Work Plan
Site Sampling in Support of Relative Risk Evaluation at Various Activities
Addendum 1

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888
Contract Task Order 0060

MAY 1998

Brown & Root Environmental

R53049802M

WORK PLAN
FOR
SITE SAMPLING IN SUPPORT OF
RELATIVE RISK EVALUATION AT VARIOUS ACTIVITIES
ADDENDUM 1

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
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Charleston, South Carolina 29405

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CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0060

MAY 1998

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C-53-05-98-08M

May 29, 1998

Project Number 7848

Commanding Officer
Department of the Navy
SOUTHDIV NAVFACENGCOM
ATTN: Mr. Bill Gates (Code 18510)
Remedial Project Manager
2155 Eagle Drive
North Charleston, SC 29406

Reference: CLEAN Contract No. N62467-94-D-0088, Contract Task Order No. 060

Subject: Transmittal of Final Work Plan Addendum for the Additional Sampling of Site 1 – Golf Course Landfill at NTC Great Lakes.

Dear Mr. Gates:

Enclosed please find two (2) copies of the Final Work Plan Addendum for the additional soil sampling of Site 1-Golf Coarse Landfill at NTC Great Lakes.

If you have any questions or require additional information, please contact me at (517) 655-4342.

Very truly yours,

Daniel R. Hamel
Task Order Manager

c: Ms. Jenny Ross, NTC Great Lakes (2 copies)
Ms. D. Evans-Riply, SOUTHDIV (w/o enclosure)
Ms. D. Wroblewski, B&RE
Mr. M. Perry, B&RE (w/o enclosures)
File 7848

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1.0 FIELD SAMPLING PLAN

1.1 INTRODUCTION

This Work Plan Addendum for Site Sampling in Support of Relative Risk Evaluation at NTC Great Lakes was prepared for the U.S. Navy (Navy) Southern Division (SOUTHDIV) Naval Facilities Engineering Command (NAVFAC) under Contract Task Order (CTO) 0060, for the Comprehensive Long-term Environmental Action Navy (CLEAN III), Contract Number N62467-94-D-0888.

This Work Plan Addendum will be used as a supplement to the original B&R Environmental Work Plan (December 1995), and provides the field procedures, quality assurance guidance and health and safety requirements for completion of sampling and analysis at NTC Great Lakes. The data obtained will be used to supplement previous sampling conducted at NTC Great Lakes by Brown & Root Environmental (B&R Environmental) in December 1995. This investigation shall comply with all applicable Federal, state, and local regulations and policies.

1.2 PROJECT OBJECTIVE

B&R Environmental will conduct additional sampling and analysis of four soil samples at what was identified during the 1995 sampling event as Site 1-Golf Course Landfill of the NTC Great Lakes. The soil samples will be analyzed for full Target Compound List/Target Analyte List (TCL/TAL).

Sampling will be conducted by personnel from the B&R Environmental office located in Williamston, Michigan.

1.3 PROJECT MANAGEMENT

B&R Environmental will perform this project with support from the Navy. This section of the Work Plan describes the project organization, project contracts and support personnel, and a project contingency plan.

1.3.1 Project Organization

The project organization for the additional sampling at NTC Great Lakes is discussed below.

Mr. Dan Hamel is the Task Order Manager (TOM) for CTO 0060 and will be the primary point of contact for B&R Environmental. He is responsible for cost and schedule control as well as technical performance.

Mr. Hamel will also provide technical continuity throughout the project and will manage the day-to-day aspects of this project.

1.3.2 Navy Support

Mr. Bill Gates will be the SOUTHDIV NAVFAC Remedial Project Manager (RPM). He will be the primary Navy point-of-contact for the project. All project activities, including reporting and field activities, will be coordinated through Mr. Gates. Any changes in scope will be approved through Mr. Gates prior to implementation. Mr. Gates will be supported by Ms. Jenny Ross, the SOUTHDIV Point of Contact at NTC Great Lakes.

Mr. Gates can be reached at the following address:

Commanding Officer
Department of the Navy
SOUTHDIV NAVFACENGCOM
Attn: Mr. Bill Gates
2155 Eagle Drive
North Charleston, SC 29405
(803) 820-7360

Ms. Ross can be reached at the following address:

Ms. Jenny Ross
EFA Midwest
Building 1A, Code N453
2201 Decatur Ave.
Great Lakes, IL 60088
(847) 688-5997 ext. 53

1.3.3 Contingency Plan

In the event major problems are encountered during field activities, the B&R Environmental TOM will be notified immediately, followed by the SOUTHDIV RPM. B&R Environmental will then develop an alternate

course of action and discuss it with the Navy. All alternate courses of action that impact the project, schedule or budget will be approved through the SOUTHDIV POC before being enacted.

1.3.4 Project Schedule

Date	Event/Deliverable
April 28, 1998	Submit Draft Work Plan
April 29, 1998	SOUTHDIV Receive Draft Work Plan for Review
May 18, 1998	Work Plan review conference call and revision session
May 29, 1998	Submit Final Work Plan
June 8, 1998	Pre-Field Meeting\Sampling
June 9, 1998	Completion of Field Work
July 24, 1998	Submit Draft Technical Memorandum
August 3, 1998	Receive Navy Comments
August 17, 1998	Submit Final Technical Memorandum

1.4 FIELD OPERATIONS SUMMARY

Soil sampling will be performed at Site 1-Golf Course Landfill of the NTC Great Lakes. The number of samples to be collected and the analyses to be performed on the samples have been identified. The B&R Environmental Field Team Leader in coordination with the NTC Great Lakes POC will identify each sample location at Site 1 in the field immediately prior to sampling.

All soil sampling conducted will consist of surface samples collected from a depth of 6-inches. A standard hand sampling disposable plastic trowel will be used to collect the soil samples. The sampling locations will be accurately mapped by measuring the horizontal distance from site structures at Site 1-Golf Course Landfill. All samples will be collected and analyzed using the procedures developed in Section 2.0, Quality Assurance/Quality Control of the original Work Plan (December 1995) and with the modifications identified in Section 2 of this Work Plan Addendum 1.

1.5 GENERAL FIELD OPERATIONS

1.5.1 Mobilization/Demobilization

The scale of this field sampling operation will require only one B&R Environmental staff person. Prior to beginning field mobilization, the B&R Environmental Representative will review this Work Plan Addendum and the original B&R Environmental Work Plan (December 1995).

The equipment required for field sampling and required bottleware will be brought to the site by the B&R Environmental field representative.

Site demobilization will entail following proper decontamination procedures for the sampling person. Because of the use of disposable sampling equipment, decontamination of equipment is not anticipated.

1.6 FIELD SAMPLING

The specific locations of the four sampling points at Site 1-Golf Course Landfill will be determined in the field at the direction of the NTC Great Lakes POC.

The four samples will be analyzed for TAL metals and cyanide, TCL pesticides and PCBs, TCL volatiles, and TCL semivolatiles.

The Site 1-Golf Course Landfill sampling locations will be identified by the NTC Great Lakes POC to initiate any required utility clearance for the sample locations. Once utility clearance has been obtained from the public works department and verified by the NTC Great Lakes POC, sampling will be conducted. A volume of soil sufficient to fill the required sample containers shall be taken using a disposable trowel (SOP SA-1.2 AND SA-1.3 in Appendix B, original Work Plan (December 1995)) and placed in the sample jars and labeled as described in Section 1.7. For this sampling round Encore samplers will be used to collect TCL VOC samples. Encore sampler procedures are described in SOP SA-1.3 in Appendix A of this Work Plan Addendum.

