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Abbreviated Field Sampling Plan

for

Subsurface Investigation
Former Drum Loading Area
Building 292
Indian Head Division
Naval Surface Warfare Center

Indian Head, Maryland

Engineering Field Activity Chesapeake
Naval Facilities Engineering Command

Northern Division Contract Number N62472-90-D-1298

Contract Task Order 0209

August 1995

Halliburton NUS
CORPORATION

079504/P

ABBREVIATED FIELD SAMPLING PLAN
FOR
SUBSURFACE INVESTIGATION
FORMER DRUM LOADING AREA
BUILDING 292
INDIAN HEAD DIVISION
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MARYLAND

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
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Environmental Branch Code 18
Naval Facilities Engineering Command
Washington Navy Yard, Building 212
Washington, D.C. 20374-2121

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1.0 INTRODUCTION AND PROJECT BACKGROUND

The Northern Division of the Naval Facilities Engineering Command has issued Contract Task Order Number 0209 (CTO 209) to Halliburton NUS Environmental Corporation (Halliburton NUS), under the Comprehensive Long-Term Environmental Action Navy (Clean) Contract No. N62472-90-D-1298. CTO 209 is for environmental work to support a potential removal action at the Former Drum Loading Area near Building 292 at the Indian Head Division, Naval Surface Warfare Center, (IHDIV-NSWC), Indian Head, Maryland (Figure 1-1). This Abbreviated Field Sampling Plan (AFSP) presents a plan to perform sampling and analysis work to define the nature and extent of contamination at the Former Drum Loading Area (Site 57).

1.1 PROJECT BACKGROUND

The IHDIV is located in the northwest section of Charles County, Maryland, 25 miles southwest of Washington, D.C. The principal mission of the facility is research, development, test, evaluation, and production of propellant and explosive ingredients, and formulations used in ordnance devices.

The field sampling area emanates from the front of Building 292 at the main facility of the IHDIV. Previous operations at the building involved vapor degreasing of metal parts using Trichloroethylene (TCE). It is believed that these operations may have resulted in the contamination of the soil and groundwater near the building.

1.1.1 Review of Existing Information

TCE was first detected in February 1994 at 53 micrograms per liter (μg/L, equivalent to parts per billion, ppb) at the industrial wastewater outfall serving the drainage basin that includes Building 292 (designated outfall IW-80). This initial sampling was conducted because of an odor reported at IW-80. A sample collected from the same outfall in May 1994 detected 60.2 μg/L TCE. The Navy notified the Maryland Department of the Environment (MDE) of the TCE discharge on June 17, 1994. In addition, the Navy submitted a revised National Pollutant Discharge Elimination System (NPDES) permit application on November 4, 1994 to MDE requesting approval of a 100 μg/L TCE discharge limit.

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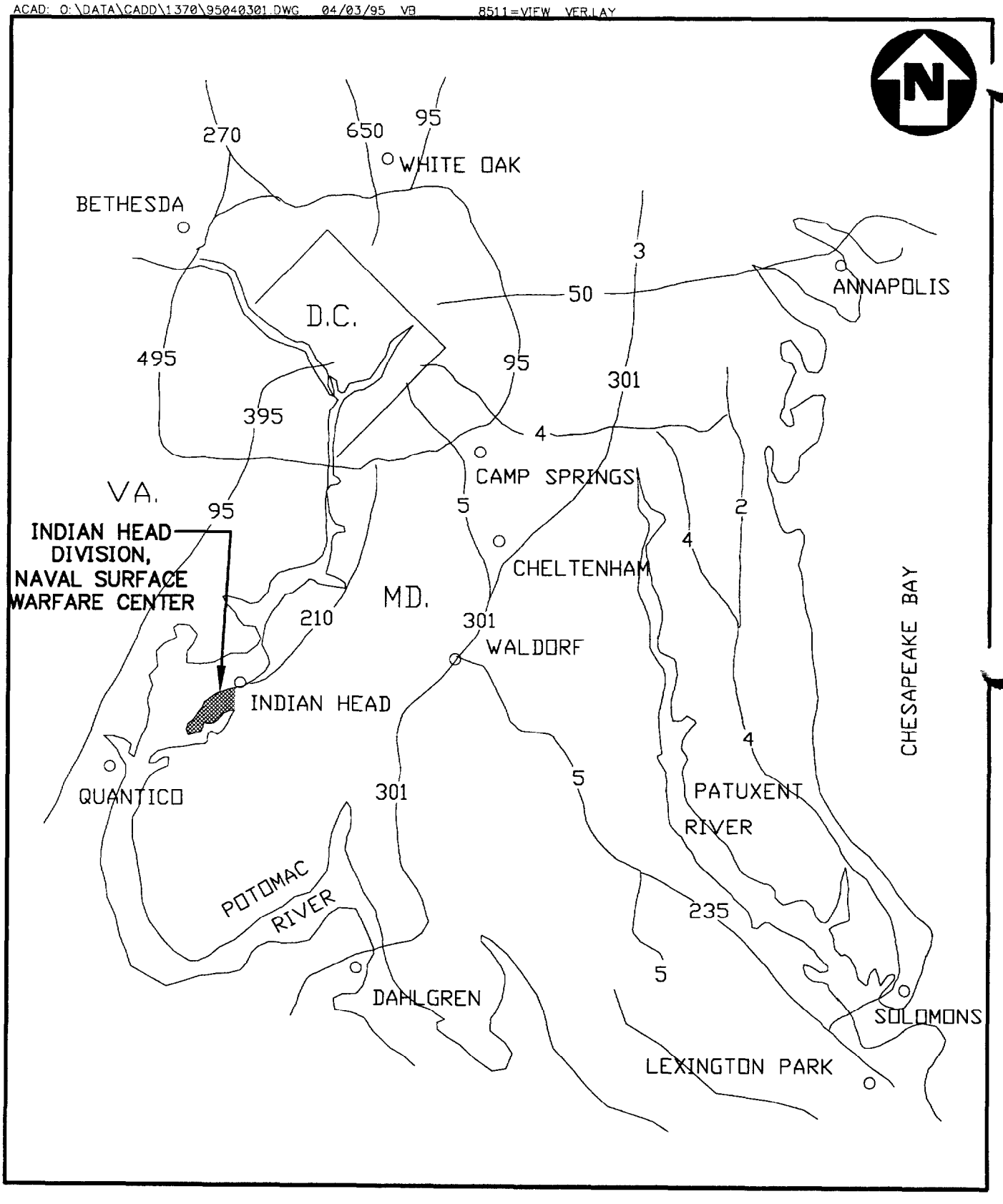

FIGURE 1-1

VICINITY MAP
INDIAN HEAD DIVISION NSWC
NOT TO SCALE

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Since May 1994, the Navy has conducted several rounds of storm sewer sampling for TCE in an attempt to locate the source of TCE:

- July 12, 1994 - Sample results did not detect TCE or any other volatile organic priority pollutant upstream or downstream at the manhole receiving flow from Building 292, (designated MH-1).

- July 27, 1994 - Sample results did not detect TCE upstream of Building 292 but did detect TCE at MH-1 (62 μg/L) and farther downstream of Building 292 (47 μg/L). No other volatile organic priority pollutant was detected.

Building 292 operations reportedly included:

- 1,900-gallon TCE vapor degreaser used from the mid-1960s until 1989.

- Large solvent dip tanks used for general cleaning until the mid-1970s.

- Spent TCE piped to drums outside Building 292 via a ball valve through the wall of the building. Drums were reportedly stored on a grass-covered area near the ball valve and near MH-1.

The use of TCE at the facility was reportedly stopped in 1989. The Building 292 area is believed to be one potential source of TCE in the storm sewer. No other obvious sources of TCE are located in the vicinity.

1.1.2 Site Reconnaissance

On November 2, 1994, Halliburton NUS conducted a reconnaissance of the Building 292 area. Participating personnel included R. Shawn Phillips, RPM, Engineering Field Activity Chesapeake; John Gee, senior project manager, HNUS; Tony Klimek, senior project manager, HNUS; and Thomas W. Symalla, environmental engineer, IHDIV, Waste Management and Prevention Branch, Environmental Division.

The site reconnaissance began near Building 292, where MH-1, located approximately 80 feet south of Building 292, was inspected first. MH-1 (also known as Structure 430 on Master Shore Station Development Plan, Part IV Section 6, Area Development Plan, Area 12-Utilities, Sanitary Sewerage and Storm Drainage Systems, Sheet 12 of 16, Drawing No. 670,579, last dated 11/1/91) is a rectangular manhole constructed of brick. The manhole extends approximately 2 feet above the ground surface. Several pipes that enter MH-1 were visible when looking down into the manhole. Three of these pipes enter the manhole from the northwest. One appeared to be a (18-inch) corrugated metal pipe (CMP) that was approximately 4 feet

below ground surface (BGS) and was apparently connected to the gutters at ground surface on either side of Building 292. Below the CMP appeared a (18-inch) terracotta pipe (TCP). Below the TCP was a third pipe of unidentified size and composition.

What appeared to be a 24-inch TCP entered the manhole from the southwest. Flow was observed entering MH-1 from the 18-inch CMP and from the lower pipe entering from the northwest. The flow from this lower pipe was significantly greater than that from the CMP and is reportedly non-contact cooling water from the base power plant.

A reconnaissance of the exterior of Building 292 revealed a number of pipes that extend through the walls of the building and discharge to the concrete storm sewer drain system for the building. In addition to these pipe discharges from inside the building, the ground-level storm sewer drains also receive roof drainage. Halliburton NUS also observed possible spring discharge from a hill adjacent to the building that also discharges to this drain system. A sheen was present on the water from this spring. The building contains a number of less-than-90-day hazardous waste storage units. An inspection of the contents of the hazardous waste storage units was not conducted.

A degreaser unit was still in place in Building 292 and it appeared to be operational. According to a label on the unit, it was manufactured by Randall Manufacturing Company, of Hillside, New Jersey, in March 1980. The degreaser unit was used to vaporize TCE for cleaning parts. Operations at Building 292 and throughout IHDIV have reportedly substituted 1,1,1-trichloroethane (1,1,1-TCA) for TCE. The vapors collected in the hood of the machine are exhausted directly outside the building. The TCE or 1,1,1-TCA vapors may, upon contact with ambient air form condensate that drips onto the ground or into the gutter system at Building 292. According to the foreman of the facility the degreaser unit was inactive between approximately January 1995 through June 1995, and is currently in operation using TCA. Furthermore, there are several direct discharge lines (including an overflow) from the degreaser to the gutter system at the building. Numerous drums of 1,1,1-TCA were in the building. The used 1,1,1-TCA is recycled on site in a still, adjacent to the degreaser unit. The workers in the facility transfer used 1,1,1-TCA into the still by pouring or pumping.

1.1.3 TCE/1,1,1-TCA Degradation and Impurities

TCE degrades in the environment to form cis-1,2 dichloroethene, trans-1,2-dichloroethene (1,2-DCE), 1,1-dichloroethene (1,1-DCE), and 1,2-dichloroethane (1,2-DCA). These compounds can degrade to form vinyl chloride and chloroethane. The presence of vinyl chloride is usually indicative of an older TCE discharge.

Technical-grade TCE contains 0.035 percent 1,1,1-TCA, as well as chloroform, carbon tetrachloride, and other priority pollutants.

1,1,1-TCA degrades in the environment to form 1,1-DCE, 1,1-dichloroethane(1,1-DCA), vinyl chloride, and/or chloroethane. The presence of the last two compounds is usually indicative of an older 1,1,1-TCA discharge. Impurities in commercial-grade 1,1,1-TCA are normally below a concentration of 250 mg/L.

1.2 OBJECTIVE AND SAMPLING STRATEGY

The objective of the work described in this AFSP is to conduct an investigation of the area between MH-1 and the drum loading area near the ball valve in the wall of Building 292 to determine if TCE or its degradation byproducts have impacted the area. Halliburton NUS understands that additional future investigations of this area will be required to delineate any impact and prepare a removal design. Halliburton NUS also understands that the Navy will be conducting an investigation of the storm sewer system to evaluate other potential sources of TCE.

1.3 PLAN FORMAT

Section 1.0 of this AFSP contains an Introduction and Background Information. Section 2.0 and 3.0 describe proposed field operations and environmental sampling that will be used to implement the field work. Quality Assurance/Quality Control is discussed in Section 4.0, and Project Organization and Responsibilities is discussed in Section 5.0. Additional support documentation is included in the appendices at the end of this document.

2.0 FIELD OPERATIONS

2.1 FIELD OPERATIONS SUMMARY

The field investigation to be performed will consist of: (1) sampling to determine the location and extent of contamination, and (2) analysis to determine the characteristics of the contamination. Soil gas samples, soil samples, groundwater samples, and storm sewer samples will be collected and analyzed for the contaminants of concern. The field investigative work phase of the project is anticipated to last approximately 5 days. Initially, soil gas samples will be collected from 4 feet below grade at up to 25 probe locations. The soil gas samples will be analyzed in the field to establish a basis for selecting subsurface soil sampling locations (see Section 2.3). Subsurface soil samples will be collected from 3 feet below grade and at the soil/water interface at four locations. Groundwater samples will be collected from two field-selected locations (see Section 2.3). In addition, two storm sewer samples will be collected from two pipes discharging to MH-1 to confirm previous results.

2.2 MOBILIZATION\DEMOBILIZATION

Halliburton NUS will secure the services of a direct-push/soil gas survey subcontractor and an analytical laboratory. After procurement of the direct-push/soil gas survey subcontractor and approval of this AFSP, Halliburton NUS will begin mobilization activities. All field team members will review the AFSP, including the Health and Safety Plan (HASP), and Section 4.0 Quality Assurance/Quality Control in this document. In addition, a field team orientation meeting will be held to familiarize personnel and representatives of the IHDIV with the scope of the field activities. Upon mobilization at the site, the Halliburton NUS Site Safety Officer (SSO), or representative, will provide site-specific health and safety training to the field team and subcontractor personnel.

The Halliburton NUS Field Operations Leader (FOL) will coordinate the mobilization activities upon arrival at the Former Drum Loading Area. The FOL will also make any equipment purchases required to conduct the field investigation. The equipment required for the field activities will be loaded in Pittsburgh and driven to the site by Halliburton NUS. After field activities are completed, the FOL and a field technician will demobilize the equipment and drive back to Pittsburgh. The schedule for performing the site investigation activities will consist of approximately 5 consecutive days.

2.3 DIRECT-PUSH SAMPLING

The objective of this activity is to collect soil gas, subsurface soil and groundwater samples at the potential TCE spill area using a direct-push sampling system. Initially, soil gas samples will be collected from 4 feet below grade at up to 25 probe locations. The soil gas samples will be analyzed in the field by a chemist using a portable gas chromatograph calibrated to detect TCE and degradation by-products of TCE.

