the trespasser scenario is unlikely due to the constant movement of Navy ships in and out of the turning basin, resulting in a high potential for personal injury and the security associated with ship movements, designed to prohibit unauthorized personnel from being in the area.

The following statement will be added to the end of the first paragraph in Section 5.1.3.2. "Only soil and groundwater are being investigated at AOC C, consequently, potential exposures will be only evaluated for these media." The following sentence will be added to the end of the sixth bullet. "No surface water or sediments samples are being collected during the site investigation consequently no potential exposures will be evaluated for recreational users

25 ***Section 5.1.3.2, Page 5-6, Fourth Bullet.*** *Under the construction worker scenario, the text states that construction workers may come into contact with surface water and sediment. However, these exposure pathways are not shown in Tables 5-1 and 5-2. The text should be changed to include exposure to surface water and sediment by the construction worker, if these are in fact reasonable exposure media.*

RESPONSE:

Disagree - As previously discussed, surface water and sediment are not being investigated at AOC C. The sentence "Construction workers may also come into contact with surface water or sediment while performing construction" will be removed from the text

26 ***Section 5.2.3.1, Page 5-20.*** *The first sentence of the second paragraph of this section states that USEPA Region IV has not promulgated its own surface soil guidelines. However, in the December 22, 1998 memo from Ted W. Simon, a toxicologist for the USEPA Region IV Office of Technical Services, new surface soil guidelines for Region IV are introduced. These newly issued Region IV ecological surface soil screening values or their updates should be used in this ERA. The Work Plan should be changed to state that these values will be used and the text should be revised to acknowledge that Region IV has promulgated its own surface soil guidelines.*

RESPONSE:

The Work Plan will be modified to indicate that Region IV surface soil screening levels presented in the December 22, 1998 memorandum will be used in the ERA.

The following references were cited in the response to comments.

DON (Department of the Navy). 1999. Navy Policy for Conducting Ecological Risk Assessment. Office of the Chief of Naval Operations, Washington, D.C., April 6.

USEPA (U.S. Environmental Protection Agency). 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, June 5, Edison, New Jersey.