1.6.1 Equipment

The following sampling equipment will be used for this project.

- Disposable trowel
- Encore Sampler

The required health and safety equipment is outlined in Section 3.0.

1.6.2 Decontamination

All sampling equipment is disposable and provided precleaned. Equipment decontamination is not anticipated.

1.7 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 in the Quality Assurance/Quality Control Section 2.0 of this addendum.

1.7.1 Sample Identification

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 naval activity and site. The code also identifies the sample number and quality assurance (QA) designation, if required. Any other pertinent information regarding sample identification will be recorded in the field logbooks.

The sample numbers for the four samples at Site 1-Golf Course Landfill are identified below:

GL-001-02
GL-001-03
GL-001-04
GL-001-05

1.7.2 Sample Packaging and Shipping

Samples will be packaged in accordance with SOP SA-6.2 (Work Plan (December 1995)). Samples will be picked up at the site by the analytical laboratory or shipped by overnight carrier. The B&R Environmental sampler 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

1.7.3 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. SOP SA-6.1 (Work Plan (December 1995)) provides a description of the chain-of-custody procedures to be followed. A sample chain-of-custody form is also provided in Appendix A of the original Work Plan (December 1995).

1.8 RECORD KEEPING

In addition to chain-of-custody records, a standard sample log sheet for sediment/soils will be completed for sampling description and documentation. A copy of the sample log sheet is presented in Appendix A of the original Work Plan (December 1995).

A bound/weatherproof field notebook shall be maintained by the B&R Environmental field representative. This book will contain a summary of the day's activities. All information related to sampling or field activities will be recorded in the field notebook. This information will include, but is not limited to, sampling time, weather conditions, unusual events, field measurements, descriptions of photographs, and whether the site has been recently disturbed by construction activities.

At the completion of field activities, the B&R Environmental shall submit all field records, data, field notebooks, chain-of-custody receipts, sample log sheet, etc., to the Task Order Manager.

1.9 WASTE HANDLING

Investigation derived waste (IDW) is expected to be minimal. Soil in excess of what is needed for the sample will be replaced back into the sample location. All disposable equipment, Tyvek coveralls and other investigative derived waste (IDW) will be collected by B&R Environmental, placed in double plastic garbage bags, and disposed in a dumpster at the NTC Great Lakes. Decontamination liquids are not anticipated.

2.0 QUALITY ASSURANCE/QUALITY CONTROL

Under Contract Task Order (CTO) 0009 of Contract Number N62467-94-D-0888 to the U.S. Navy, Southern Division, (SOUTHDIV), Brown & Root Environmental (B&R Environmental) prepared a Quality Assurance Project Plan (QAPP) to conduct sampling efforts at various Activities throughout the Southern Division Naval Facilities Engineering Command (NAVFACENGCOM) in support of the Relative Risk Site Evaluation Program. The QAPP, which is Section 2 of the original Work Plan-1995, pertains to Project activities performed under Comprehensive Environmental Restoration and Compensation Liability Act (CERCLA) requirements. Accordingly, the original QAPP was prepared in accordance with the USEPA guidance "Requirements for Quality Assurance Project Plans for Environmental Data Operations" (May, 1993).

To conduct the additional sampling at Site 1-Golf Course Landfill at NTC Great Lakes, B&R environmental will follow the procedures identified in the original QAPP (December 1995). Any modifications to the original QAPP which are required to complete the additional sampling are identified below in this Work Plan, Addendum 1.

2.1 PROJECT ORGANIZATION AND RESPONSIBILITIES

B&R Environmental personnel from the Williamston, Michigan office will be responsible to carry out the additional sampling task.

2.2 DATA QUALITY REQUIREMENTS

The overall data quality objectives will be the same as those described in the original Work Plan (December 1995). Field related quality control samples are identified in Table 2-1.

2.3 SAMPLE CUSTODY AND SHIPMENT

Sample custody and shipping procedures will be the same as those described in the original Work Plan (December 1995).

TABLE 2-1

SUMMARY OF ANALYSIS, BOTTLE REQUIREMENTS, PRESERVATION REQUIREMENTS, AND HOLDING TIMES
NTC GREAT LAKES
PAGE 1 OF 1

Parameter	Sample Container	Container Volume	Preservation	Maximum Holding Time	Analytical Methodology
SOLID (SURFACE SOIL AND SEDIMENT)					
TCL Volatile Organic Compounds (VOCs)	EnCore Sampler	5 gram and 25 gram	EnCore Samplers -Cool to 4°C during shipment Laboratory – Low Level – Sodium Bisulfite Medium Level - Methanol	48 Hrs to preserve -14 days to analysis	U.S. EPA-SW846 Method 5035 for preparation and 8260B for analysis
TCL Semivolatile Organic Compounds (SVOCs)	Clear wide-mouth glass, Teflon-lined cap	8 oz	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	U.S. EPA-CLP SOW for Organic Analysis, Multi-Media, Multi-Concentration (Doc. #OLMO3.1)
TCL Pesticides and Polychlorinated Biphenyls (PCBs)	Clear wide-mouth glass, Teflon-lined cap	16 oz	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	U.S. EPA-CLP SOW for Organic Analysis, Multi-Media, Multi-Concentration (Doc. #OLMO3.1)
TAL Metals/Cyanide	Flint glass bottle, black phenolic cap, polyethylene liner	16 oz	Cool to 4°C	180 days until analysis; 28 days for mercury; 14 days for cyanide	U.S. EPA-CLP SOW for Organic Analysis, Multi-Media, Multi-Concentration (Doc. #ILMO3.0)

(1) Encore Samplers

2.4 SAMPLE ANALYSES

Chemical analyses will be conducted by a pre-qualified laboratory subcontractor(s). The analytical laboratory(s) will have prior Naval Facilities Engineering Services Center (NFESC; formerly NEESA) approval.

In accordance with regulatory and Navy criteria, only EPA-approved methodologies will be used to conduct chemical constituent analysis. Analytical methodologies will be the same as those described in the original Work Plan with the exception of VOC analysis. VOC analysis will be conducted using SW 846 Method 5035 for low and medium level analysis preparation and using Method 8260B for analysis.

Table 2-2 presents the number and matrices of samples to be collected and analyzed at Site 1 of NTC Great Lakes.

2.5 LABORATORY QC CHECKS

Laboratory QC procedures will be the same as described in the original Work Plan (December 1995).

2.6 DATA REDUCTION, VALIDATION, AND REPORTING

Data reduction, validation, and reporting procedures and requirements are the same as those described in the original Work Plan (1995).

2.7 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits will be performed as described in the original Work Plan (December 1995).

2.8 CORRECTIVE ACTIONS

Corrective action if required will be implemented as described in the original Work Plan (December 1995).

TABLE 2-2

REQUIRED ANALYSIS
NTC GREAT LAKES
PAGE 1 OF 1

Site	Parameter[1]	Method	Sample Type	No. of Samples	Trip Blanks[2]	Equipment Rinsates	Field Duplicates[3]	Total No. of Samples
Site 00001	TCL Volatile Organic Compounds	SW846 Method 5035 Method 8260B	Soil	4	1	0	0	5
	TCL Semivolatile Organic Compounds	CLP SOW OLMO3.1	Soil	4	N/A[4]	0	0	4
	TCL Pesticides/PCB[5] Compounds	CLP SOW OLMO3.1	Soil	4	N/A	0	0	4
	TAL Metals/Cyanide	CLP SOW ILMO3.0	Soil	4	N/A	0	0	4

1. TAL - Target Analyte List; TCL - Target Compound List.

2. Trip Blanks - Samples that originate from analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with the volatile organic compound (VOC) samples. One trip blank per cooler containing VOCs. VOC samples consolidated in one (or more if required) cooler. Trip Blank is depicted for first site shown. Trip Blanks are analyzed for VOCs only.