Soil gas results will be summarized and analyzed in the field to select subsurface sample locations. Subsurface soil samples will be collected from 3 feet below grade and at the soil/water interface at four locations. Groundwater samples will be collected from two field selected locations. The subsurface soil and groundwater samples collected will be submitted to a NFESC-approved laboratory for rapid (14-day) turnaround of Target Compound List (TCL) analyses by SW-846/8240 (DQO Level C) which includes analysis for cis-1,2-dichloroethene, trans-1,2-dichloroethene, 1,1-DCE, 1,2-DCA, vinyl chloride and chloroethane, 1,1,1-TCA, and 1,1-DCA.

The subsurface at IHDIV is expected to contain stiff clay deposits which may cause difficulty with direct-push sampling efforts. In addition, groundwater sampling may take significant effort since groundwater is expected to be at least 15 feet below ground surface at the site.

Soil gas sampling will commence near Building 292 with the placement of sampling point SG-01 as close as practical to the ball spigot in the southwest building wall. Subsequent sampling will occur at 50 foot intervals along an axis running generally toward the south as shown on Figure 2-1, and will include sampling points SG-02 through SG-05. The placement of additional sampling points will be determined in the field based on the soil gas analytical results from the first 5 points. Soil gas sampling will continue along the initial (north-south) axis until the analytical results indicate "non-detect".

The interval between soil gas points may be adjusted depending on the results of the soil gas analyses. For instance, if three adjacent samples along an axis exhibit the same order of magnitude of contaminant concentration, the horizontal interval between sampling points may be increased to 100 feet. On the other hand, if three adjacent samples along an axis exhibit successive increases or decreases in concentration of an order of magnitude or more, the horizontal interval between sampling points may be decreased to 25 feet.

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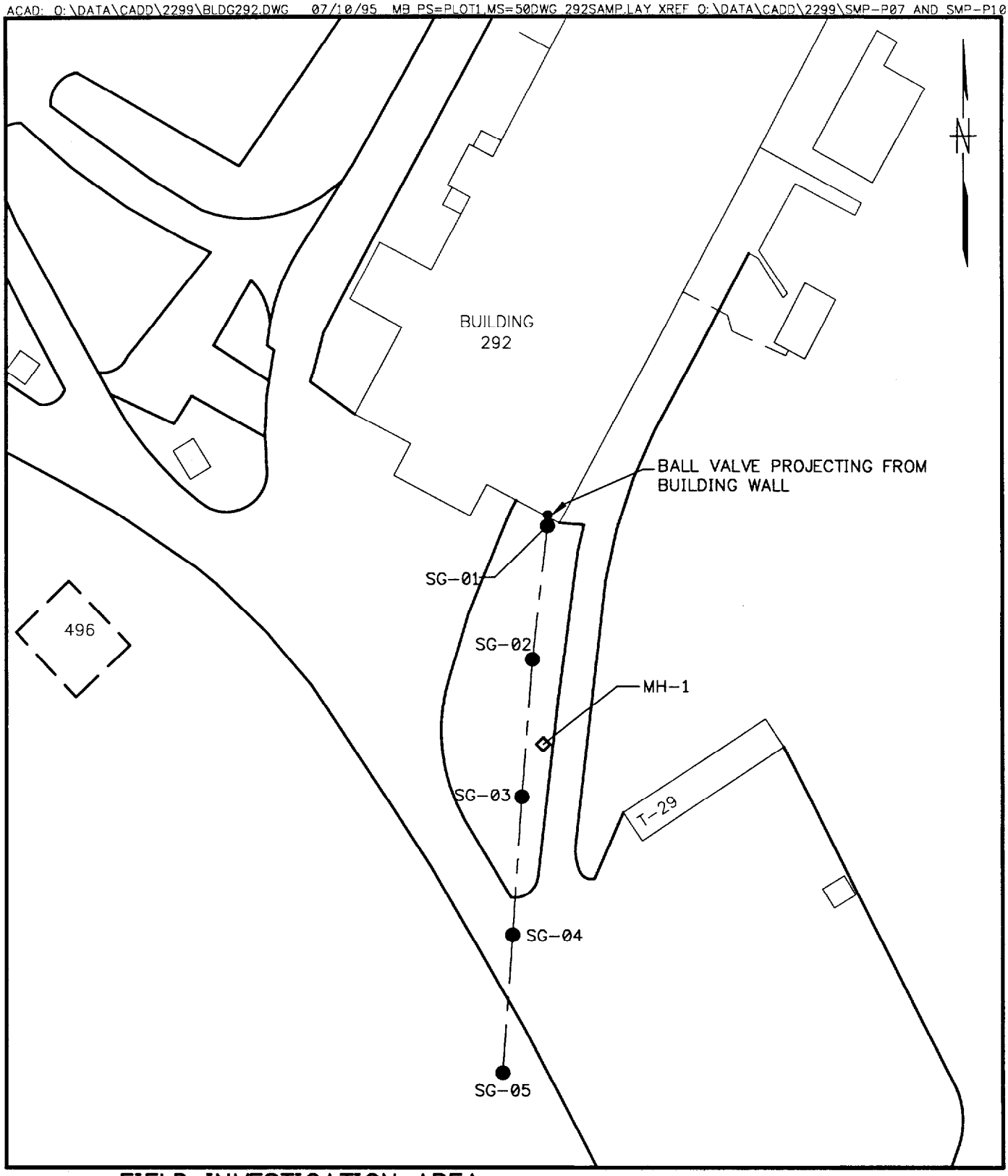

FIELD INVESTIGATION AREA
BUILDING 292, FORMER DRUM LOADING AREA
NAVAL SURFACE WARFARE CENTER,
INDIAN HEAD, MARYLAND

0 50 100
SCALE IN FEET

FIGURE 2-1

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Once the limits of contamination have been established along the north-south axis, a second axis, perpendicular to the first (generally east-west), will be established emanating from the soil gas point exhibiting the highest soil gas contaminant concentration. Soil gas sampling will proceed from the identified point toward the east and toward the west in a manner similar to that described above.

The four soil sampling locations will be positioned as follows:

a. One location as close as practical to each of the three soil gas sampling points exhibiting the highest contaminant concentrations.

b. One location as close as practical to the first soil gas location exhibiting a "non-detect" along the north-south axis.

Groundwater sampling locations will be identified based on the soil gas sampling point exhibiting the highest contaminant concentration, and the soil gas point exhibiting the first "non-detect" along the north-south axis.

2.4 STORM SEWER SAMPLING

Storm sewer samples will be collected from two pipes discharging to MH-1 to confirm previous results. Halliburton NUS will attempt to obtain one discrete sample from the upper pipe and a second discrete sample from the lower pipe, if flow is observed in the pipes during field operations. Samples will be obtained using a bailer or wheaton dip sampler.

2.5 COLLECTION OF SITE MEASUREMENTS

The final location of all sampling points will be measured by Halliburton NUS after sampling is completed using a tape measure and Building 292 as a horizontal datum. No measurements of elevation will be made. The vertical position of sampling points will be limited to determinations of the depth below ground surface.

2.6 DECONTAMINATION

The equipment involved in field sampling will be decontaminated prior to and during sampling activities. This equipment includes major equipment and all sampling equipment.

2.6.1 Major Equipment

The geoprobe shall be steam cleaned prior to beginning work, at any time it leaves the site prior to completing the investigation, and at the completion of the sampling program.

Prior to beginning field operations, specific site locations for decontamination activities and for potable water and electrical sources will be identified by the IHDIV point of contact. Decontamination operations will consist of washing the equipment using a high-pressure steam wash. Additional requirements for major equipment decontamination can be found in Halliburton NUS SOP GH-1.6 (Appendix B).

2.6.2 Sampling Equipment

All sampling equipment used for collecting samples will be decontaminated prior to beginning field sampling and between collection of each sample. Equipment decontamination will be conducted as described in Section 4.2.

2.7 SOIL AND WASTE HANDLING

Two types of wastes are anticipated to be generated by the sampling activities: (1) subsurface soil cores and (2) other IDW (Investigative-Derived Waste). It is assumed that all IDW generated during field activities can be handled, stored, sampled for disposal characterization, and transported to off-site disposal by the Navy. It is estimated that four 55-gallon drums of subsurface soil cores, decontamination fluid, and spent personal protective equipment (PPE) will be generated during field investigation activities. Halliburton NUS will provide four 55-gallon drums, containerize all IDW and label all IDW drums.

3.0 ENVIRONMENTAL SAMPLING PROCEDURES

This section describes the procedures for environmental sampling, as well as sample handling requirements.

3.1 SAMPLING METHODS

This section details the site-specific methodology to be used to obtain the environmental samples. Field sampling procedures are described in the Halliburton NUS Standard Operating Procedures Guidelines contained in Appendix B. Table 3-1 provides an analytical summary for samples collected.

3.1.1 Soil Gas Sampling

A total of 25 soil gas sample locations are planned for this investigation as indicated in Section 2.3 of this AFSP. At each soil gas sample location, a truck-mounted hydraulic probe will be used to advance interconnected 3' lengths of 1.25"-diameter steel pipe to the sampling depth (conditions permitting). The bottom of the pipe will be opened and a small diameter stainless steel probe will be lowered, through the steel casing, to the bottom of the hole. The probe will be sealed at the base of the pipe to isolate the sampling zone from the surface. Each gas sample will be collected from the predescribed depth through the probe, by drawing on a manual syringe, and encapsulated in a glass vial, pending analysis. Samples will be handled as described in Section 4.2.

3.1.2 Soil Sampling

Soil samples will be extracted at the points described in Section 2.3 of this AFSP. Soil samples will be collected by hydraulically driving a 1.25"-diameter piston-type sampler to the top of the desired interval (conditions permitting). The piston within the sampler will then be released and the pipe will advance through the target interval. The soil core will enter the sampler, which contains a new non-reactive plastic or stainless steel liner. After the drive rod is removed from the soil, the liner containing the soil column will be removed. The liner may be capped at the ends or the soil may be extruded into 2-oz. glass jars and sealed with teflon-lined caps. If a plastic liner is used, it may be opened longitudinally to expose the soil, and a specific section of the sample can be chosen for analysis. To the extent practicable, soil samples for volatile organics analysis will be placed in the sample container so as to minimize the unoccupied volume within the container. The sample will be refrigerated pending analysis. If sampling equipment is reused, the equipment will be decontaminated between samples as described in Section 4.2.

TABLE 3-1

FIELD SAMPLE SUMMARY
BUILDING 292, FORMER DRUM STORAGE AREA
INDIAN HEAD, MARYLAND

Analysis	Methodology	Media	Number of Samples	Number of Field Duplicates	Number of Rinsate Blanks	Number of Trip Blanks	Number of Field Blanks	Total
TCL Volatile Organic Compounds	CLP SOW 0LM01.8	Soil	8	1	3	3	0	15
		Groundwater	2	1	1	2	1	7
		Storm Water	2	1	1	2	0	6

QA/QC samples will be collected as described in Section 4.1.3.

3.1.3 Groundwater Sampling

Groundwater samples will be extracted at all points described in Section 2.3 of this AFSP. To collect groundwater samples, the hydraulic probe will be used to drive a 1.25"-diameter steel pipe to the prescribed depth (conditions permitting) at each location. The bottom of the pipe will be opened or the pipe will be replaced with a slotted PVC pipe to allow water to enter from the soil. Subcontractor personnel will gauge the actual depth to groundwater in the initial hole. Samples of ground water will be collected with a teflon sampling tube or a stainless steel mini-bailer lowered through the steel pipe. Each water sample will be stored in a 40-ml amber glass VOA vial. Samples will be pH adjusted to inhibit microbial breakdown of contaminants and refrigerated, pending analysis (see Section 4.2).

QA/QC samples will be collected as described in Section 4.1.3.

3.1.4 Storm Water Sampling

Two storm water samples will be collected as grab samples from locations indicated in Section 2.3 of this AFSP. Discrete samples will be collected if flow is observed in the two pipes during field operations. Immediately prior to sampling, the temperature (degrees C), pH, and conductivity (micro mhos/cm) of the sample water will be measured and recorded on the sample log sheet (included in Appendix A). Samples will be obtained using a bailer or wheaton dip sampler. The contents of the bailer will be poured into the sample bottle until full, preservatives (see Section 4.2) will be added if required and the sample bottle will be capped.

QA/QC samples will be collected as described in Section 4.1.3.

3.2 SAMPLE HANDLING

Sample handling includes the field-related considerations concerning the selection of sample containers, preservatives, allowable holding times and analysis requested. In addition, sample identification, packaging and shipping will be addressed.

The EPA User's Guide to the Contract Laboratory Program (EPA, December 1986), and the Federal Register (EPA, October 26, 1984) address the topics of containers and sample preservations.

3.2.1 Sampling Identification System

Each sample collected will be assigned a unique sample tracking number. The sample tracking number will consist of a two-segment, alpha-numeric code that identifies the sampled medium and location, sample depth, and quality assurance (QA) designation, if required. Any other pertinent information regarding sample identification will be recorded in the field logbooks.

The alpha-numeric code to be used in the sample system is explained below:

(AA)	-	(NN)	-	(NN)	-	(A)
[Media Sampled]		[Sample Number]		[Sample Depth]		[QA Designation] (if appropriate)

Character Type:

A = Alpha

N = Numeric

Media Sampled:

SG = Soil Gas

SO = Soil

GW = Groundwater

SW = Storm Water

Sample Number:

NN = Assigned sample number for each sample of a particular media

Sample Depth:

NN = Depth below ground surface of extracted soil sample

QA Sample Designations:

E = Equipment rinsate blank (aqueous solution)

F = Field blank

T = Trip Blank

For example, the second soil sample collected during the field work, if taken from the 3 foot depth in the second hole would be designated as:

SO-02-03

Field and rinsate blank QA/QC samples will be labeled F-1 and E-1, etc. To maintain blinded identity, field duplicate samples will be labeled with a fictitious sample number, which does not represent a true sample location. This labeling will be noted in the field notebook. All field QA/QC samples will be completely documented with location and depth (if applicable), sample time, date and description in the field logbook.

3.2.2 Sample Packaging and Shipping

Samples will be packaged in accordance with Halliburton NUS SOP SA-6.1. Samples will be picked up at the site by the analytical laboratory. The FOL will be responsible for completion of the following forms:

- Sample Labels
- Chain-of-Custody Forms
- Appropriate labels applied to shipping coolers
- Chain-of-Custody Labels

3.3 SAMPLE CUSTODY

Custody of samples must be maintained and documented at all times. Chain-of-custody begins with the collection of the samples in the field. Halliburton NUS SOP SA-6.1 provides a description of the chain-of-custody procedures to be followed. A sample chain-of-custody form is included in Appendix A.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

This section provides technical guidelines and procedures for conducting the field work. This document references the Halliburton NUS Standard Operating Procedures (SOPs) for specific protocols pertaining to individual procedures discussed.

4.1 QUALITY ASSURANCE OBJECTIVES

The objective of this sampling event is to provide sufficient data to verify the presence or absence of subsurface contamination in the area of a suspected Trichloroethene (TCE) spill next to Building 292 at the Indian Head Division, Naval Warfare Center (IHDIV-NSWC), Indian Head, Maryland.

Achieving the above described objectives requires that the data collected from the field conform to an appropriate level of quality. The quality of a data set is measured by certain characteristics of the data, namely the parameters of precision and accuracy, representativeness, completeness, and comparability (PARCC). Some of the parameters are expressed quantitatively, while others are expressed qualitatively. The PARCC goals for a particular project are determined by the intended use of the data, usually referred to as DQOs.

4.1.1 Data Quality Objectives

The intended use of the data resulting from a field investigation is a determining factor in defining the Data Quality Objective (DQO) for that data. As described in the Naval Energy and Environmental Support Activity (NEESA) guidance document (NEESA 20.2-047B, June 1988), the Navy has adopted three analytical quality levels (C, D, and E) corresponding to EPA quality levels III, IV, and V described in the EPA document "Data Quality Objectives for Remedial Response Activities Development Process."

Chemical analyses will be performed by a laboratory subcontractor. The analytical data reports generated as a result of the sampling and analysis discussed in this document will conform with NEESA data quality Level D requirements. The data will support the determination of the presence or absence of TCE (and its degradation by-products) contamination in the soil and groundwater under the Former Drum Loading Area or the water flowing into MH-1. A summary of the analyses to be conducted and the number and matrix of samples to be collected (including associated field quality control samples) is presented in Table 3-1.

4.1.2 PARCC Parameters

The PARCC goals for the work covered by this AFSP are discussed in the following sections.

4.1.2.1 Precision and Accuracy

Field sampling precision and accuracy are not easily measured. Field contamination, sample preservation, and sample handling will affect precision and accuracy. By following the appropriate Halliburton NUS Standard Operating Procedures (Appendix B), precision and accuracy errors associated with field activities can be minimized. Field duplicates and blanks (field/rinsate trip) will be used to estimate field sampling precision and accuracy. This evaluation is conducted as part of the data reduction and validation process, which is discussed in Sections 4.6 and 4.10.

4.1.2.2 Representativeness

Representativeness describes the degree to which analytical data accurately and precisely define the population being measured. Several elements of the sampling methods and sample handling process must be controlled to maximize the representativeness of the analytical data. For instance, these elements may include the quantity of samples collected, the physical state of the samples, site-specific factors (e.g., the type of matrix sampled), sampling equipment, containers, sample preservation and storage, holding times, sample identity and chain-of-custody. These elements are defined in this document to assure that the samples analyzed represent the population being measured. The sampling program is designed to provide analytical data that is representative of the existing contaminant levels.

4.1.2.3 Completeness

Completeness describes the amount of data generated that meets the objectives for precision, accuracy, and representativeness versus the amount of data expected to be obtained. For relatively clean, homogeneous matrices, 100 percent completeness is expected. However, as matrix complexity and heterogeneity increase, completeness may decrease. Where analysis is precluded or where data quality objectives are compromised, effects on the overall investigation must be considered. Whether or not any particular sample is critical to the investigation will be evaluated in terms of the sample location, the parameter in question, the intended data use, and the risk associated with the error.

The sampling and analysis program for the site is sufficiently broad in scope to prevent a single data point or parameter from jeopardizing attainment of the project objectives. Critical data points may not be

evaluated until all the analytical results are evaluated. Additionally, several sampling points, in aggregate, may be considered to be critical either by location or by analysis. If, in the evaluation of laboratory results, it becomes apparent that the data for a specific medium are of insufficient quality, either with respect to the number of samples or an individual analysis, a subsequent sampling event may be necessary.

For the purposes of this effort, 90 percent is established as the minimum acceptable level of completeness. A data point shall be determined to contribute to the completeness of the data set if the information provided is meaningful, useful and contributes to the project objectives.

4.1.2.4 Comparability

One of the objectives of this AFSP is to provide analytical data that is characterized by a level of quality that is comparable between sampling points. By specifying the use of standard analytical procedures in addition to standardizing field sampling procedures by employing Halliburton NUS SOPs, the potential for variables to affect the final data quality will have been effectively minimized.

4.1.3 Quality Control Samples

Quality control (QC) samples to be collected during the sampling effort are identified below. QC samples include field duplicates, rinsate blanks, field blanks, and trip blanks. Each type of field quality control sample defined below will undergo the same processing as the associated environmental samples. The samples are to be submitted to the laboratory subcontractor for analysis of volatile organic compounds via CLP methodology. All analyses will be conducted on an accelerated turnaround term of 14 days.

4.1.3.1 Field Duplicates

Field Duplicates will be submitted at the rate of one for every 20 samples, per matrix, as prescribed for NEESA DQO Level D. Field personnel will note in the remarks block on the Chain-of-Custody Form which of the duplicate samples is to be used for internal laboratory duplicate analysis, however, field duplicates will be submitted as blinds to the laboratory. Field duplicates are collected by mixing a double portion of the required volume of sample and dividing it into two sample containers. Field duplicates provide precision information regarding homogeneity, handling, shipping, storing, preparation, and analysis.

4.1.3.2 Rinsate Blanks

Rinsate blanks are obtained under representative field conditions by running analyte-free deionized water through sample collection equipment after decontamination, and placing it in the appropriate sample containers for analysis. These samples are used to assess the effectiveness of decontamination procedures. Rinsate blanks will be prepared at the rate of one per sampling train per day and will be analyzed for the same parameters as the related samples. However, only rinsate blanks obtained from every other day will be analyzed unless significant positive detections for target analytes are noted.

4.1.3.3 Field Blanks

Field blanks are obtained by sampling the source water used for decontamination during the field investigation. Field blanks will be used to determine if the source water may be contributing to sample contamination. A field blank will be collected from the analyte-free water used in equipment decontamination and submitted at a frequency of one per sampling event. No potable water field blank will be collected and analyzed.

4.1.3.4 Trip Blanks

Trip blanks are defined as samples which originate from analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with the volatile organic (VOA) samples. One trip blank should accompany each cooler containing VOAs, should be stored at the laboratory with the samples, and analyzed by the laboratory. Trip blanks are only analyzed for VOAs.

4.2 SAMPLING PROCEDURES

Field sampling will be conducted in accordance with Section 3.1 of this document and the Halliburton NUS SOPs in Appendix B. A project sample summary is provided in Table 3-1. Allowable sample holding times and preservation requirements (Halliburton NUS SOP SA-6.1) are shown in Table 4-1.

4.2.1 Sampling Procedures

The equipment involved in field sampling activities will be decontaminated prior to and during sampling activities. All sampling equipment used for collecting samples will be decontaminated both prior to beginning field sampling and between samples. The following decontamination steps will be taken:

TABLE 4-1

SUMMARY OF ANALYSIS, BOTTLE REQUIREMENTS, PRESERVATION REQUIREMENTS AND HOLDING TIMES INDIAN HEAD, MARYLAND

Media	Analysis	Number of Samples(1)	Number of Containers per Sample	Container Type	Preservation Requirements	Holding Times
Soil	TCL volatile organic compounds	9	2	2 oz glass jars with teflon liners	Cool to 4° C	14 days
Groundwater and Stormwater	TCL volatile organic compounds	6	2	40 ml VOA vials	HCl to a pH <2 and cool to 4° C	14 days
Equipment Rinsate and Field Blanks	TCL volatile organic compounds	6	2	40 ml VOA vials	HCl to a pH <2 and cool to 4° C	14 days
Trip Blanks	TCL Volatile organic compounds	7	2	40 ml VOA vials	Cool to 4° C	14 days

HCl - Hydrochloric acid

(1) Includes field duplicates.

- Potable water rinse
- Alconox or Liquinox detergent wash
- Potable water rinse
- Analyte-free water rinse
- Isopropanol rinse
- Analyte-free water rinse
- Air dry

Additional requirements for sampling equipment decontamination can be found in Halliburton NUS SOP SF-2.3 (Appendix B) Alternately, dedicated or disposable sampling equipment may be used.

4.3 SAMPLE CUSTODY

The custody of field samples will be maintained, recorded, and tracked in accordance with Halliburton NUS SOPs in Appendix B.

4.4 CALIBRATION PROCEDURES

Monitoring equipment which requires calibration will only be required if entrance into a confined area is required. This is not expected to occur with this project. Field equipment normally requiring calibration will be calibrated and operated in accordance with the manufacturer's instructions and manuals. A log will be kept documenting the calibration results for each field instrument.

Calibration procedures for laboratory equipment used in the analysis of environmental samples will be performed in accordance with the laboratory quality assurance plan.

4.5 ANALYTICAL PROCEDURES

Environmental samples collected during the field investigations covered by this AFSP will be analyzed by General Physics Environmental Services (GPES). The analytical procedures will conform to NEESA DQO Level D as described in Section 4.1.1. Data assessment will be performed by Halliburton NUS personnel.

4.6 DATA REDUCTION

4.6.1 Field Measurements and Sample Collection

Raw data from field measurements will be recorded directly in field notebooks or on sample logs. Field data presented in data reports will be in original, unedited form and will comprise logs and chain-of-custody forms. If data are reduced for inclusion in summary tables, the method of reduction will be documented in the report.

4.6.2 Laboratory Services

Calculations of sample concentrations and QC measurements (e.g., recoveries) will be performed in accordance with the cited procedures and with the laboratory SOPs.

4.7 DATA REPORTING

Field data will be presented as site base maps, showing the locations of all sampling locations, data presentations maps, and cross-sections. Raw field data (e.g., sample collection logs) will be included in appendices.

The analytical data packages will be presented in CLP (U.S. EPA's Contract Laboratory Program) format, which includes all raw and backup data needed to perform data validation. Copies of the chain-of-custody forms received at the laboratory, copies of laboratory log-in documentation, sample preparation bench sheets, and instrument run logs will also be included in the data packages.

One hard copy of the data package will be submitted for inclusion in the final evidence files. The laboratory will also generate electronic deliverables, in accordance with Halliburton NUS CLEAN laboratory Basic Ordering Agreement (BOA) requirements.

The results of solid samples will be reported on a dry-weight basis. Reporting units will conform to those stipulated by the method.

4.8 DATA VALIDATION

An initial review of data obtained from field measurements will be performed by the Halliburton NUS FOL. This review will consist of checking procedures utilized in the field, ensuring that field measurement

instruments were properly calibrated, verifying the accuracy of transcriptions, and comparing data obtained in the field to historic measurements. An independent review of these parameters will be provided by a qualified person who is not a member of the project team.

An internal review of analytical data will be the responsibility of laboratory personnel. The laboratory analyst will initiate the data review process by examining and accepting the data. The completed data package will then be reviewed by the Data Reviewer. The Data Reviewer will provide a technical review for accuracy and precision according to the methods employed and laboratory protocols. He/she will also review for completeness of the data package (i.e., all pertinent information is included, all appropriate forms are signed and dated, calculations are correct, and holding times and QC sample acceptance criteria have been met). A final review of the data will be provided by the Laboratory Project Director to ensure that the data package meets the project specifications.

Validation of the data will be provided by a group of experienced Halliburton NUS chemists. Validation will be according to EPA Functional Guidelines for Validation of Organic Analyses and will cover 100% of the data. Where necessary, the Functional Guidelines will be adapted to incorporate EPA Region III and project-specific information. The results of the validation will be summarized in validation reports that include the following:

- Samples included in the validation,
- Validation guidelines used, including any project-specific modifications,
- Review elements, and
- Discussion of validation results, including any qualifiers appended.

Data validation qualifiers used will be from the National Functional Guidelines.

4.9 INTERNAL QUALITY CONTROL

Section 4.1.3 discussed the types and frequency of quality control samples that will be prepared during the field investigation activities. The quantities of the various types of the QA/QC samples are shown in Table 3-1; bottleware requirements are presented in Table 4-1.

Laboratory analyses for TCL volatile organic compounds will be conducted in accordance with the U.S. EPA CLP SOW OLM01.8.

4.10 PERFORMANCE AND SYSTEM AUDITS

System audits will be performed as appropriate, to assure that the work is being implemented in accordance with the approved project SOPs and in an overall satisfactory manner.

- The FOL will supervise and check on a daily basis that the equipment is thoroughly decontaminated, samples are collected and handled properly, and the field work is accurately and neatly documented in the field logbook (Halliburton NUS SOP SA-6.3).

- The data will be assessed by qualified Halliburton NUS personnel in accordance with the procedure described in Section 4.8.

- The project manager will oversee the FOL and data assessor, and check that management of the acquired data proceeds in an organized and expeditious manner.

- A formal audit of the field sampling procedures may be conducted at the discretion of the Navy and the CLEAN QA/QC manager, in addition to the auditing that is an inherent part of the daily project activities. If conducted, the auditor will check that sample collection, sample handling, decontamination protocols, and instrument calibration and use are in accordance with the approved project SOPs. The auditor will also check that the field documentation logs and chain-of-custody forms are being filled out properly.

4.11 PREVENTATIVE MAINTENANCE

Halliburton NUS 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 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 maintains the equipment manual library and trains field personnel in the proper use and care of equipment.

- 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 before being taken to the job site.

4.12 DATA ASSESSMENT PROCEDURES

4.12.1 Representativeness, Accuracy, and Precision

The PARCC parameters will be evaluated as discussed in Section 4.1.2.

4.12.2 Validation

A formal validation of the laboratory data will be conducted. The data will be assessed as described in Section 4.8.

4.12.3 Data Evaluation

The evaluation of the data collected during the field investigation will include the verification of the presence or absence of TCE or its degradation by-products in soil or groundwater under the Former Drum Loading Area or the water flowing into MH-1.

4.13 CORRECTIVE ACTION

The QA program will enable problems to be identified, controlled, and corrected. Potential problems may involve nonconformance with the SOPs and/or analytical procedures established for the project or other unforeseen difficulties. Any person identifying an unacceptable condition will notify the Project Manager. The Project Manager, with the assistance of the CLEAN QA/QC Manager, will be responsible for developing and initiating appropriate corrective action, and verifying that the corrective action has been effective. Corrective actions may include resampling and/or reanalysis of samples or modifying project procedures. If warranted by the severity of the problem (for example, if a change in the approved work plan is required), the Navy will be notified in writing and their approval will be obtained prior to implementing any change. Additional work that is dependent on a nonconforming activity will not be performed until the source of the problem has been addressed.