3. No field Duplicates will be collected for this sampling event.

4. N/A Not Applicable

5. PCBs - (polychlorinated biphenyls)

3.0 HEALTH AND SAFETY PLAN

3.1 INTRODUCTION

A Health and Safety Plan (HASP) was specifically written for soil and sediment sampling tasks under Contract Task Order (CTO) 0009 that included the NTC Great Lakes Sites. The original HASP will be utilized, along with the modifications listed in this Work Plan Addendum, for the additional sampling at Site 1-Golf Course Landfill at the NTC Great Lakes

3.2 SITE INFORMATION AND PERSONEL ASSIGNMENTS

Project: Additional sampling Site 1 at the NTC Great Lakes for Relative Risk Site Evaluation.

Project Team:

B&R Environmental Personnel: Discipline/Tasks Assigned:

Debra M. Wroblewski	Program Manager
Daniel R. Hamel	Task Order Manager (TOM)
Matthew M. Soltis, CIH, CSP	Manager of Health and Safety (HSM)
TBD from personnel located in the Williamston, Michigan of B&R Environmental	Field Sampler/Site Safety Officer (SSO)

Non-B&R Environmental Personnel: Affiliation/Discipline/Tasks Assigned:

NTC Great Lakes POC	Second person contact for H&S if required during sampling activities.

Prepared by: Dan Hamel

3.3 EMERGENCY CONTACTS

Prior to performing work at Site 1, emergency contacts will be established and the applicable phone numbers of these contacts shall be provided in Table 3-1. Specifically, telephone numbers for ambulance, fire departments, hospitals, Base contacts, and other emergency contacts will be determined during the initial site meeting with the NTC Great Lakes POC. Additionally, directions to the area hospital or medical facility shall be determined and provided in this section of the HASP.

TABLE 3-1

GREAT LAKES NTC
EMERGENCY REFERENCE

AGENCY	TELEPHONE
EMERGENCY	911
Base Fire Department	
Base Security	
Base Ordnance Officer	
Base EOD Office	
Base Environmental Office Jenny Ross	(847) 688-5997 ext. 53
Local Fire Department, Police, Ambulance	
Area Hospital or Medical Facility _____	
Poison Control	1-800-962-1250
Base Contact Jenny Ross	(847) 688-5997 ext. 53
B&R Environmental Program Manager, Debbie Wroblewski	(412) 921-8968
Project Manager, Dan Hamel	(517) 655-4342
B&R Environmental Office, Pittsburgh	1-800-245-2730 (412) 921-7090
CLEAN Health and Safety Manager, Matthew M. Soltis, CIH, CSP	(412) 921-8912
Project Health and Safety Officer, Matthew M. Soltis, CIH, CSP	(412) 921-8912

3.4 EMERGENCY ROUTE TO HOSPITAL

Directions to _____:

(to be completed at mobilization)

APPENDIX A

STANDARD OPERATING PROCEDURES

- **SA-1.3 SOIL SAMPLING**

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1.0 PURPOSE

This procedure discusses the methods used to collect surface, near surface, and subsurface soil samples. Additionally, it describes the method for sampling of test pits and trenches to determine subsurface soil and rock conditions, and recover small-volume or bulk samples.

2.0 SCOPE

This procedure is applicable to the collection of surface, near surface and subsurface soils for laboratory testing, which are exposed through hand digging, hand augering, drilling, or machine excavating at hazardous substance sites.

3.0 GLOSSARY

Composite Sample - A composite sample exists as a combination of more than one sample at various locations and/or depths and times, which is homogenized and treated as one sample. This type of sample is usually collected when determination of an average waste concentration for a specific area is required. Composite samples are not to be collected for volatile organics analysis.

Grab Sample - One sample collected at one location and at one specific time.

Non-Volatile Sample - A non-volatile sample includes all other chemical parameters (e.g., semivolatiles, pesticides/PCBs, metals, etc.) and those engineering parameters that do not require undisturbed soil for their analysis.

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 a Shelby tube) used to recover relatively undisturbed soil samples. These tubes are available in various sizes, ranging from 2 to 5 inches outside diameter (OD) and from 18 to 54 inches in length.

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-barrel sampler is typically 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-barrel samplers commonly range in size from 2-inch OD to 3-1/2 inch OD. The larger sizes are commonly used when a larger volume of sample material is required.

Test Pit and Trench - Open, shallow excavations, typically rectangular (if a test pit) or longitudinal (if a trench), excavated to determine the shallow subsurface conditions for engineering, geological, and soil chemistry exploration and/or sampling purposes. These pits are excavated manually or by machine (e.g., backhoe, clamshell, trencher excavator, or bulldozer).

Confined Space - As stipulated in 29 CFR 1910.146, a confined space means a space that: 1) is large enough and so configured that an employee can bodily enter and perform assigned work; 2) has limited or restricted means for entry or exit (for example tanks, vessels, silos, storage bins, hoppers, vaults, and pits, and excavations are spaces that may have limited means of entry.); and 3) is not designed for continuous employee occupancy. Brown & Root Environmental considers all confined space as permit-required confined spaces.

4.0 RESPONSIBILITIES

Project Manager - The Project Manager is responsible for determining sampling objectives, as well as, the field procedures used in the collection of soil samples. Additionally, in consultation with other project personnel (geologist, hydrogeologist, etc.), the Project Manager establishes the need for test pits or trenches, and determines their approximate locations and dimensions.

Site Safety Officer (SSO) - The SSO (or a qualified designee) is responsible for providing the technical support necessary to implement the project Health and Safety Plan. This will include (but not be limited to) performing air quality monitoring during sampling, boring and excavation activities, and to ensure that workers and offsite (downwind) individuals are not exposed to hazardous levels of airborne contaminants. The SSO/designee may also be required to advise the FOL on other safety-related matters regarding boring, excavation and sampling, such as mitigative measures to address potential hazards from unstable trench walls, puncturing of drums or other hazardous objects, etc.

Field Operations Leader (FOL) - The FOL is responsible for finalizing the location of surface, near surface, and subsurface (hand and machine borings, test pits/trenches) soil samples. He/she is ultimately responsible for the sampling and backfilling of boreholes, test pits and trenches, and for adherence to OSHA regulations during these operations.

Project Geologist/Sampler - The project geologist/sampler is responsible for the proper acquisition of soil samples and the completion of all required paperwork (i.e., sample log sheets, field notebook, boring logs, test pit logs, container labels, custody seals, and chain-of-custody forms).

Competent Person - A Competent Person, as defined in 29 CFR 1929.650 of Subpart P - Excavations, means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

5.0 PROCEDURES

5.1 Overview

Soil sampling is an important adjunct to groundwater monitoring. Sampling of the soil horizons above the groundwater table can detect contaminants before they have migrated into the water table, and can establish the amount of contamination sorbed on aquifer solids that have the potential of contributing to groundwater contamination.