4.14 QUALITY ASSURANCE REPORTS/DOCUMENTS

A bound/weatherproof field logbook shall be maintained by the FOL. The FOL or designee shall record all information related to sampling or field activities. This information may include sampling time, weather conditions, unusual events, field measurements, description of photographs, etc. The site logbook maintained by the FOL will contain a summary of the day's activities and will reference the field notebooks when applicable.

Custody of samples must be maintained and documented at all times. Chain-of-custody begins with the collection of the samples in the field. Section 4.3 addresses the topic of chain-of-custody.

At the completion of field activities, the FOL shall submit to the Project Manager all field records, data, field notebooks, logbooks, chain-of-custody receipts, sample log sheets, daily activities records, weekly field summary reports, etc. The Project Manager shall ensure that these materials are entered into the project file.

Changes in project operating procedures may be necessary as a result of changed field conditions or unanticipated events. A summary of the sequence of events associated with field changes is as follows:

- The FOL notifies the Project Manager of the need for the change.
- If necessary, the Project Manager will discuss the change with the pertinent individuals (e.g., Navy personnel and CLEAN QA/QC Manager) and will provide a verbal approval or denial to the FOL for the proposed change.
- The FOL will document the change on a Field Modification Record and forward the form to the Project Manager at the earliest convenient time (e.g., end of the workweek).
- The Project Manager will sign the form and distribute copies to the Program Manager, CLEAN QA/QC Manager, FOL, and the project file.
- A copy of the completed Field Modification Record form will also be attached to the field copy of the affected document (i.e., AFSP).

5.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Halliburton NUS will be responsible for the overall management of the project, including all field sampling activities. Personnel from Navy will support Halliburton NUS in a number of areas during the project.

5.1 NAVY SUPPORT

Mr. Shawn Phillips is the Navy Remedial Project Manager (RPM). He will be the primary Navy point of contact for the sampling event. All project activities, including reporting and field activities, will be coordinated through Mr. Phillips. Any changes in scope will be approved through Mr. Phillips and the Contracting Officer prior to implementation. Mr. Phillips may be contacted at the following address:

Mr. Shawn Phillips, Code 181
EFA - Chesapeake
Naval Facilities Engineering Command
901 M Street, S.E.
Washington Naval Yard, Building 212
Washington, D.C. 20374-2121
(202) 685-3274

Ms. Kristene Tye will be the primary point of contact at Indian Head Division, NSWC. All field work will be coordinated through Ms. Tye; she will notify appropriate personnel (security, etc.) and make arrangements for any escorts required by the Navy. Ms. Tye may be contacted at the following address:

Ms. Kristene Tye, Code 0952F
Indian Head Division
Naval Surface Warfare Center
Building D-28
101 Strauss Avenue
Indian Head, MD 20640-5035
(301) 743-6745

5.2 PROJECT ORGANIZATION

The project will be staffed with personnel from the Pittsburgh office. The address and main phone number for the Pittsburgh office is:

Halliburton NUS Corporation
Foster Plaza VII
661 Andersen Drive
Pittsburgh, Pennsylvania 15220
(412) 921-7090

Key management staff and project staff members for this project are as follows:

• John Trepanowski, P.E.	-	Program Manager	(215) 971-0900
• Daryl Hutson	-	Deputy Program Manager	(412) 921-8608
• Joe Farrell	-	Contracting Officer	(215) 971-0900
• Debra Scheib	-	QA/QC Manager	(215) 921-8876
• Matt Soltis	-	Health and Safety Manager	(412) 921-8912
• George Latulippe, P.E.	-	Project Manager	(412) 921-8195
• Robert Simcik	-	Project Engineer	(412) 921-8163

The Project Manager has the primary responsibility for the project and technical management of this project. He is responsible for the coordination of all on-site personnel, and for providing technical assistance for all activities that are directly related to the project. If quality assurance problems or deficiencies requiring special action are identified, the Project Manager, Deputy Program Manager, and Quality Assurance Manager will identify the appropriate corrective action.

5.3 FIELD ORGANIZATION

The Halliburton NUS field investigation team will consist of a FOL. The FOL will be responsible for the coordination of all onsite Halliburton NUS subcontractor personnel and for providing technical assistance when required. The FOL, or his or her designee will coordinate and be present during all sampling activities and will assure availability and maintenance of all sampling materials/equipment. The FOL will be responsible for the completion of all sampling and chain-of-custody documentation, and will assume custody of all samples and ensure the proper handling and shipping of samples.

The Quality Assurance Manager, although not formally part of the field team, will be responsible for the adherence of all QA/QC guidelines. Strict adherence to these procedures is critical to the collection of acceptable and representative data.

The FOL will serve as the site Health and Safety Officer and is responsible for assuring that all team members adhere to the designated health and safety requirements.

APPENDIX A

FORMS

HALLIBURTON NUS
Environmental Laboratories
5350 CAMPBELLS RUN ROAD
PITTSBURGH, PA. 15206

NUS SAMPLE #

Client Name _____

Date Sampled _____ Time _____

Client Sample # _____

Sample Source _____

_____

CHAIN-OF-CUSTODY SEAL

HALLIBURTON NUS
Environmental Corporation

CUSTODY SEAL

Date

Signature

HALLIBURTON NUS
Environmental Corporation

CUSTODY SEAL

Date

Signature

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

HALLIBURTON NUS Environmental Corporation and Subsidiaries

CHAIN OF CUSTODY RECORD

PROJECT NO.:	SITE NAME:
SAMPLERS (SIGNATURE):	

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CON-TAINERS							REMARKS

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:	

NUS 440 REVISED 0891

Brown & Root Environmental

SAMPLE LOG SHEET

☐ Monitoring Well Data
☐ Domestic Well Data
☐ Other _____

Page _____ of _____

Case # _____

By _____

Project Site Name _____ Project Site Number _____

NUS Source No. _____ Source Location _____

Total Well Depth:	Purge Data						
Well Casing Size & Depth:	Volume	pH	S.C.	Temp. (°C)	TURB	DO	SAL
Static Water Level:							
One Casing Volume:							
Start Purge (hrs.):							
End Purge (hrs.):							
Total Purge Time (min.):							
Total Amount Purged (gal.):							
Monitor Reading:							
Purge Method:							
Sample Method:							
Depth Sampled:							
Sample Date & Time:	Sample Data						
	pH	S.C.	Temp. (°C)	TURB	DO	SAL	
Sampled By:							
Signature(s):	Observations / Notes:						

Type of Sample

☐ Low Concentration
☐ High Concentration
☐ Grab
☐ Composite
☐ Grab - Composite

Analysis:	Preservative				

SAMPLE LOG SHEET

Brown & Root Environmental

☐ Spring
☐ Lake
☐ Stream
☐ Other _____

Page _____ of _____

Case # _____

By _____

Project Site Name _____ Project Site Number _____

NUS Source No. _____ Source Location _____

Sample Method:	Sample Data				
	pH	S.C.	Temp. (°C)	Color & Turbidity	
Depth Sampled:					
Sample Date & Time:					
	DO	Eh	SALINITY		
Sampled By:					
Signatures:					

Type of Sample

☐ Low Concentration
☐ High Concentration
☐ Grab
☐ Composite
☐ Grab - Composite

Analysis:	Preservative	Bottle Req.

Brown & Root Environmental

DAILY ACTIVITIES RECORD

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

Brown & Root Environmental

BORING LOG

PROJECT: _____ BORING NO.: _____

PROJECT NO.: _____ DATE: _____ DRILLER: _____

ELEVATION: _____ FIELD GEOLOGIST: _____

WATER LEVEL DATA: _____

(Date, Time & Conditions) _____

SAMPLE NO. & TYPE	DEPTH (FT.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION*			ROCK BR. OR USCS	REMARKS
					SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION		

REMARKS _____

BORING _____

PAGE ____ OF ____

* See Legend on Back

Brown & Root Environmental

MULTIPLE SAMPLE LOG SHEET

PAGE ___ OF ___

☐ SURFACE SOIL
☐ SUBSURFACE SOIL
☐ SEDIMENT
☐ LAGOON/POND
☐ OTHER

SAMPLER(S) SIGNATURE _____

PROJECT NAME: _____

PROJECT NUMBER: _____

AREA DESIGNATION _____

Sample No.	SAMPLE METHOD	DEPTH (FT)	DATE	TIME	SAMPLED BY	CONCENTRATION (L)LOW (H)HIGH	(G)GRAB (C)COMPOSITE	ANALYSES							No. OF CONT. TOTAL	SOIL DESCRIPTION

REMARKS:

LAB:

COC NO:

ACAD. C:\FORMS\SAMPLOG.DWG 02/17/95 10

INCIDENT REPORT

Report No. _____

Site: _____ Project No. _____

Location: _____

Date of Report: _____ Preparer's Name: _____

Name and Address of Injured: _____ SSN: _____ Age: _____

_____ Sex: _____

Years of Service: _____ Time of Present Job: _____ Title/Classification: _____

Division/Department: _____ Date of Incident: _____ Time: _____

Incident Category: _____ Motor Vehicle _____ Property Damage _____ Fire

___ Chemical Exposure _____ Near-Miss _____ Other

Severity of Injury or Illness: __ Nondisabling __ Disabling

__ Medical Treatment __ Fatality

Amount of Damage: $_____ Property Damage: _____

Estimated Number of Days Away from Job: _____

Nature of Injury or Illness: _____

1. CLASSIFICATION OF INJURY:

_____ Fractures
_____ Dislocations
_____ Sprains
_____ Abrasions
_____ Lacerations
_____ Punctures
_____ Bites
_____ Respiratory Allergy

_____ Heat Burns
_____ Chemical Burns
_____ Radiation Burns
_____ Bruises
_____ Blisters
_____ Respiratory Exposure
_____ Ingestion
_____ Dermal Allergy

___ Cold Exposure
___ Frostbite
___ Heat Stroke
___ Heat Exhaustion
___ Concussion
___ Faint/Dizziness

Part of Body Affected: _____

Degree of Disability: _____

Date Medical Care Was Received: _____

Where Medical Care Was Received: _____

Address (if off site): _____

2. INCIDENT LOCATION

Causative agent most directly related to accident (object, substance, material, machinery, equipment, conditions): _____

_____

_____

_____

Was weather a factor? _____

Unsafe mechanical/physical/environmental condition at time of accident (Be specific):

_____

_____

_____

Unsafe act by injured and/or others contributing to the accident (Be specific, must be answered):

_____

_____

_____

Personal factors (improper attitude, lack of knowledge or skill, slow reaction, fatigue):

_____

_____

_____

Level of personal protection equipment required in Site Safety Plan:

_____

_____

_____

Modifications: _____

_____

_____

Was injured using required equipment? _____

_____

_____

If not, how did actual equipment use differ from plan? _____

_____

_____

What can be done to prevent a recurrence of this type of accident (modification of machine; mechanical guards; correct environment; training)?

_____

_____

_____

Detailed narrative description (how did accident occur, why; objects, equipment tools used, circumstances, assigned duties). Be specific:

_____

_____

_____

(Use back of sheet, as required)

Witnesses to accident: _____

_____

_____

Signature of Preparer _____

Signature of Site Manager _____

3. DEPARTMENT APPRAISAL AND RECOMMENDATION

In your opinion, what actions or equipment contributed to this accident?

_____

_____

_____

Your recommendation:

_____

_____

_____

Date: _____ Signature of Department Manager _____

4. COSTS OF THE INCIDENT (TO BE COMPLETED BY HEALTH SCIENCES DEPARTMENT)

Temporary total _____

Death or permanent total _____

Started losing time _____

Returned to work _____

Time charge _____

Compensation $_____

Other $_____

Permanent partial _____

Part of body _____

Percent loss or

loss of use _____

Time charge _____

Medical $_____

Total $_____

Name and Address

of Hospital _____

_____

Name and Address

of Physician _____

_____

cc: Office Health and Safety Supervisor

Office Manager

Manager of Health Sciences

Medical Consultant

INCIDENT FOLLOW-UP REPORT

(To be Completed by Health Sciences Department)

Date of Incident: _____

Name: _____ Employee No. _____

Site: _____

Brief description of incident: _____

_____

_____

_____

_____

_____

_____

Outcome of incident: _____

_____

_____

_____

_____

_____

_____

Physician's recommendations: _____

_____

_____

_____

_____

_____

Date returned to work: _____

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

cc: Office Health and Safety Supervisor

Office Manager

Manager of Health Sciences

Medical Consultant

APPENDIX B

HALLIBURTON NUS
STANDARD OPERATING PROCEDURES

APPENDIX B

HALLIBURTON NUS STANDARD OPERATING PROCEDURES (SOPs)

SA-6.1	Sample Handling
SA-6.3	Site Logbook
SF-2.3	Decontamination of Chemical Sampling and Field Analytical Equipment
GH-1.3	Soil and Rock Sampling
GH-1.6	Decontamination of Drilling Rigs and Monitoring Well Materials

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1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide information on chain-of-custody, sample preservation, packaging, and shipping procedures to be used as Brown & Root Environmental policy in handling environmental samples for chemical constituent and geotechnical analysis.

2.0 SCOPE

This procedure:

- Describes the steps necessary for transferring samples through the use of Chain-of-Custody Record Forms.
- 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

Chain-of-Custody Record Form - A Chain-of-Custody Record Form is a printed, three-part form that accompanies a sample or group of samples while custody of the sample(s) is transferred from one custodian to another custodian.

The Chain-of-Custody Record Form is a three-page, carbon-copy-type form (Attachment B). The original and one copy of the form accompanies the samples during shipment, and the third copy is retained in the site file.

Custodian - The person responsible for the custody of samples at a particular time, until custody is transferred to another person (and so documented), who then becomes custodian. A sample is under your custody if:

- It is in your actual possession.
- It is in your view, after being in your physical possession.
- It was in your physical possession until locked up to prevent tampering.
- It is in a designated and identified secure area.

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. The term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials as defined in this section; materials designated as hazardous under the provisions of §172.101 and §172.102 of this subchapter; and materials that meet the defining criteria for hazard classes and divisions in Part 173 of this subchapter.

Hazardous Waste - Any substance listed in 40 CFR, Subpart D (ÿ261.30 et seq.), or otherwise characterized as ignitable, corrosive, reactive, or EP toxic as specified under 40 CFR, Subpart C (ÿ261.20 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 or n.o.i.b.n (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.

Preservatives:

- Hydrochloric Acid - HCl
- Sulfuric Acid - H_2SO_4
- Nitric Acid - HNO_3
- Sodium Hydroxide - NaOH

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, 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

5.1 SAMPLE IDENTIFICATION AND CHAIN OF CUSTODY

5.1.1 Overview

A Chain-of-Custody Record Form is required, without exception, for the tracking and recording of all samples collected for onsite or offsite analysis (chemical or geotechnical) during program activities. Use of the Chain-of-Custody Record Form creates an accurate, written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis.

5.1.2 Sample Identification

The method of sample identification depends on the type of measurement or analysis performed. When in-situ measurements are made, the data are recorded directly in bound logbooks or other field data records, with identifying information.

Samples, other than in-situ measurements, are removed and transported from the sample location to a laboratory or other location for analysis. Before removal, however, a sample is often divided into portions, depending upon the analyses to be performed. Each portion is preserved in accordance with the Sampling Plan. Each sample container is identified by a sample label (see Attachment A). The information recorded on the sample label includes:

- **Project**: Site name or project number (obtained from the Project Manager).
- **Station Location**: The unique sample number identifying this sample (can be obtained from the Sampling Plan).
- **Date**: A six-digit number indicating the month, day, and year of sample collection; e.g., 12/21/85.
- **Time**: A four-digit number indicating the time of collection within a 24-hour period (for example: 0954 is 9:54 a.m., and 1629 is 4:29 p.m.).
- **Medium**: Water, soil, sediment, sludge, waste, etc.
- **Concentration**: The expected concentration (i.e., low, medium, high).
- **Sample Type**: Grab or composite.
- **Preservation**: Type of preservation added and pH levels.
- **Analysis**: Volatile organic analyses (VOA), base neutral acids (BNAs), polychlorinated biphenyls (PCBs), pesticides, metals, cyanide, other.

- **Sampled By:** Sampler's initials.
- **Case Number:** The case number assigned by the U.S. EPA Sample Management Office (SMO).
- **Traffic Report Number:** The number obtained from the Traffic Report Label.
- **Remarks:** Any pertinent additional information.

For various reasons, sometimes it is desirable to keep the name of the site confidential. Using just the project number on the sample label maintains the anonymity of sites. This may be necessary, even to the extent of preventing the laboratory performing analysis from knowing the identity of the site (e.g., if the laboratory is part of an organization that has performed previous work on the site).

5.1.3 Chain-of-Custody Procedures

After collection, separation, identification, and preservation, the sample is maintained under chain-of-custody procedures until it is in the custody of the analytical laboratory and has been stored or disposed of.

5.1.3.1 Field Custody Procedures

- Samples are collected as described in the site-specific Sampling Plan. Care must be taken to record precisely the sample location and to ensure that the sample number on the label matches the sample log sheet and Chain-of-Custody Record Form exactly.
- The person undertaking the actual sampling in the field is responsible for the care and custody of the samples collected until they are properly transferred or dispatched.
- When photographs are taken of the sampling as part of the documentation procedure, the name of the photographer, date, time, site location, and site description are entered sequentially in the site logbook as photos are taken. Once developed, the photographic prints are serially numbered, corresponding to the logbook descriptions.
- Sample labels are completed for each sample, using waterproof ink unless prohibited by weather conditions (e.g., a logbook notation would explain that a pencil was used to fill out the sample label because a ballpoint pen would not function in freezing weather).

5.1.3.2 Transfer of Custody and Shipment

Samples are accompanied by a Chain-of-Custody Record Form. A sample Chain-of-Custody Record Form is provided in Attachment B. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the sample custody transfer from the sampler, often through another person, to the analyst in the laboratory. The Chain-of-Custody Record is filled out as follows:

- Enter header information (project number, samplers, and project name -- project name if approved by Project Manager).
- Sign, date, and enter the time under "Relinquished by" entry.

- Enter station number. The station number represents the sample location (e.g., MW-01) rather than the sample number (e.g., MW-01-FT02).
- Check composite or grab sample.
- Enter station location number. The station number is the official sample number, as designated in the Sampling Plan.
- Enter the total number of containers per station number and the type of each bottle.
- Make sure that the person receiving the sample signs the "Received by" entry, or enter the name of the carrier (e.g., UPS, Federal Express) under "Received by." Receiving laboratory will sign "Received for Laboratory by" on the lower line and enter the date and time.
- Enter the bill-of-lading or Federal Express airbill number under "Remarks," in the bottom right corner, if appropriate.
- Place the original (top, signed copy) and one carbon-type copy of the Chain-of-Custody Record Form in a large, ziplock baggie in the appropriate sample shipping package. Retain the third carbon copy with the field records.
- Sign and date the custody seal (a 1- by 3-inch white paper label with black lettering and an adhesive backing). Custody seals used are shown in Attachment C. The custody seal is part of the chain-of-custody process and is used to detect tampering with samples after they have been collected in the field. Custody seals are provided by the Laboratory Sample Coordinator on an as-needed basis.
- Place the seal across the shipping container (front and back of lid) opening, so that at least one seal would be broken if the container was opened.
- Complete other carrier-required shipping papers.

The custody record is completed using black, waterproof ink. Any corrections are made by drawing a line through and initialing and dating the change, then entering the correct information. Erasures are not permitted.

Common carriers will usually not accept responsibility for handling Chain-of-Custody Record Forms; this necessitates packing the record in the sample container (enclosed with other documentation in a plastic zip-lock bag). If custody forms are sealed inside the sample container and the custody seals are intact, commercial carriers are not required to sign off on the custody form.

If sent by mail, the package will be registered with return receipt requested. If sent by common carrier or air freight, proper documentation must be maintained.

The laboratory representative who accepts the incoming sample shipment signs and dates the Chain-of-Custody Record, completing the sample transfer process. It is then the laboratory's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis.

5.2 SAMPLE PRESERVATION

5.2.1 Overview

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. It is therefore critical to select the correct container to maintain the quality of the sample prior to analysis.

Many water and soil samples are unstable and therefore require preservation when the time interval between field collection and laboratory analysis is long enough to produce 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. The purpose of these techniques is to (1) retard biological activity, (2) retard hydrolysis of chemical compound/complexes, (3) reduce constituent volatility, and (4) reduce adsorption effects.

5.2.2 Sample Containers

For most environmental samples, either glass or plastic (typically, polyethylene, or PE) containers are satisfactory. In general, if the analyte(s) to be determined is organic in nature, the container shall be made of glass. If the analyte(s) is inorganic, then the container shall be plastic. Since container specification will depend on the analyte and sample matrix types (as indicated in Attachment D), duplicate samples shall be taken when both organic and inorganic analyses are required. Containers shall be kept in the dark (to minimize biological or photooxidation/photolysis breakdown of constituent) until they reach the analytical laboratory. The sample container shall allow approximately 5-10 percent air space ("ullage") to allow for expansion/vaporization if the sample is heated during transport (1 liter of water at 4°C expands by 15 mL if heated to 130°F/55°C). However, for collection of volatile organic compounds, head space shall be omitted.

Generally, the analytical laboratory shall provide certified-clean containers that have been cleaned according to U.S. EPA procedures. Sufficient lead time shall be allowed for a final delivery of all bottle orders.

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 missing Teflon liner (if required for the container), shall be discarded.

General sample container and sample volume requirements are listed in Attachment D. Specific container requirements are listed in Attachment E.

5.2.3 Preservation Techniques

The preservation techniques to be used for various analytes are listed in Attachments D and E. 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). 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 D and E indicate the specific analytes which require these preservatives.

5.2.3.1 Addition of Acid (H_2SO_4, HCl, or HNO_3) or Base (NaOH)

Addition of the following acids or bases may be specified for sample preservation; these reagents shall be analytical reagent (AR) grade and shall be diluted to the required concentration with double-distilled, deionized water in the laboratory, before field sampling commences:

Acid/Base	Concentration	Normality	Amount for Preservative
Hydrochloric Acid (HCl)	1:1 dilution of concentrated HCl	6N	5-10 mL*
Sulfuric Acid (H_2SO_4)	1:1 dilution of concentrated H_2SO_4	18N	2 - 5 mL*
Nitric Acid (HNO_3)	Undiluted concentrated HNO_3	16N	2 - 5 mL*
Sodium Hydroxide (NaOH)	400 grams solid NaOH in 870 mL water	10N	2 mL**

* Amount of acid to add (at the specified strength) per liter of water to reduce the sample pH to less than 2, assuming that the water is initially at pH 7, is poorly buffered, and does not contain particulate matter.

** Amount of base to add per liter of water to raise the sample pH to 12.

The approximate volumes needed to acidify one liter of neutral water to a pH of less than 2 (or raise the pH to 12) are shown in the last column of the above table. These volumes are only approximate; if the water is more alkaline, contains inorganic or organic buffers, or contains suspended particles, more acid may be required. The final pH must be checked using narrow-range pH paper.

Sample acidification or base addition shall proceed as follows:

- Check initial pH of sample with wide range (0-14) pH paper.
- Fill sample bottle to within 5-10 mL of final desired volume and add about one-half of estimated acid or base required; stir gently and check pH with medium range pH paper (pH 0-6 or pH 7.5-14, respectively).

- Add acid or base a few drops at a time while stirring gently or gently invert capped sample container. Check for final pH using narrow range (0-2.5 or 11-13, respectively) pH paper; when desired pH is reached, cap sample bottle and seal.

  Never dip pH paper into the sample; apply a drop of sample to the pH paper using the clean stirring rod or pour from container lid.

5.2.3.2 Cyanide Preservation

Pre-sample preservation is required if oxidizing agents, such as chlorine, are suspected to be present. To test for oxidizing agents, place a drop of the sample on KI-starch paper; a blue color indicates the need for treatment. Add ascorbic acid to the sample, a few crystals at a time, until a drop of sample produces no color on the KI-starch paper. Then add an additional 0.6 g of ascorbic acid for each liter of sample volume. Add NaOH solution to raise the pH to greater than 12, as described in 5.2.3.1. If oxidizing agents are not suspected, add NaOH as directed.

5.2.3.3 Sulfide Preservation

Samples for sulfide analysis must be preserved by the addition of 4 drops (0.2 mL) of 2N zinc acetate solution per 100 mL of sample. The sample pH is then raised to 9 using NaOH. The 2N zinc acetate solution is made by dissolving 220 g of zinc acetate in 870 mL of distilled water to make 1 liter of solution.

5.2.3.4 Preservation of Organic Samples Containing Residual Chlorine

Some organic samples containing residual chlorine must be treated to remove this chlorine upon collection (see Attachment E). Test the samples for residual chlorine using EPA Methods 330.4 or 330.5 (Field Test Kits are available for this purpose). If residual chlorine is present, add 0.008 percent sodium thiosulfate (80 mg per liter of sample).

Certified clean and pre-preserved (with HCl) VOA vials can be obtained directly from the manufacturer. Containers comply with the required detection limits established by the U.S. EPA in "Specifications and Guidance for Contaminant-Free Sample Containers."

5.2.3.5 Field Filtration

When the objective is to determine concentration of dissolved inorganic constituents in a water system, the sample must be filtered through a non-metallic, 0.45-micron membrane filter immediately after collection. A filtration system is recommended if large quantities of samples must be filtered in the field. 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. Because the sample never comes in contact with the pump, sampling integrity is ensured. The silicon tubing is threaded through the pump head of the peristaltic pump. Then, the filter canister (note the flow direction arrow) is inserted on the discharge end of the silicon tubing, and the intake end of the silicon tubing is placed into the aqueous sample to be filtered. The peristaltic pump is turned on and the filtrate is collected in a suitable bottle (see Section 5.2.2) and is immediately acidified to pH 2.0 or less with nitric acid, the purity of which is consistent with the measurement to be made.

Samples used for determining temperature, dissolved oxygen, Eh, and pH should not be filtered. Do not use vacuum filtering prior to determining carbonate and bicarbonate concentration because it

removes dissolved carbon dioxide and exposes the sample to the atmosphere. Pressure filtration can be accomplished using water pressure from the well. If gas pressure is required, use an inert gas such as argon or nitrogen.

Do not filter samples for analysis of volatile organic compounds. If samples are to be filtered for analyzing other dissolved organic constituents, use a glass-fiber or metal-membrane filter and collect the samples in a suitable container (see Section 5.2.2). Because most organic analyses require extraction of the entire sample, do not discard any of it. After filtering, the membrane containing the suspended fraction can be sealed in a glass container and analyzed separately as soon as practicable. Total recoverable inorganic constituents may be determined using a second, unfiltered sample collected at the same time as the sample for dissolved constituents.

5.3 SAMPLE PACKAGING AND SHIPPING

5.3.1 Introduction

Samples collected for shipment from a site shall be classified as either environmental or hazardous material (or waste) samples. In general, environmental samples are collected off site (for example from streams, ponds, or wells) and are not expected to be grossly contaminated with high levels of hazardous materials. Onsite samples (for example, soil, water, and materials from drums or bulk storage tanks, obviously contaminated ponds, lagoons, pools, and leachates from waste sites) are considered hazardous. 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.

5.3.2 Environmental Samples

5.3.2.1 Packaging

Environmental samples are packaged as follows:

- Place sample container, properly identified and with a sealed lid, in a polyethylene bag, and seal the bag.
- Place sample in a cooler constructed of sturdy material which has been lined with a large, polyethylene bag.
- Pack with enough noncombustible, absorbent, cushioning materials (shoulders of bottles should be iced if required) to minimize the possibility of the container breaking.
- If cooling is required (see Attachments D and E), place ice in zip-lock bags, on container lids (minimum of 8 pounds of ice for a medium-size cooler).
- Seal large bag.

- Attach appropriate chain-of-custody form to inside lid of container.
- Close and seal outside container.

5.3.2.2 **Marking/Labeling**

Sample containers must have a completed sample identification tag, and the outside container (cooler) must be marked "Environmental Sample." The appropriate side of the container must be marked "This End Up" and arrows placed appropriately. No DOT marking or labeling is required.

5.3.2.3 **Shipping Papers**

No DOT shipping papers are required. However, the appropriate chain-of-custody forms must be included with the shipment.

5.3.2.4 **Transportation**

There are no DOT restrictions on mode of transportation.

5.3.3 **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.

5.3.3.1 **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 G of this document.)

To determine the proper shipping name, use the following steps to help in locating 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 go to the general hazard class for a proper shipping name. For example, Flammable Liquid, n.o.s, or Oxidizer, n.o.s.

5.3.3.2 **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 F of this document.)

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 G of this document.