Soil types can vary considerably on a hazardous waste site. These variations, along with vegetation, can effect the rate of contaminant migration through the soil. It is important, therefore, that a detailed record be maintained during the sampling operations, particularly noting the location, depth, and such characteristics as grain size, color, and odor. Subsurface conditions are often stable on a daily basis and may demonstrate only slight seasonal variation especially with respect to temperature, available oxygen and light penetration. Changes in any of these conditions can radically alter the rate of chemical reactions or the associated microbiological community, thus further altering specific site conditions. As a result, samples must be kept at their at-depth temperature or lower, protected from direct light, sealed tightly in approved glass containers and be analyzed as soon as possible.

The physical properties of the soil, its grain size, cohesiveness, associated moisture, and such factors as depth to bedrock and water table, will limit the depth from which samples can be collected and the method required to collect them. Often this information on soil properties can be obtained from published soil surveys available through the U.S. Geological Surveys and other government or farm agencies. It is the intent of this procedure to present the most commonly employed soil sampling methods used at hazardous waste sites.

5.2 Soil Sample Collection

5.2.1 Procedure for Collecting Soil Samples for Volatile Organic Compounds

The above described traditional sampling techniques, used for the collection of soil samples for volatile organic analysis have recently been evaluated by the scientific community and determined to be ineffective in producing accurate results (biased low) due to the loss of volatile organics in the sampling stages and microbial degradation of aromatic volatiles. One of the newly adopted sampling procedures for collecting soil samples include the field preservation of samples with methanol or sodium bisulfate to minimize volatilization and biodegradation. These preservation methods may be performed either in the field or laboratory, depending on the sampling methodology employed.

Soil samples to be preserved by the laboratory are currently being performed using method SW-846, 5035. Laboratories are currently performing low level analyses (sodium bisulfate preservation) and high level analyses (methanol preservation) depending on the end users needs.

It should be noted that a major disadvantage of the methanol preservation method is that the laboratory reporting limits will be higher than conventional testing. The reporting levels using the new method for most analytes is 0.5 µg/g for GC/MS and 0.05 µg/g for GC methods.

The alternative preservation method for collecting soil samples is with sodium bisulfate. This method is more complex to perform in the field and therefore is not preferred for field crews. It should also be noted that currently, not all laboratories have the capabilities to perform this analysis. The advantage to this method is that the reporting limits (0.001 µg/g for GC/PID or GC/ELCD, or 0.010 for GC/MS) are lower than those described above.

The following procedures outline the necessary steps for collecting soil samples to be preserved at the laboratory, and for collecting soil samples to be preserved in the field with methanol or sodium bisulfate.

5.2.1.1 Soil Samples to be Preserved at the Laboratory

Soil samples collected for volatile organics that are to be preserved at the laboratory will be obtained using a hermetically sealed sample vial such as an EnCore™ sampler. Each sample will be obtained using a reusable sampling handle provided with the EnCore™ sampler. The sample is collected by pushing the EnCore™ sampler directly into the soil, ensuring that the sampler is packed tight with soil, leaving zero headspace. Using this type of sampling device eliminates the need for field preservation and the shipping restrictions associated with preservatives.

Once the sample is collected, it should be placed on ice immediately and shipped to the laboratory within 48 hours (following the chain-of-custody and documentation procedures outlined in SOP SA-6.1). Samples must be preserved by the laboratory within 48 hours of sample collection.

If the lower detection limits are necessary, an option would be to collect 3 EnCore™ samplers at a given sample location. Send all samplers to the laboratory and the laboratory can perform the required preservation and analyses.

5.2.1.2 Soil Samples to be Preserved in the Field

Soil samples preserved in the field may be prepared for analyses using both the low-level (sodium bisulfate preservation) method and medium-level (methanol preservation) method.

Methanol Preservation (Medium Level):

Soil samples to be preserved in the field with methanol will utilize 40-60 mL glass vials with septum lids. Each sample bottle will be filled with 25 mL of demonstrated analyte-free purge and trap grade methanol. Bottles may be prespiked with methanol in the laboratory or prepared in the field.

Soil will be collected with the use of a decontaminated (or disposable), small-diameter coring device such as a disposable tube/plunger-type syringe with the tip cut off. The outside diameter of the coring device must be smaller than the inside diameter of the sample bottle neck.

A small electronic balance or manual scale will be necessary for measuring the volume of soil to be added to the methanol preserved sample bottle. Calibration of the scale should be performed prior to use and intermittently throughout the day according to the manufacturers requirements.

The sample should be collected by pulling the plunger back and inserting the syringe into the soil to be sampled. The top several inches of soil should be removed before collecting the sample. Approximately 10 grams $\pm$2g (8-12 grams) of soil should be collected. The sample should be weighed and adjusted until obtaining the required amount of sample. The sample weight should be recorded to the nearest 0.01 gram in the field logbook and/or sample log sheet. The soil should then be extruded into the methanol preserved sample bottle taking care not to contact the sample container with the syringe. The threads of the bottle and cap must be free of soil particles.

After capping the bottle, swirl the sample (do not shake) in the methanol and break up the soil such that all of the soil is covered with methanol. Place the sample on ice immediately and prepare for shipment to the laboratory as described in SOP SA-6.1.

Sodium Bisulfate Preservation (Low Level):

Samples to be preserved using the sodium bisulfate method are to be prepared as follows:

Add 1 gram of sodium bisulfate to 5 mL of laboratory grade deionized water in a 40-60 mL glass vial with septum lid. Bottles may be prespiked in the laboratory or prepared in the field. The soil sample should be collected in a manner as described above and added to the sample container. The sample should be weighed to nearest 0.01 gram as described above and recorded in field logbook or sample log sheet.

Care should be taken when adding the soil to the sodium bisulfate solution. A chemical reaction of soils containing carbonates (limestone) may cause the sample to effervescent or the vial to possibly explode.

When preparing samples using the sodium bisulfate preservation method, duplicate samples must be collected using the methanol preservation method on a one for one sample basis. The reason

for this is because it is necessary for the laboratory to perform both the low level and medium level analyses. Place the sample on ice immediately and prepare for shipment to the laboratory as described in SOP SA-6.1.

If the lower detection limits are necessary, an option to field preserving with sodium bisulfate would be to collect 3 EnCore™ samplers at a given sample location. Send all samplers to the laboratory and the laboratory can perform the required preservation and analyses.

5.2.2 Procedure for Collecting Non-Volatile Soil Samples

Non-volatile soil samples may be collected as either grab or composite samples. The non-volatile soil sample is thoroughly mixed in a stainless steel or disposable, inert plastic tray, using a stainless steel trowel or other approved tool, then transferred into the appropriate sample container(s). Head space is permitted in a non-volatile soil sample container to allow for sample expansion.

5.2.3 Procedure for Collecting Undisturbed Soil Samples (ASTM D1587-83)

When it is necessary to acquire undisturbed samples of soil for purposes of engineering parameter analysis (e.g., permeability), a thin-walled, seamless tube sampler (Shelby tube) will be employed. The following method will be used:

1. Remove all surface debris (e.g., vegetation, roots, twigs, etc.) from the specific sampling location and drill and clean out the borehole to the sampling depth, being careful to minimize the chance for disturbance of the material to be sampled. In saturated material, withdraw the drill bit slowly to prevent loosening of the soil around the borehole and to maintain the water level in the hole at or above groundwater level.

2. The use of bottom discharge bits or jetting through an open-tube sampler to clean out the borehole shall not be allowed. Use of any side-discharge bits is permitted.

3. 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 into the borehole, check to ensure that the sampler head contains a check valve. The check valve is necessary to keep water in the rods from pushing the sample out the tube sampler during sample withdrawal and to maintain a suction within the tube to help retain the sample.