5.3.4 **Packaging and Shipping of Samples Classified as Flammable Liquid (or Solid)**

5.3.4.1 **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. Collect sample in the prescribed container with a nonmetallic, Teflon-lined screw cap. To prevent leakage, fill container no more than 90 percent full. Seal lid with 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, one sample per bag. Position sample identification label so that it can be read through bag. Seal bag.

4. Place sealed bag inside metal can 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.

5. Place one or more metal cans (or single 1-gallon bottle) into a strong outside container, such as a metal picnic cooler or a DOT-approved fiberboard box. Surround cans 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 of Section 5.3.4.2.

5.3.4.2 **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. Then 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.

5.3.4.3 **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.

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.

5.3.4.4 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 Field Team Leader 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 H) 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 I.

5.3.5 Shipment of Lithium Batteries

Monitoring well data are analyzed using either the Hermit SE 1000, or the Hermit SE 2000 Long-term monitor. 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 Field Team Leader 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 J. 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 J. 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.

7.0 ATTACHMENTS

Attachment A - Sample Label
Attachment B - Chain-of-Custody Record Form
Attachment C - Chain-of-Custody Seal
Attachment D - General Sample Container and Preservation Requirements CERCLA/RCRA Samples
Attachment E - Required Containers, Preservation Techniques, and Holding Times (sheets)
Attachment F - DOT Hazardous Material Classification (49 CFR 173.2)
Attachment G - Guide for Hazardous Materials Shippers
Attachment H - Hazardous Materials Shipping Check list
Attachment I - DOT Segregation and Separation Chart
Attachment J - Lithium Battery Shipping Papers

ATTACHMENT A

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 ☐	HNO3 to pH < 2 ☐
METALS: TOTAL ☐ DISSOLVED ☐	NaOH to pH > 12 ☐
CYANIDE ☐	_____ ☐
_____ ☐	

Sampled by: _____

Case No. _____ Traffic Report No. _____

Remarks:

ATTACHMENT B

CHAIN-OF-CUSTODY RECORD
(Original is 8.5 x 11")

	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 C

CHAIN-OF-CUSTODY SEAL

CUSTODY SEAL

Date

Signature

CUSTODY SEAL

Date

Signature

ATTACHMENT D

GENERAL SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS CERCLA/RCRA SAMPLES

Sample Type and Concentration		Container[1]	Sample Size	Preservation[2]	Holding Time[2]
WATER					
Organics (GC&GC/MS)	VOA Low	Borosilicate glass	2 x 40 mL	Cool to 4°C HCl to ≤ 2	14 days[9]
	Extractables Low Medium	Amber glass	2x2 mL or 4x1 L 4 x 32 oz.	Cool to 4°C None	7 days to extraction; 40 days after extraction
Inorganics	Metals Low Medium	High-density polyethylene Wide-mouth glass	1 L 16 oz.	HNO_3 to pH ≤2 None	6 months (Hg-28 days) 6 months
	Cyanide Low Medium	High-density polyethylene Wide-mouth glass	1 L 16 oz.	NaOH to pH>12 None	14 days
Organic/ Inorganic	High Hazard	8-oz. wide-mouth glass	6 oz.	None	14 days
COD	Low	High-density polyethylene	0.5 L	H_2SO_4 to pH <2 Cool to 4°C	28 days
TOC	Low	High-density polyethylene	0.5 L	HCl to pH <2 Cool to 4°C	28 days
Oil & Grease	Low	Glass	1.0 L	H_2SO_4 to pH <2 Cool to 4°C	28 days
Phenols	Low	High-density polyethylene	1.0 L	H_2SO_4 to pH <2 Cool to 4°C	28 days
General Chemistry	---	High-density polyethylene	1.0 L	Cool to 4°C	---
SOIL					
Organics (GC&GC/MS)	VOA	2 x 120 mL (4-oz.) wide-mouth glass	240 mL	Cool to 4°C	14 days
	Extractables Low Medium	8-oz. or 2 x 4-oz. (120 mL) wide-mouth glass	6 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
Inorganics	Low/Medium	8-oz. or 2 x 4-oz. (120 mL) wide-mouth glass	6 oz.	Cool to 4°C	6 months (Hg - 28 days) Cyanide (14 days)
Organic/ Inorganic	High Hazard	8-oz. (120 mL) wide-mouth glass	6 oz.	None	NA
Dioxin	All	4-oz. (120 mL) wide-mouth glass	4 oz.	None	7 days until extraction; 40 days after extraction
EP Toxicity	All	250 mL high-density polyethylene	200 grams	None	NA
AIR					
Volatile Organics	Low Medium	Charcoal tube -- 7 cm long, 6 mm OD, 4 mm ID	100 L air	Cool to 4°C	NA

(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 E

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	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Biochemical Oxygen Demand	P, G	Cool, 4°C	48 hours
Bromide	P, G	None required	28 days
Biochemical Oxygen Demand, Carbonaceous	P, G	Cool, 4°C	48 hours
Chemical Oxygen Demand	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
Hydrogen Ion (pH)	P, G	None required	Analyze immediately
Kjeldahl and Organic Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Nitrate	P, G	None required	48 hours
Nitrate-Nitrite	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Nitrite	P, G	Cool, 4°C	48 hours
Oil & Grease	G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Organic Carbon	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 (elemental)	G	Cool, 4°C	48 hours
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	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	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 E
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
Surfactants	P, G	Cool, 4°C	48 hours
Temperature	P, G	None required	Analyze immediately
Turbidity	P, G	Cool, 4°C	48 hours
METALS:[7]			
Chromium VI	P, G	Cool, 4°C	24 hours
Mercury	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] Acrylonitrile	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[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
Chlorinated Hydrocarbons[11]	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
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 E
REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
PAGE THREE

Parameter Number/Name	Container[1]	Preservation[2][3]	Maximum Holding Time[4]
PESTICIDES TESTS:			
Pesticides[11]	G, Teflon-lined cap	Cool, 4°C; pH 5 - 9 [15]	7 days until extraction; 40 days after extraction
RADIOLOGICAL TESTS:			
1-5 Alpha, beta and radium	P, G	HNO_3 to pH 2	6 months

(1) Polyethylene (P) or Glass (G)
(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 mails, 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 F

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 F (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 G

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 G (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 th 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 H

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 I

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 J
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:

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

Additional Handling Information

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)

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.

ATTACHMENT J (CONTINUED)
LITHIUM BATTERY SHIPPING PAPERS

LITHIUM BATTERIES CONTAINED IN EQUIPMENT.
UN-3091.
SHIPPED UNDER CA-9206009

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Subject SITE LOGBOOK		Approved D. Senovich	

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1.0 PURPOSE

This procedure describes the process for keeping a site logbook.

2.0 SCOPE

The site logbook is a controlled document which records all major on-site activities during a Remedial Investigation/Feasibility Study. At a minimum, the following activities/events shall be recorded in the site logbook:

- Arrival/departure of site visitors
- Arrival/departure of equipment
- Sample pickup (chain-of-custody form numbers, carrier, time)
- Sampling activities/sample logsheet numbers
- Start or completion of borehole/trench/monitoring well installation or sampling activities
- Health and Safety issues

The site logbook is initiated at the start of the first on-site activity (e.g., initial reconnaissance survey). Entries are made for every day that on-site activities take place which involve RI/FS contractor personnel. One current site logbook is maintained per site.

The site logbook becomes part of the permanent site file maintained in the RI contractor's office. Because information contained in the site logbook may be admitted as evidence in cost recovery or other legal proceedings, it is critical that this document be properly maintained.

3.0 GLOSSARY

Site Logbook - The logbook is a bound notebook with consecutively numbered pages that cannot be removed. Upon entry of data, the logbook requires signature by the responsible site leader (see Section 5.1).

4.0 RESPONSIBILITIES

The site logbook is issued by the Regional Manager (or his designee) to the Site Manager for the duration of the project. The Site Manager releases the site logbook to the Field Operations Leader or other person responsible for the direction of on-site activities (e.g., Reconnaissance Survey Team Leader, Sampling Team Leader). It is the responsibility of this person (or his designee) to keep the site logbook current while in his possession, and return it to the Site Manager or turn it over to another field team. Following the completion of all fieldwork, the site logbook is returned to the Site Manager for inclusion in the permanent site files.

5.0 PROCEDURES

5.1 GENERAL

The cover of each site logbook contains the following information:

- Project Name
- NUS Project Number
- RI/FS Contractor and Site Manager's Name
- Sequential Book Number

- Start Date
- End Date

Daily entries into the logbook may contain a variety of information. At the beginning of each day the following information must be recorded:

- Date
- Start time
- Weather
- All field personnel present
- Any visitors present

During the day, a summary of all site activities and level of personal protection shall be recorded in the logbook. The information need not duplicate that recorded in other field notebooks (e.g., sample logbook, Site Geologist's notebook, Health and Safety Officer's notebook, etc.), but shall summarize the contents of these other notebooks and refer to the page locations in these notebooks for detailed information. An example of a site logbook page is shown in Attachment A.

The sample logsheet for each sample collected (see Procedure SA-6.6) must be referenced. 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 notebook and page number(s) on which they are recorded (see Attachment A).

All entries shall be made in black pen. 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 must be signed. It must also be signed by the Field Operations Leader or responsible site leader at the end of each day.

5.2 PHOTOGRAPHS

When movies, slides, or photographs are taken of a site or any monitoring location, they are numbered to correspond to logbook entries. The name of the photographer, date, time, site location, site description, and weather conditions are 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 may be used to account for routine film processing. Once processed, the slides of photographic prints shall be serially numbered and labeled according to the logbook descriptions.

6.0 REFERENCES

None.

7.0 ATTACHMENTS

Attachment A - Typical Site Logbook Entry

ATTACHMENT A
TYPICAL SITE LOGBOOK ENTRY

START TIME: _____ DATE: _____

SITE LEADER: _____
PERSONNEL:

NUS	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 offsite, gate locked.

_____
Field Operations Leader

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Subject DECONTAMINATION OF CHEMICAL SAMPLING AND FIELD ANALYTICAL EQUIPMENT		Approved D. Senovich	

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6.0 REFERENCES

7.0 RECORDS

1.0 PURPOSE

The purpose of these procedures is to provide a general methodology, protocol, and reference information on the proper decontamination procedures to be used on chemical sampling and field analytical equipment.

2.0 SCOPE

This procedure addresses chemical sampling and field analytical equipment only, and should be consulted when equipment decontamination procedures are being developed as part of project-specific plans.

3.0 GLOSSARY

None.

4.0 RESPONSIBILITIES

Site Manager - responsible for ensuring that project-specific plans and the implementation of field investigations are in compliance with these guidelines.

Field Operations Leader - responsible for ensuring that decontamination procedures for all chemical sampling and field analytical equipment are programmed prior to the actual field effort and that personnel required to accomplish the task have been briefed and trained to execute the task.

5.0 PROCEDURES

In order to assure that chemical analysis results are reflective of the actual concentrations present at sampling locations, chemical sampling and field analysis equipment must be properly decontaminated prior to the field effort, during the sampling program (i.e., between sample points) and at the conclusion of the sampling program. This will minimize the potential for cross-contamination between sample points and the transfer of contamination offsite.

This procedure incorporates only those aspects of decontamination not addressed in other procedures. Specifically it incorporates those items involved in decontamination of chemical sampling and field analytical equipment.

5.1 ACCESS FOR SAMPLING

5.1.1 Bailers and Bailing Line

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

Before the initial sampling and after each succeeding sampling point, the bailer must be decontaminated. The following steps should be followed if sampling for organic contaminants:

- Potable water rinse
- Alconox or Liquinox detergent wash
- Scrubbing of the line and bailer with a scrub brush may be required if the sample point if heavily contaminated with heavy or extremely viscous compounds
- Potable water rinse
- Rinse with 10 percent nitric acid solution*
- Deionized water rinse
- Acetone or methanol rinse
- Hexane rinse**
- Distilled/Deionized water rinse
- Air dry

If sampling for organics only, the nitric acid, acetone, methanol, and hexane rinses may be omitted. Contract-specific requirements may permit alternative procedures.

Braided nylon or polypropylene lines may be used with a bailer, however, the same line must not come in contact with the sample medium, otherwise, the line must be discarded in an approved receptacle and replaced. Prior to use, the bailer should be wrapped in aluminum foil or polyethylene sheeting.

5.1.2 Sampling Pumps

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

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

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

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

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

5.1.3 Filtering Equipment

Part of the sampling plan may incorporate the filtering of groundwater samples, and subsequent preservation. This should occur as soon after sample retrieval as possible; preferably in the field as soon as the sample is obtained. To this end, three basic filtration systems are most commonly used - the in-line disposable Teflon filter, the inert gas over-pressure filtration system, and the vacuum filtration system.

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

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

5.2 FIELD ANALYTICAL EQUIPMENT

5.2.1 Water Level Indicators

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

- Rinse with potable water
- Rinse with deionized water
- Acetone or methanol rinse
- Rinse with deionized water

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

5.2.2 Probes

Probes, e.g., pH or specific ion electrodes, geophysical probes, or thermometers which would come in direct contact with the sample, will be decontaminated using the procedures specified above unless manufacturer's instructions indicate otherwise; in those cases, the methods of decontamination must be clearly described in the FSAP. Probes that contact a volume of groundwater not used for laboratory analyses can be rinsed with deionized water. For probes which make no direct contact, e.g., OVA equipment, the probe will be wiped with clean paper-towels or cloth wetted with alcohol.

6.0 REFERENCES

None.

7.0 RECORDS

None.

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- 5.4 ROCK SAMPLING (CORING) (ASTM D2113-83)
- 5.4.1 Diamond Core Drilling
- 5.4.2 Rock Sample Preparation and Documentation

6.0 REFERENCES

7.0 RECORDS

1.0 PURPOSE

The purpose of this procedure is to identify the equipment, sequence of events, and appropriate methods necessary to obtain soil, both surface and subsurface, and rock samples during field sampling activities.

2.0 SCOPE

The methods described within this procedure are applicable while collecting surface and subsurface soil samples; obtaining rock core samples for lithologic and hydrogeologic evaluation; excavation/foundation design and related civil engineering purposes.

3.0 GLOSSARY

Hand Auger- A sampling device used to extract soil from the ground in a relatively undisturbed form.

Thin-Walled Tube Sampler - A thin-walled metal tube (also called Shelby tube) used to recover relatively undisturbed soil samples. These tubes are available in various sizes, ranging from 2 to 5 inches O.D. and 18 to 54 inches long. A stationary piston device may be included in the sampler to reduce sampling disturbance and increase sample recovery.

Split-Barrel Sampler - A steel tube, split in half lengthwise, with the halves held together by threaded collars at either end of the tube. Also called a split-spoon sampler, this device can be driven into resistant materials using a drive weight mounted in the drilling string. A standard split spoon sampler (used for performing Standard Penetration Tests) is 2 inches outside diameter (OD) and 1-3/8 inches inside diameter (ID). This standard spoon typically is available in two common lengths, providing either 20-inch or 26-inch longitudinal clearance for obtaining 18-inch or 24-inch long samples, respectively. These split-spoon samplers range in size from 2-inch O.D. to 3-1/2-inch O.D., depending upon manufacturer. The larger sizes are commonly used when a larger volume of material is required.

Rock Coring - A method in which a continuous solid cylindrical sample of rock or compact rock-like soil is obtained by the use of a double tube core barrel that is equipped with an appropriate diamond-studded drill bit which is advanced with a hydraulic rotary drilling machine.

Wire-Line Coring - As an alternate for conventional coring, this is valuable in deep hole drilling, since this method eliminates trips in and out of the hole with the coring equipment. With this technique the core barrel becomes an integral part of the drill rod string. The drill rod serves as both a coring device and casing.

4.0 RESPONSIBILITIES

Field Operations Leader - Responsible for overall management of field activities and ensuring that the appropriate sampling procedures are being implemented.

Site Geologist - The site geologist directly oversees the sampling procedures, classifies soil and rock samples, and directs the packaging and shipping of soil samples. Such duties may also be performed by geotechnical engineers, field technicians, or other qualified field personnel.

5.0 PROCEDURES

5.1 SUBSURFACE SOIL SAMPLES

Subsurface soil samples are used to characterize subsurface stratigraphy. This characterization can indicate the potential for migration of chemical contaminants in the subsurface. In addition, definition of the actual migration of contaminants can be obtained through chemical analysis of the soil samples. Where the remedial activities may include in-situ treatment or the excavation and removal of the contaminated soil, the depth and areal extent of contamination must be known as accurately as possible.

Engineering and physical properties of soil may also be of interest should site construction activities be planned. Soil types, grain size distribution, shear strength, compressibility, permeability, plasticity, unit weight, and moisture content are some of the physical characteristics that may be determined for soil samples.

Penetration tests are also described in this procedure. The tests can be used to estimate various physical and engineering parameters such as relative density, unconfined compressive strength, and consolidation characteristics of soils.

The procedures described here are representative of a larger number of possible drilling and sampling techniques. The choice of techniques is based on a large number of variables such as cost, DQOs, local geology, etc. The final choice of methods must be made with the assistance of drilling subcontractors familiar with the local geologic conditions. Alternative techniques must be based upon the underlying principles of quality assurance implicit in the following procedures.

5.1.1 Equipment

The following equipment is used for subsurface soil sampling and test boring:

- Drilling equipment, provided by subcontractor.
- Split barrel (split spoon) samplers, OD 2 inches, ID 1-3/8 inches, either 20-inch or 26 inches long. Larger O.D. samplers are available if a larger volume of sample is needed. A common size is 3-inch O.D. (2-1/2-inch I.D.).
- Thin walled tubes (Shelby), O.D. 2 to 5 inches, 18 to 54 inches long.
- Drive weight assembly, 140-lb. (± 2 lb.) weight, driving head and guide permitting free fall of 30 inches (± 1 inch).
- Drive weight assembly, 300-lb. (± 2 lb.) weight, driving head and guide permitting free fall of 18 inches (± 1 inch).
- Accessory equipment, including labels, logbook, paraffin, and sample jars.

5.1.2 Split Barrel (Split Spoon) Sampling (ASTM D1586-84)

The following method will be used for split barrel sampling:

- Clean out the borehole to the desired sampling depth using equipment that will ensure that the material to be sampled is not disturbed by the operation. In saturated sands and silts, withdraw the drill bit slowly to prevent loosening of the soil around the hole and maintain the water level in the hole at or above groundwater level.

- Side-discharge bits are permissible. A bottom-discharge bit shall not be used. The process of jetting through an open tube sampler and then sampling when the desired depth is reached shall not be permitted. Where casing is used, it may not be driven below the sampling elevation.

- Install the split barrel sampler and sampling rods into the boring to the desired sampling depth. After seating the sampler by means of a single hammer blow, three 6-inch increments shall be marked on the sampling rod so that the progress of the sampler can be monitored.

- The 2-inch OD split barrel sampler shall be driven with blows from a 140-lb. (± 2 lb.) hammer falling 30 inches (± 1 inch) until either a total of 50 blows have been applied during any one of the three 6-inch increments, a total of 100 blows have been applied, there is no observed advance of the sampler for 10 successive hammer blows, or until the sampler has advanced 18 inches without reaching any of the blow count limitation constraints described herein. This process is referred to as the Standard Penetration Test.

- A 300-lb. weight falling 18 inches is sometimes used to drive a 2-1/2-inch or 3-inch O.D. spoon sampler. This procedure is used where dense materials are enountered or when a large volume of sample is required. However, this method does not conform the ASTM specifications.

- Repeat this operation at intervals not greater than 5 feet in homogeneous strata, or as specified in the sampling plan.

- Record the number of blows required to effect each 6 inches of penetration or fraction thereof. The first 6 inches is considered to be seating drive. The sum of the number of blows required for the second and third 6 inches of penetration is termed the penetration resistance, N. If the sampler is driven less than 18 inches, the penetration resistance is that for the last 1 foot penetrated.

- Bring the sampler to the surface and remove both ends and one half of the split barrel so that the soil recovered rests in the remaining half of the barrel. Describe carefully the sample interval, recovery (length), composition, structure, consistency, color, condition, etc., of the recovered soil then put a representative portion of each sample into a jar, without ramming. Jars with samples not taken for chemical analysis shall be sealed with wax, or hermetically sealed (using a teflon cap liner) to prevent evaporation of the soil moisture, if the sample is to be later evaluated for moisture content. Affix labels to the jar and complete Chain-of-Custody and other required sample data forms. Protect samples against extreme temperature changes and breakage by placing them in appropriate cartons stored in a protected area. Pertinent data which shall be noted on the label or written on the jar lid for each sample includes the project number, boring number, sample number, depth interval, blow counts, and date of sampling.

- An addition to the sampler mentioned above is an internal liner, which is split longitudinally and has a thin-wall brass, steel, or paper liner inserted inside, which will preserve the sample. However, since the development of the thin-walled samplers (mentioned below) the split barrel sampler with liner has declined in use.

5.1.3 Thin Walled Tube (Shelby Tube) Sampling (ASTM D1587-83)

When it is desired to take undisturbed samples of soil, thin-walled seamless tube samplers (Shelby tubes) will be used. The following method will be used:

- Clean out the borehole to the sampling depth, being careful to minimize the chance for disturbance of the material to be sampled. In saturated materials, withdraw the drill bit slowly to prevent loosening of the soil around the borehole and maintain the water level in the hole at or above groundwater level.

- The use of bottom discharge bits or jetting through an open-tube sampler to clean out the hole shall not be allowed. Any side discharge bits are permitted.

- A stationary piston-type sampler may be required to limit sample disturbance and aid in retaining the sample. Either the hydraulically operated or control rod activated-type of stationary piston sampler may be used. Prior to inserting the tube sampler in the hole, check to ensure that the sampler head contains a check valve. The check valve is necessary to keep water in the sampling rods from pushing the sample out of the tube sampler during sample withdrawal and to maintain a suction within the tube to help retain the sample.

- To minimize chemical reaction between the sample and the sampling tube, brass tubes may be required, especially if the tube is stored for an extended time prior to testing. While steel tubes coated with shellac are less expensive than brass, they are more reactive, and shall only be used when the sample will be tested within a few days after sampling or if chemical reaction is not anticipated. With the sampling tube resting on the bottom of the hole and the water level in the boring at the groundwater level or above, push the tube into the soil by a continuous and rapid motion, without impacting or twisting. In no case shall the tube be pushed farther than the length provided for the soil sample. Allow about 3 inches in the tube for cuttings and sludge.

- Upon removal of the sampler tube from the hole, measure the length of sample in the tube and also the length penetrated. Remove disturbed material in the upper end of the tube and measure the length of sample again. After removing at least an inch of soil from the lower end and after inserting an impervious disk, seal both ends of the tube with at least a 1/2-inch thickness of wax applied in a way that will prevent the wax from entering the sample. Newspaper or other types of filler must be placed in voids at either end of the sampler prior to sealing with wax. Place plastic caps on the ends of the sampler, tape in the caps place, and dip the ends in wax.

- Affix labels to the tubes as required and record sample number, depth, penetration, and recovery length on the label. Mark the same information and "up" direction on the tube with indelible ink, and mark the end of the sample. Complete Chain-of-Custody and other required forms. Do not allow tubes to freeze and store the samples vertically (with the same orientation they had in the ground, i.e., top of sample is up) in a cool place out of the

sun at all times. Ship samples protected with suitable resilient packing material to reduce shock, vibration, and disturbance.

Thin-walled undisturbed tube samplers are restricted in their usage by the consistency of the soil to be sampled. Often, very loose and/or wet samples cannot be retrieved by the samplers, and soils with a consistency in excess of very stiff cannot be penetrated by the sampler. Devices such as Denison or Pitcher core samplers can be used to obtain undisturbed samples of stiff soils. Using these devices normally increases sampling costs and therefore their use shall be weighed against the increased cost and the need for an undisturbed sample. In any case, if a sample cannot be obtained with a tube sampler, an attempt shall be made with a split barrel sampler at the same depth so that at least a sample can be obtained for classification purposes.

5.1.4 Continuous Core Soil Samples

The CME continuous sample tube system provides a method of sampling soil continuously during hollow stem augering. The 5-foot sample barrel fits within the lead auger of a hollow auger column. The sampling system can be used with a wide range of I.D. hollow stem augers (from 3-1/4-inch to 8-1/4-inch I.D.). This method has been used to sample many different materials such as glacial drift, hard clays and shales, mine tailigs, etc. This method is particularly used when SPT samples are not required and a large volume of material is needed. Also, this method is useful when a visual description of the subsurface lithology is required.

5.2 SURFACE SOIL SAMPLES

For loosely packed earth or waste pile samples, stainless steel scoops or trowels can be used to collect representative samples. For densely packed soils or deeper soil samples, a hand or power soil auger may be used.

The following methods are to be used:

- Use a soil auger for deep samples (6 to 24 inches) or a scoop or trowel for surface samples. Remove debris, rocks, twigs, and vegetation before collection of soil. Mark the location with a numbered stake if possible and locate sample points on a sketch of the site.

- Use a new or freshly-decontaminated sampler for each sample taken. Attach a label and identification tag. Record all required information in the field logbook and on the sample log sheet, Chain-of-Custody record, and other required forms.

- Pack and ship accordingly.

- When a representative composited sample is to be prepared (e.g., samples taken from a gridded area or from several different depths), it is best to composite individual samples in the laboratory where they can be more precisely composited on a weight or volume basis. If this is not possible, the individual samples (all of equal volume, i.e., the sample bottles shall be full) shall be placed in a decontaminated stainless steel bucket, mixed thoroughly using a stainless steel spatula or trowel, and a composite sample collected.

5.3 WASTE PILE SAMPLES

The use of stainless steel scoops or trowels to obtain small discrete samples of homogeneous waste piles is usually sufficient for most conditions. Layered (nonhomogeneous) piles require the use of tube samplers to obtain cross-sectional samples.

- Collect small, equal portions of the waste from several points around the pile, penetrating it as far as practical. Use numbered stakes, if possible, to mark the sampling locations and locate sampling points on the site sketch.

- Place the waste sample in a glass container. Attach a label and identification tag. Record all the required information in the field logbook and on the sample log sheet and other required forms.

For layered, nonhomogeneous piles, grain samplers, sampling triers, or waste pile samplers must be used at several representative locations to acquire a cross-section of the pile. The basic steps to obtain each sample are

- Insert a sampler into the pile at a 0- to 45-degree angle from the horizontal to minimize spillage.

- Rotate the sampler once or twice to cut a core of waste material. Rotate the grain sampler inner tube to the open position and then shake the sampler a few times to allow the material to enter the open slits. Move the sampler into position with slots upward (grain sampler closed) and slowly withdraw from the pile.

5.4 ROCK SAMPLING (CORING) (ASTM D2113-83)

Rock coring enables a detailed assessment of borehole conditions to be made, showing precisely all lithologic changes and characteristics. Because coring is an expensive drilling method, it is commonly used for shallow studies of 500 feet or less, or for specific intervals in the drill hole that require detailed logging and/or analyzing. It can, however, proceed for thousands of feet continuously, depending on the size of the drill rig. It yields better quality data than air rotary drilling, although at a substantially reduced drilling rate. Rate of drilling varies widely, depending on the characteristics of lithologies encountered, drilling methods, depth of drilling, and condition of drilling equipment. Average output in a 10-hour day ranges from 40 to over 200 feet. Downhole geophysical logging or television camera monitoring is sometimes used to complement the data generated by coring.

Borehole diameter can be drilled to various sizes, depending on the information needed. Standard sizes of core barrels (showing core diameter) and casing are shown in Attachment No. 1.

Core drilling is used when formations are too hard to be sampled by soil sampling methods and a continuous solid sample is desired. Usually, soil samples are used for overburden, and coring begins in sound bedrock. Casing is set into bedrock before coring begins to prevent loose material from entering the borehole, to prevent loss of drilling fluid, and to prevent cross contamination of aquifers.

ATTACHMENT 1

STANDARD SIZES OF CORE BARRELS AND CASING

Coring bit size	Nominal *		Set size *	
	O.D.	I.D.	O.D.	I.D.
RWT	$1\frac{5}{32}$	$\frac{3}{4}$	1.160	.735
EWT	$1\frac{1}{2}$	$\frac{29}{32}$	1.470	905
EX, EXL, EWG, EWM	$1\frac{1}{2}$	$\frac{13}{16}$	1.470	.845
AWT	$1\frac{7}{8}$	$1\frac{9}{32}$	1.875	1 281
AX, AXL, AWG, AWM	$1\frac{7}{8}$	$1\frac{3}{16}$	1.875	1 185
BWT	$2\frac{3}{8}$	$1\frac{3}{4}$	2.345	1 750
BX, BXL, BWG, BWM	$2\frac{3}{8}$	$1\frac{5}{8}$	2.345	1.655
NWT	3	$2\frac{5}{16}$	2 965	2.313
NX, NXL, NWG, NWM	3	$2\frac{1}{8}$	2.965	2.155
HWT	$3\frac{29}{32}$	$3\frac{3}{16}$	3.889	3.187
HWG	$3\frac{29}{32}$	3	3.889	3.000
$2\frac{3}{4} \times 3\frac{7}{8}$	$3\frac{7}{8}$	$2\frac{3}{4}$	3.840	2.690
$4 \times 5\frac{1}{2}$	$5\frac{1}{2}$	4	5.435	3.970
$6 \times 7\frac{3}{4}$	$7\frac{3}{4}$	6	7.655	5.970
AX Wire line 1/	$1\frac{7}{8}$	1	1 875	1.000
BX Wire line 1/	$2\frac{3}{8}$	$1\frac{7}{16}$	2.345	1.437
NX Wire line 1/	3	$1\frac{15}{16}$	2 965	1.937

* All dimensions are in inches; to convert to millimeters, multiply by 254.
1/ Wire line dimensions and designations may vary according to manufacturer.