4. 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're 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 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.

5. Upon removal of the sampling 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. Clean filler must be placed in voids at either end of the tube prior to sealing with wax. Place plastic caps on the ends of the sample tube, tape the caps in place, and dip the ends in wax.

6. Affix label(s) to the tube as required and record sample number, depth, penetration, and recovery length on the label. Mark the "up" direction on the side of the tube with indelible ink, and mark the end of the sample. Complete Chain-of-Custody and other required forms (see SOP SA-6.3). 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 Dennison 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 need for acquiring an undisturbed sample.

5.3 Surface Soil Sampling

The simplest, most direct method of collecting surface soil samples (most commonly collected to a depth of 6 inches) for subsequent analysis is by use of a stainless steel trowel.

In general, the following equipment is necessary for obtaining surface soil samples:

- Stainless steel trowel.
- Real-time air monitoring instrument (e.g., PID, FID, etc.).
- Latex gloves.
- Required Personal Protective Equipment (PPE).
- Required paperwork.
- Required decontamination equipment.
- Required sample container(s).
- Wooden stakes or pin flags.
- Sealable polyethylene bags (i.e., Ziploc baggies).
- Heavy duty cooler.
- Ice (if required) double-bagged in sealable polyethylene bags.
- Chain-of-custody records and custody seals.

When acquiring surface soil samples, the following procedure shall be used:

1. Carefully remove vegetation, roots, twigs, litter, etc., to expose an adequate soil surface area to accommodate sample volume requirements.

2. Using a decontaminated stainless steel trowel, follow the procedure cited in Section 5.2.1 for collecting a volatile soil sample.

3. Thoroughly mix (in-situ) a sufficient amount of soil to fill the remaining sample containers and transfer the sample into those containers utilizing the same stainless steel trowel employed above. Cap and securely tighten all sample containers.

4. Affix a sample label to each container. Be sure to fill out each label carefully and clearly, addressing all the categories described in SOP SA-6.3.

5. Proceed with the handling and processing of each sample container as described in SOP SA-6.2.

5.4 Near-Surface Soil Sampling

Collection of samples from near the surface (depth of 6-18 inches) can be accomplished with tools such as shovels and stainless steel trowels.

The following equipment is necessary to collect near surface soil samples:

- Clean shovel.
- Plus the equipment listed under Section 5.3 of this procedure.

To obtain near-surface soil samples, the following protocol shall be observed:

1. With a clean shovel, make a series of vertical cuts to the depth required in the soil to form a square approximately 1 foot by 1 foot.

2. Lever out the formed plug and scrape the bottom of the freshly dug hole with a decontaminated stainless steel trowel to remove any loose soil.

3. Follow steps 2 through 5 listed under Section 5.3 of this procedure.

5.5 Subsurface Soil Sampling With a Hand Auger

A hand augering system generally consists of a variety of all stainless steel bucket bits (i.e., cylinders 6-1/2" long, and 2-3/4", 3-1/4", and 4" in diameter), a series of extension rods (available in 2', 3', 4' and 5' lengths), and a cross handle. A larger diameter bucket bit is commonly used to bore a hole to the desired sampling depth and then withdrawn. In turn, the larger diameter bit is replaced with a smaller diameter bit, lowered down the hole, and slowly turned into the soil at the completion depth (approximately 6"). The apparatus is then withdrawn and the soil sample collected.

The hand auger can be used in a wide variety of soil conditions. It can be used to sample soil both from the surface, or to depths in excess of 12 feet. However, the presence of rock layers and the collapse of the borehole normally contribute to its limiting factors.

To accomplish soil sampling using a hand augering system, the following equipment is required:

- Complete hand auger assembly (variety of bucket bit sizes).
- Stainless steel mixing bowls.
- Plus the equipment listed under Section 5.3 of this procedure.

To obtain soil samples using a hand auger, the following procedure shall be followed:

1. Attach a properly decontaminated bucket bit to a clean extension rod and further attach the cross handle to the extension rod.

2. Clear the area to be sampled of any surface debris (vegetation, twigs, rocks, litter, etc.).

3. Begin augering (periodically removing accumulated soils from the bucket bit) and add additional rod extensions as necessary. Also, note (in a field notebook or on standardized data sheets) any changes in the color, texture or odor of the soil.

4. After reaching the desired depth, slowly and carefully withdraw the apparatus from the borehole.

5. Remove the soiled bucket bit from the rod extension and replace it with another properly decontaminated bucket bit. The bucket bit used for sampling is commonly smaller in diameter than the bucket bit employed to initiate the borehole.

6. Carefully lower the apparatus down the borehole. Care must be taken to avoid scraping the borehole sides.

7. Slowly turn the apparatus until the bucket bit is advanced approximately 6 inches.

8. Discard the top of the core (approximately 1"), which represents any loose material collected by the bucket bit before penetrating the sample material.

9. Fill volatile sample container(s), using a properly decontaminated stainless steel trowel, with sample material directly from the bucket bit. Refer to Section 5.2.1 of this procedure.

10. Utilizing the above trowel, remove the remaining sample material from the bucket bit and place into a properly decontaminated stainless steel mixing bowl and thoroughly homogenize the sample material prior to filling the remaining sample containers. Refer to Section 5.2.2 of this procedure.

11. Follow steps 4 and 5 listed under Section 5.3 of this procedure.

5.6 Subsurface Soil Sampling With a Split-Barrel Sampler (ASTM D1586-84)

Split-barrel (split-spoon) samplers consist of a heavy carbon steel or stainless steel sampling tube that can be split into two equal halves to reveal the soil sample (see Attachment A). A drive head is attached to the upper end of the tube and serves as a point of attachment for the drill rod. A removable tapered nosepiece/drive shoe attaches to the lower end of the tube and facilitates cutting. A basket-like sample retainer can be fitted to the lower end of the split tube to hold loose, dry soil samples in the tube when the sampler is removed from the drill hole. This split-barrel sampler is made to be attached to a drill rod and forced into the ground by means of a 140-lb. or larger casing driver.

Split-barrel samplers are used to collect soil samples from a wide variety of soil types and from depths greater than those attainable with other soil sampling equipment.

The following equipment is used for obtaining split-barrel samples:

- Drilling equipment (provided by subcontractor).
- Split-barrel samplers (O.D. 2 inches, I.D. 1-3/8 inches, either 20 inches or 26 inches long); Larger O.D. samplers are available if a larger volume of sample is needed.
- Drive weight assembly, 140-lb. weight, driving head and guide permitting free fall of 30 inches.

- Stainless steel mixing bowls.
- Plus equipment listed under Section 5.3 of this procedure.

The following steps shall be followed to obtain split-barrel samples:

1. Remove the drive head and nosepiece, and open the sampler to reveal the soil sample. Immediately scan the sample core with a real-time air monitoring instrument (e.g., OVA, HNu, etc.). Carefully separate the soil core, with a decontaminated stainless steel knife or trowel, at about 6-inch intervals while scanning the center of the core for elevated readings. Also scan stained soil, soil lenses, and anomalies (if present), and record readings.

2. Collect the volatile sample from the center of the core where elevated readings occurred. If no elevated readings where encountered the sample material should still be collected from the core's center (this area represents the least disturbed area with minimal atmospheric contact). Refer to Section 5.2.1 of this procedure.

3. Using the same trowel, remove remaining sample material from the split-barrel sampler (except for the small portion of disturbed soil usually found at the top of the core sample) and place the soil into a decontaminated stainless steel mixing bowl. Thoroughly homogenize the sample material prior to filling the remaining sample containers. Refer to Section 5.2.2 of this procedure.