ATTACHMENT 1
PAGE TWO

Size Designations			Casing coupling					Approximate core diameter	
Casing; Casing coupling; Casing bits; Core barrel bits	Rod; Rod couplings	Casing O.D., inches	O.D., inches	I.D., inches	Casing bit, O.D., inches	Core barrel bit O.D., inches*	Drill rod O.D., inches	Normal, inches	Thinwall, inches
RX	RW	1.437	1.437	1.188	1.485	1.160	1.094	—	735
EX	E	1.812	1.812	1.500	1.875	1.470	1.313	.845	.905
AX	A	2.250	2.250	1.906	2.345	1.875	1.625	1.185	1.281
BX	B	2.875	2.875	2.375	2.965	2.345	1.906	1.655	1.750
NX	N	3.500	3.500	3.000	3.615	2.965	2.375	2.155	2.313
HX	HW	4.500	4.500	3.938	4.625	3.890	3.500	3.000	3.187
RW	RW	1.437	Flush joint	No coupling	1.485	1.160	1.094	—	.735
EW	EW	1.812			1.875	1.470	1.375	.845	.905
AW	AW	2.250			2.345	1.875	1.750	1.185	1.281
BW	BW	2.875			2.965	2.345	2.125	1.655	1.750
NW	NW	3.500			3.615	2.965	2.625	2.155	2.313
HW	HW	4.500			4.625	3.890	3.500	3.000	3.187
PW	—	5.500			5.650	—	—	—	—
SW	—	6.625			6.790	—	—	—	—
UW	—	7.625			7.800	—	—	—	—
ZW	—	8.625			8.810	—	—	—	—
—	AX 1/	—	—	—	—	1.875	1.750	1.000	—
—	BX 1/	—	—	—	—	2.345	2.250	1.437	—
—	NX 1/	—	—	—	—	2.965	2.813	1.937	—

* For hole diameter approximation, assume $\frac{1}{32}$ inch larger than core barrel bit.

1/ Wire line size designation, drill rod only, serves as both casing and drill rod. Wire line core bit, and core diameters vary slightly according to manufacturer.

NOMINAL DIMENSIONS FOR DRILL CASINGS AND ACCESSORIES. (DIAMOND CORE DRILL MANUFACTURERS ASSOCIATION). 288-D-2889.

Drilling through bedrock is initiated by using a diamond-tipped core bit threaded to a drill rod (outer core barrel) with a rate of drilling determined by the downward pressure, rotation speed of drill rods, drilling fluid pressure in the borehole, and the characteristics of the rock (mineralogy, cementation, weathering).

5.4.1 Diamond Core Drilling

A penetration of typically less than 6 inches per 50 blows using a 140-lb. hammer dropping 30 inches with a 2-inch split spoon sampler shall be considered an indication that soil sampling methods may not be applicable and that coring may be necessary to obtain samples.

When formations are encountered that are too hard to be sampled by soil sampling methods, the following diamond core drilling procedure may be used.

- Firmly seat a casing into the bedrock or the hard material to prevent loose materials from entering the hole and to prevent the loss of drilling fluid return. Level the surface of the rock or hard material when necessary by the use of a fishtail or other bits. If the drill hole can be retained open without the casing and if cross contamination of aquifers in the unconsolidated materials is unlikely, it may be omitted.

- Begin the core drilling using a double-tube swivel-core barrel of the desired size. After drilling no more than 10 feet (3 m), remove the core barrel from the hole, and take out the core. If the core blocks the flow of the drilling fluid during drilling, remove the core barrel immediately. In soft materials, a large starting size may be specified for the coring tools; where local experience indicates satisfactory core recovery or where hard, sound materials are anticipated, a smaller size or the single-tube type may be specified and longer runs may be drilled. NX/NW size coring equpment is the most commonly used size.

- When soft materials are encountered that produce less than 50 percent recovery, stop the core drilling. If soil samples are desired, secure such samples in accordance with the procedures described in ASTM Method D 1586 (Split Barrel Sampling) or in Method D 1587 (Thin-Walled Tube Sampling) for Sampling of Soils (see Section 5.1.1 and 5.1.2). Resume diamond core drilling when refusal materials are again encountered.

- Since rock structures and the occurrence of seams, fissures, cavities, and broken areas are among the most important items to be detected and described, take special care to obtain and record these features. If such broken zones or cavities prevent further advance of the boring, one of the following three steps shall be taken: (1) cement the hole; (2) ream and case; or (3) case and advance with the next smaller size core barrel, as the conditions warrant.

- In soft, seamy, or otherwise unsound rock, where core recovery may be difficult, M-design core barrels may be used. In hard, sound rock where a high percentage of core recovery is anticipated, the single-tube core barrel may be employed.

5.4.2 Rock Sample Preparation and Documentation

Once the rock coring has been completed and the core recovered, the rock core shall be carefully removed from the barrel, placed in a core tray (previously labeled "top" and "bottom" to avoid confusion), classified, and measured for percentage of recovery as well as the rock quality designation (RQD). Each core shall be described, classified, and logged using a uniform system as presented in Procedure GH-1.5. If moisture content will be determined or if it is desirable to prevent drying (e.g.,

to prevent shrinkage of clay formations) or oxidation of the core, the core shall be wrapped in plastic sleeves immediately after logging. Each plastic sleeve shall be labeled with indelible ink. The boring number, run number, and the footage represented in each sleeve shall be included, as well as the top and bottom of the core run.

After sampling, rock cores shall be placed in the sequence of recovery in well-constructed wooden boxes provided by the drilling contractor. Rock cores from two different borings shall not be placed in the same core box unless accepted by the Site Geologist. The core boxes shall be constructed to accommodate at least 20 linear feet of core in rows of approximately 5 feet each and shall be constructed with hinged tops secured with screws, and a latch (usually a hook and eye) to keep the top securely fastened down. Wood partitions shall be placed at the end of each core run and between rows. The depth from the surface of the boring to the top and bottom of the drill run and run number shall be marked on the wooden partitions with indelible ink. A wooden partition (wooden block) shall be placed at the end of each run with the depth of the bottom of the run written on the block. These blocks will serve to separate successive core runs and indicate depth intervals for each run. The order of placing cores shall be the same in all core boxes. Rock core shall be placed in the box so that, when the box is open, with the inside of the lid facing the observer,the top of the cored interval contained within the box is in the upper left corner of the box,and the bottom of the cored interval is in the lower right corner of the box (see Attachment 2). The top and bottom of each core obtained and its true depth shall be clearly and permanently marked on each box. The width of each row must be compatible with the core diameter to prevent lateral movement of the core in the box. Similarly, an empty space in a row shall be filled with an appropriate filler material or spacers to prevent longitudinal movement of the core in the box.

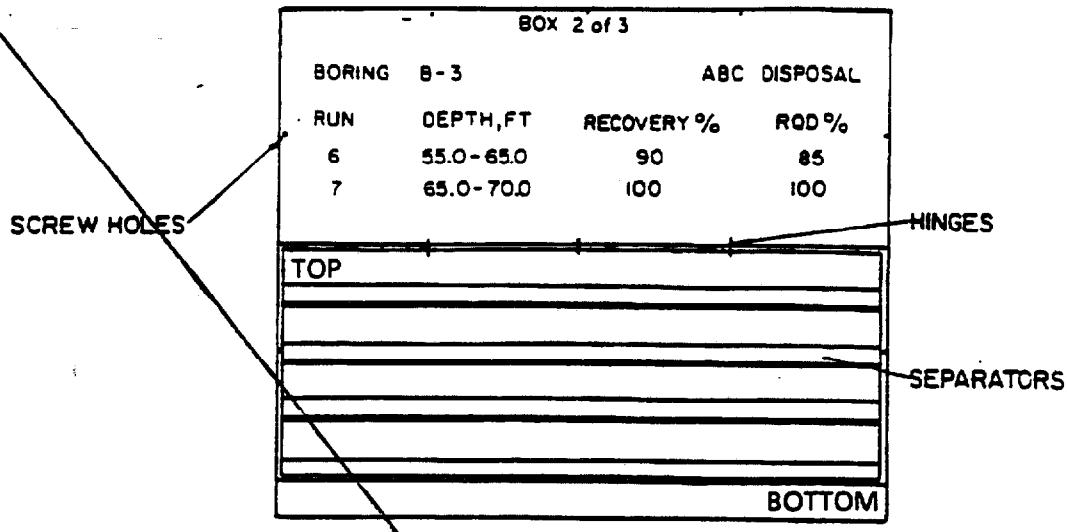
The inside and outside of the core-box lid shall be marked by indelible ink to show all pertinent data on the box's contents. At a minimum, the following information shall be included:

- Project name
- Project number
- Boring number
- Run numbers
- Footage (depths)
- Recovery
- RQD (%)
- Box number and total number of boxes for that boring (Example: Box 5 of 7).

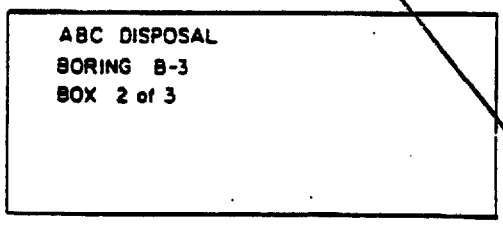
For easy retrieval when core boxes are stacked, the sides and ends of the box shall also be labeled and include project number, boring number, top and bottom depths of core and box number. Attachment No. 2 illustrates a typical rock core box.

Prior to final closing of the core box, a photograph of the recovered core and the labeling on the inside cover shall be taken. If moisture content is not critical, the core shall be wetted and wiped clean for the photograph. (This will help to show true colors and bedding features in the cores).

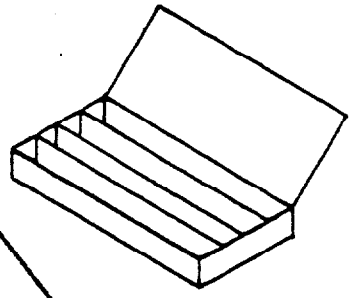
ATTACHMENT 2

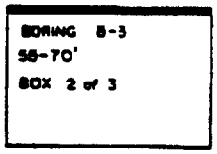


CORE BOX (OBLIQUE VIEW)



CORE BOX (TOP VIEW)





CORE BOX (END VIEW)

TYPICAL ROCK CORE BOX

NOT TO SCALE

NUS CORPORATION
A Halliburton Company

6.0 REFERENCES

American Society for Testing and Materials, 1985. Method for Penetration Test and Split Barrel Sampling of Soils. ASTM Method D 1586-84, Annual Book of Standards, ASTM, Philadelphia, Pennsylvania.

American Society for Testing and Materials, 1985. Thin-Walled Tube Sampling of Soils. Method D-1587-83, Annual Book of Standards, ASTM, Philadelphia, Pennsylvania.

Acker Drill Co., 1958. Basic Procedures of Soil Sampling. Acker Drill Co., Scranton, Pennsylvania.

American Society for Testing and Materials, 1989. Standrd Practice for Diamond Core Drilling for Site Investigation. ASTM Method D2113-83 (reapproved 1987), Annual Book of Standards, ASTM, Philadelphia, Pennsylvania.

U.S. Department of the Interior, 1974, Earth Manual, A Water Resources Technical Publication, 810 pages.

Central Mine Equipment Company, Drilling Equipment, St. Louis, Missouri.

7.0 RECORDS

None.

NUS CORPORATION ENVIRONMENTAL MANAGEMENT GROUP	STANDARD OPERATING PROCEDURES	Number GH-1.6	Page 1 of 3
		Effective Date 05/04/90	Revision 2
		Applicability EMG	
		Prepared Earth Sciences	
Subject DECONTAMINATION OF DRILLING RIGS AND MONITORING WELL MATERIALS		Approved D. Senovich	

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1.0 PURPOSE

The purpose of this procedure is to provide reference information regarding the appropriate procedures to be followed when conducting decontamination activities of drilling equipment and monitoring well materials used during field investigations.

2.0 SCOPE

This procedure addresses only drilling equipment and monitoring well materials decontamination, and shall not be considered for use with chemical sampling and field analytical equipment decontamination.

3.0 GLOSSARY

None.

4.0 RESPONSIBILITIES

Field Operations Leader - Responsible for ensuring that project specific plans and the implementation of field investigations are in compliance with these procedures.

5.0 PROCEDURES

To insure that analytical chemical results are reflective of the actual concentrations present at sampling locations, various drilling equipment involved in field investigations must be properly decontaminated. This will minimize the potential for cross-contamination between sampling locations, and the transfer of contamination off site.

Prior to the initiation of a drilling program. all drilling equipment involved in field sampling activities shall be decontaminated by steam cleaning at a predetermined area. The steam cleaning procedure shall be performed using a high-pressure spray of heated potable water producing a pressurized stream of steam. This steam shall be sprayed directly onto all surfaces of the various equipment which might contact environmental sample. The decontamination procedure shall be performed until all equipment is free of all visible potential contamination (dirt, grease, oil, noticeable odors, etc.) In addition, this decontamination procedure shall be performed at the completion of each sampling and/or drilling location, including soil borings, installation of monitoring wells, test pits, etc. Such equipment shall include drilling rigs, backhoes, downhole tools, augers, well casings, and screens.

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

In certain cases, due to budget constraints, such an elaborate decontamination pad is not possible. In such cases, a plastic lined gravel bed pad with a collection system may serve as an adequate decontamination area. The location of the steam cleaning area shall be on site in order to minimize potential impacts at certain sites.

Guidance to be used when decontaminating equipment shall include:

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

Rinsate samples of well casing and screens may be necessary if specifically required for a given site. If required, at least 1 percent, and no more than 5 percent of steam cleaned lengths of casing and screens combined shall be sampled.

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

6.0 RECORDS

None.

APPENDIX C

HEALTH AND SAFETY PLAN