4. Follow steps 4 and 5 listed under Section 5.3 of this procedure.

5.7 Excavation and Sampling of Test Pits and Trenches

5.7.1 Applicability

This subsection presents routine test pit or trench excavation techniques and specialized techniques that are applicable under certain conditions.

During the excavation of trenches or pits at hazardous waste sites, several health and safety concerns arise which control the method of excavation. No personnel shall enter any test pit or excavation except as a last resort, and then only under direct supervision of a Competent Person (as defined in 29 CFR 1929.650 of Subpart P - Excavations). Whenever possible, all required chemical and lithological samples should be collected using the excavator bucket or other remote sampling apparatus. If entrance is still required, all test pits or excavations must be stabilized by bracing the pit sides using specifically designed wooden or steel support structures. Personnel entering the excavation may be exposed to toxic or explosive gases and oxygen-deficient environments. Any entry may constitute a Confined Space and must be done in conformance with all applicable regulations. In these cases, substantial air monitoring is required before entry, and appropriate respiratory gear and protective clothing is mandatory. There must be at least two persons present at the immediate site before entry by one of the investigators. The reader shall refer to OSHA regulations 29 CFR 1926, 29 CFR 1910.120, 29 CFR 1910.134, AND 29 CFR 1910.146.

Excavations are generally not practical where a depth of more than about 15 feet is desired, and they are usually limited to a few feet below the water table. In some cases, a pumping system may be required to control water levels within the pit, providing that pumped water can be

adequately stored or disposed. If data on soils at depths greater than 15 feet are required, the data are usually obtained through test borings instead of test pits.

In addition, hazardous wastes may be brought to the surface by excavation equipment. This material, whether removed from the site or returned to the subsurface, must be properly handled according to any and all applicable federal, state, and local regulations.

5.7.2 Test Pit and Trench Excavation

These procedures describe the methods for excavating and logging test pits and trenches excavated to determine subsurface soil and rock conditions. Test pit operations shall be logged and documented as described in SOP SA-6.3.

Test pits and trenches may be excavated by hand or by power equipment to permit detailed description of the nature and contamination of the in-situ materials. The size of the excavation will depend primarily on the following:

- The purpose and extent of the exploration.
- The space required for efficient excavation.
- The chemicals of concern.
- The economics and efficiency of available equipment.

Test pits normally have a cross section that is 4 to 10 feet square; test trenches are usually 3 to 6 feet wide and may be extended for any length required to reveal conditions along a specific line. The following table, which is based on equipment efficiencies, gives a rough guide for design consideration:

Equipment	Typical Widths, in Feet
Trenching machine	2
Backhoe	2-6
Track dozer	10
Track loader	10
Excavator	10
Scraper	20

The lateral limits of excavation of trenches and the position of test pits shall be carefully marked on area base maps. If precise positioning is required to indicate the location of highly hazardous waste materials, nearby utilities, or dangerous conditions, the limits of the excavation shall be surveyed. Also, if precise determination of the depth of buried materials is needed for design or environmental assessment purposes, the elevation of the ground surface at the test pit or trench location shall also be determined by survey. If the test pit/trench will not be surveyed immediately, it shall be backfilled and its position identified with stakes placed in the ground at the margin of the excavation for later surveying.

The construction of test pits and trenches shall be planned and designed in advance as much as possible. However, field conditions may necessitate revisions to the initial plans. The final depth and construction method shall be determined by the field geologist. The actual layout of each test pit, temporary staging area and spoils pile will be predicated based on site conditions and wind

direction at the time the test pit is made. Prior to excavation, the area can be surveyed by magnetometer or metal detector to identify the presence of underground utilities or drums.

As mentioned previously, no personnel shall enter any test pit or excavation except as a last resort, and then only under direct supervision of a Competent Person. If entrance is still required, Occupational Safety and Health Administration (OSHA) requirements must be met (e.g., walls must be braced with wooden or steel braces, ladders must be in the hole at all times, and a temporary guardrail must be placed along the surface of the hole before entry). It is emphasized that the project data needs should be structured such that required samples can be collected without requiring entrance into the excavation. For example, samples of leachate, groundwater, or sidewall soils can be taken with telescoping poles, etc.

Dewatering may be required to assure the stability of the side walls, to prevent the bottom of the pit from heaving, and to keep the excavation dry. This is an important consideration for excavations in cohesionless material below the groundwater table. Liquids removed as a result of dewatering operations must be handled as potentially contaminated materials. Procedures for the collection and disposal of such materials should be discussed in the site-specific project plans.

5.7.3 *Sampling in Test Pits and Trenches*

5.7.3.1 General

Test pits and trenches are usually logged as they are excavated. Records of each test pit/trench will be made as described in SOP SA-6.3. These records include plan and profile sketches of the test pit/trench showing materials encountered, their depth and distribution in the pit/trench, and sample locations. These records also include safety and sample screening information.

Entry of test pits by personnel is extremely dangerous, shall be avoided unless absolutely necessary, and can occur only after all applicable Health and Safety and OSHA requirements have been met.

The final depth and type of samples obtained from each test pit will be determined at the time the test pit is excavated. Sufficient samples are usually obtained and analyzed to quantify contaminant distribution as a function of depth for each test pit. Additional samples of each waste phase and any fluids encountered in each test pit may also be collected.

In some cases, samples of soil may be extracted from the test pit for reasons other than waste sampling and chemical analysis, for instance, to obtain geotechnical information. Such information would include soil types, stratigraphy, strength, etc., and could therefore entail the collection of disturbed (grab or bulk) or relatively undisturbed (hand-carved or pushed/driven) samples, which can be tested for geotechnical properties. The purposes of such explorations are very similar to those of shallow exploratory or test borings, but often test pits offer a faster, more cost-effective method of sampling than installing borings.

5.7.3.2 Sampling Equipment

The following equipment is needed for obtaining samples for chemical or geotechnical analysis from test pits and trenches:

- Backhoe or other excavating machinery.
- Shovels, picks and hand augers, stainless steel trowels.

- Sample container - bucket with locking lid for large samples; appropriate bottleware for chemical or geotechnical analysis samples.

- Polyethylene bags for enclosing sample containers; buckets.

- Remote sampler consisting of 10-foot sections of steel conduit (1-inch-diameter), hose clamps and right angle adapter for conduit (see Attachment B).

5.7.3.3 Sampling Methods

The methods discussed in this section refer to test pit sampling from grade level. If test pit entry is required, see Section 5.7.3.4.

- Excavate trench or pit in several depth increments. After each increment, the operator will wait while the sampler inspects the test pit from grade level to decide if conditions are appropriate for sampling. (Monitoring of volatiles by the SSO will also be used to evaluate the need for sampling.) Practical depth increments range from 2 to 4 feet.

- The backhoe operator, who will have the best view of the test pit, will immediately cease digging if:

- Any fluid phase or groundwater seepage is encountered in the test pit.

- Any drums, other potential waste containers, obstructions or utility lines are encountered.

- Distinct changes of material are encountered.

This action is necessary to permit proper sampling of the test pit and to prevent a breach of safety protocol. Depending upon the conditions encountered, it may be required to excavate more slowly and carefully with the backhoe.

For obtaining test pit samples from grade level, the following procedure shall be followed:

- Remove loose material to the greatest extent possible with backhoe.

- Secure walls of pit if necessary. (There is seldom any need to enter a pit or trench which would justify the expense of shoring the walls. All observations and samples should be taken from the ground surface.)

- Samples of the test pit material are to be obtained either directly from the backhoe bucket or from the material once it has been deposited on the ground. The sampler or Field Operations Leader directs the backhoe operator to remove material from the selected depth or location within the test pit/trench. The bucket is brought to the surface and moved away from the pit. The sampler and/or SSO then approaches the bucket and monitors its contents with a photoionization or flame ionization detector. The sample is collected from the center of the bucket or pile and placed in sample containers using a decontaminated stainless steel trowel or spatula.

- If a composite sample is desired, several depths or locations within the pit/trench are selected and a bucket is filled from each area. It is preferable to send individual sample bottles filled from each bucket to the laboratory for compositing under the more controlled laboratory

conditions. However, if compositing in the field is required, each sample container shall be filled from materials that have been transferred into a mixing bucket and homogenized. Note that homogenization/compositing is not applicable for samples to be subjected to volatile organic analysis.

- Using the remote sampler shown in Attachment B, samples can be taken at the desired depth from the side wall or bottom of the pit. The face of the pit/trench shall first be scraped (using a long-handled shovel or hoe) to remove the smeared zone that has contacted the backhoe bucket. The sample shall then be collected directly into the sample jar, by scraping with the jar edge, eliminating the need to utilize samplers and minimizing the likelihood of cross-contamination. The sample jar is then capped, removed from the assembly, and packaged for shipment.

- Complete documentation as described in SOP SA-6.3.

5.7.3.4 In-Pit Sampling

Under rare conditions, personnel may be required to enter the test pit/trench. This is necessary only when soil conditions preclude obtaining suitable samples from the backhoe bucket (e.g., excessive mixing of soils or wastes within the test pit/trench) or when samples from relatively small discrete zones within the test pit are required. This approach may also be necessary to sample any seepage occurring at discrete levels or zones in the test pit that are not accessible with remote samplers.

In general, personnel shall sample and log pits and trenches from the ground surface, except as provided for by the following criteria:

- There is no practical alternative means of obtaining such data.

- The Site Safety Officer and Competent Person determines that such action can be accomplished without breaching site safety protocol. This determination will be based on actual monitoring of the pit/trench after it is dug (including, at a minimum, measurements of volatile organics, explosive gases and available oxygen).

- A Company-designated Competent Person determines that the pit/trench is stable or is made stable (by grading the sidewalls or using shoring) prior to entrance of any personnel. OSHA requirements must be strictly observed.

If these conditions are satisfied, one person will enter the pit/trench. On potentially hazardous waste sites, this individual will be dressed in safety gear as required by the conditions in the pit, usually Level B. He/she will be affixed to a safety rope and continuously monitored while in the pit.

A second individual will be fully dressed in protective clothing including a self-contained breathing device and on standby during all pit entry operations. The individual entering the pit will remain therein for as brief a period as practical, commensurate with performance of his/her work. After removing the smeared zone, samples shall be obtained with a decontaminated trowel or spoon. As an added precaution, it is advisable to keep the backhoe bucket in the test pit when personnel are working below grade. Such personnel can either stand in or near the bucket while performing sample operations. In the event of a cave-in they can either be lifted clear in the bucket, or at least climb up on the backhoe arm to reach safety.

5.7.3.5 Geotechnical Sampling

In addition to the equipment described in Section 5.7.3.2, the following equipment is needed for geotechnical sampling:

- Soil sampling equipment, similar to that used in shallow drilled boring (i.e., open tube samplers), which can be pushed or driven into the floor of the test pit.
- Suitable driving (i.e., a sledge hammer) or pushing (i.e., the backhoe bucket) equipment which is used to advance the sampler into the soil.
- Knives, spatulas, and other suitable devices for trimming hand-carved samples.
- Suitable containers (bags, jars, tubes, boxes, etc.), labels, wax, etc. for holding and safely transporting collected soil samples.
- Geotechnical equipment (pocket penetrometer, torvane, etc.) for field testing collected soil samples for classification and strength properties.

Disturbed grab or bulk geotechnical soil samples may be collected for most soils in the same manner as comparable soil samples for chemical analysis. These collected samples may be stored in jars or plastic-lined sacks (larger samples), which will preserve their moisture content. Smaller samples of this type are usually tested for their index properties to aid in soil identification and classification, while larger bulk samples are usually required to perform compaction tests.

Relatively undisturbed samples are usually extracted in cohesive soils using open tube samplers, and such samples are then tested in a geotechnical laboratory for their strength, permeability and/or compressibility. The techniques for extracting and preserving such samples are similar to those used in performing Shelby tube sampling in borings, except that the sampler is advanced by hand or backhoe, rather than by a drill rig. Also, the sampler may be extracted from the test pit by excavation around the sampler when it is difficult to pull it out of the ground. If this excavation requires entry of the test pit, the requirements described in Section 5.7.3.4 of this procedure must be followed. The open tube sampler shall be pushed or driven vertically into the floor or steps excavated in the test pit at the desired sampling elevations. Extracting tube samples horizontally from the walls of the test pit is not appropriate, because the sample will not have the correct orientation.

A sledge hammer or the backhoe may be used to drive or push the sampler or tube into the ground. Place a piece of wood over the top of the sampler or sampling tube to prevent damage during driving/pushing of the sample. Pushing the sampler with a constant thrust is always preferable to driving it with repeated blows, thus minimizing disturbance to the sample. If the sample cannot be extracted by rotating it at least two revolutions (to shear off the sample at the bottom), hand-excavate to remove the soil from around the sides of the sampler. If hand-excavation requires entry of the test pit, the requirements in Section 5.7.3.4 of this procedure must be followed. Prepare, label, pack and transport the sample in the required manner, as described in SOP SA-6.3.

5.7.4 Backfilling of Trenches and Test Pits

All test pits and excavations must be either backfilled, covered, or otherwise protected at the end of each day. No excavations shall remain open during non working hours unless adequately covered or otherwise protected.

Before backfilling, the onsite crew shall photograph all significant features exposed by the test pit and trench and shall include in the photograph a scale to show dimensions. Photographs of test pits shall be marked to include site number, test pit number, depth, description of feature, and date of photograph. In addition, a geologic description of each photograph shall be entered in the site logbook. All photographs shall be indexed and maintained as part of the project file for future reference.

After inspection, backfill material shall be returned to the pit under the direction of the FOL.

If a low permeability layer is penetrated (resulting in groundwater flow from an upper contaminated flow zone into a lower uncontaminated flow zone), backfill material must represent original conditions or be impermeable. Backfill could consist of a soil-bentonite mix prepared in a proportion specified by the FOL (representing a permeability equal to or less than original conditions). Backfill can be covered by "clean" soil and graded to the original land contour. Revegetation of the disturbed area may also be required.

5.8 Records

The appropriate sample log sheet (see SOP SA-6.3; Field Documentation) must be completed by the site geologist/sampler. All soil sampling locations must be documented by tying in the location of two or more nearby permanent landmarks (building, telephone pole, fence, etc.) and shall be noted the appropriate sample log sheet, site map, or field notebook. Surveying may also be necessary, depending on the project requirements.

Test pit logs (see SOP SA-6.3; Field Documentation) shall contain a sketch of pit conditions. In addition, at least one photograph with a scale for comparison shall be taken of each pit. Included in the photograph shall be a card showing the test pit number. Boreholes, test pits and trenches shall be logged by the field geologist in accordance with SOP GH-1.5.

Other data to be recorded in the field logbook include the following:

- Name and location of job.
- Date of boring and excavation.
- Approximate surface elevation.
- Total depth of boring and excavation.
- Dimensions of pit.
- Method of sample acquisition.
- Type and size of samples.
- Soil and rock descriptions.
- Photographs.
- Groundwater levels.
- Organic gas or methane levels.
- Other pertinent information, such as waste material encountered.

6.0 REFERENCES

American Society for Testing and Materials, 1987. ASTM Standards D1587-83 and D1586-84. ASTM Annual Book of Standards. ASTM. Philadelphia, Pennsylvania. Volume 4.08.

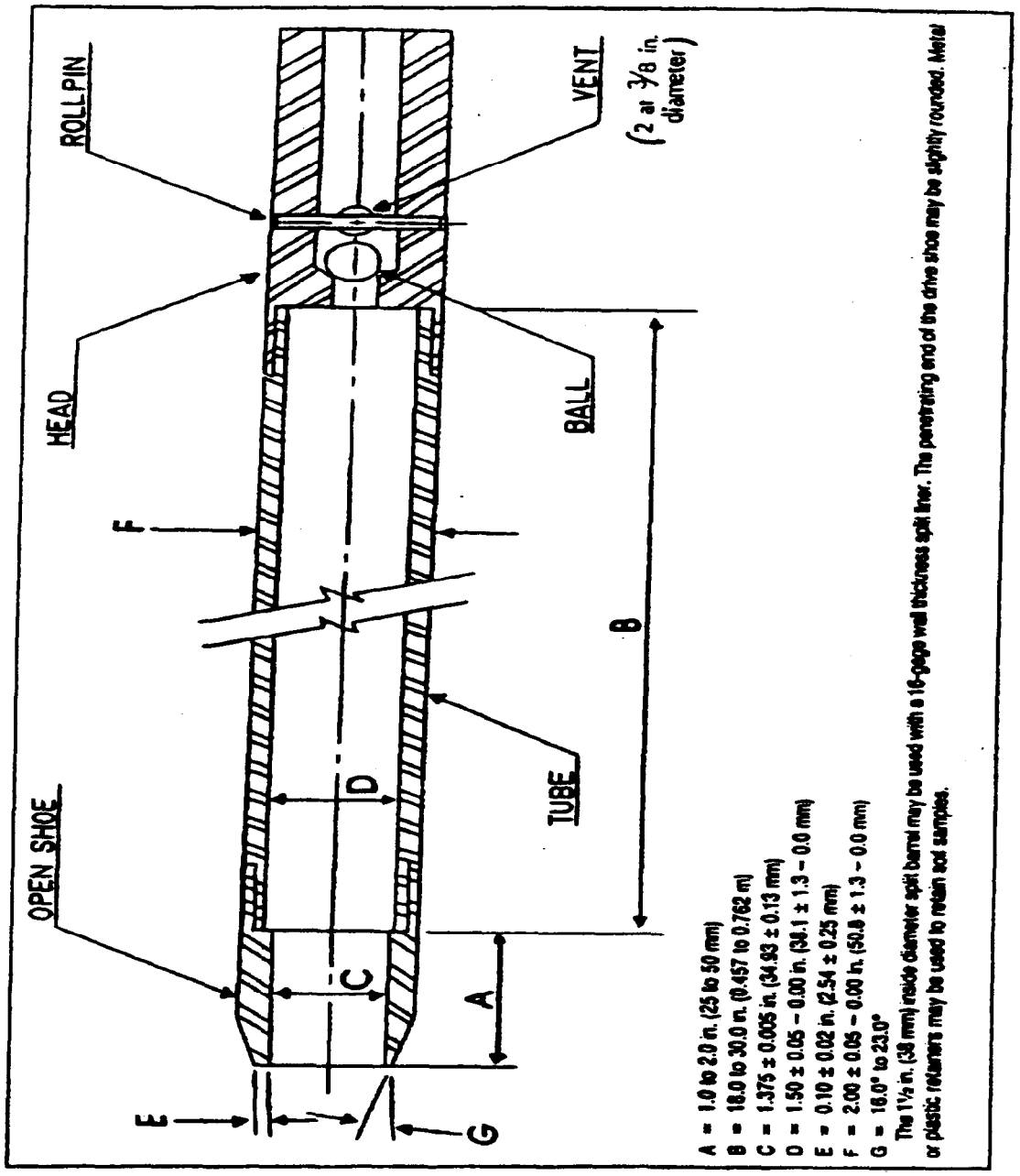
NUS Corporation, 1986. Hazardous Material Handling Training Manual.

NUS Corporation and CH2M Hill, August, 1987. Compendium of Field Operation Methods. Prepared for the U.S. EPA.

OSHA, Excavation, Trenching and Shoring 29 CFR 1926.650-653.

OSHA, Confined Space Entry 29 CFR 1910.146.

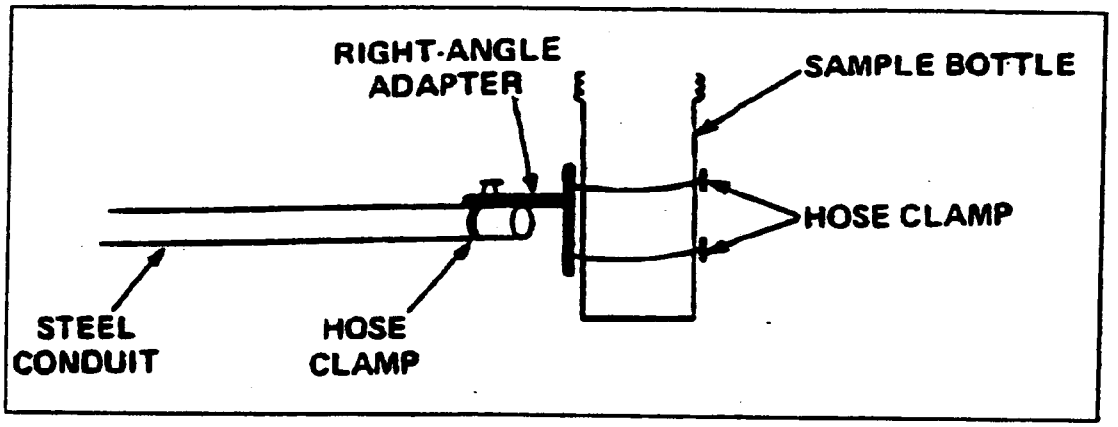
ATTACHMENT A
SPLIT-SPOON SAMPLER



A = 1.0 to 2.0 in. (25 to 50 mm)
B = 18.0 to 30.0 in. (0.457 to 0.762 m)
C = 1.375 ± 0.005 in. (34.93 ± 0.13 mm)
D = 1.50 ± 0.05 – 0.00 in. (34.1 ± 1.3 – 0.0 mm)
E = 0.10 ± 0.02 in. (2.54 ± 0.25 mm)
F = 2.00 ± 0.05 – 0.00 in. (50.8 ± 1.3 – 0.0 mm)
G = 18.0° to 23.0°

The 1½ in. (38 mm) inside diameter split barrel may be used with a 16-gage wall thickness split liner. The penetrating end of the drive shoe may be slightly rounded. Metal or plastic retainers may be used to retain soil samples.

ATTACHMENT B
REMOTE SAMPLE HOLDER FOR TEST PIT/TRENCH SAMPLING



APPENDIX B

SITE MAP

SITE 1 – GOLF COURSE LANDFILL
NTC GREAT LAKES

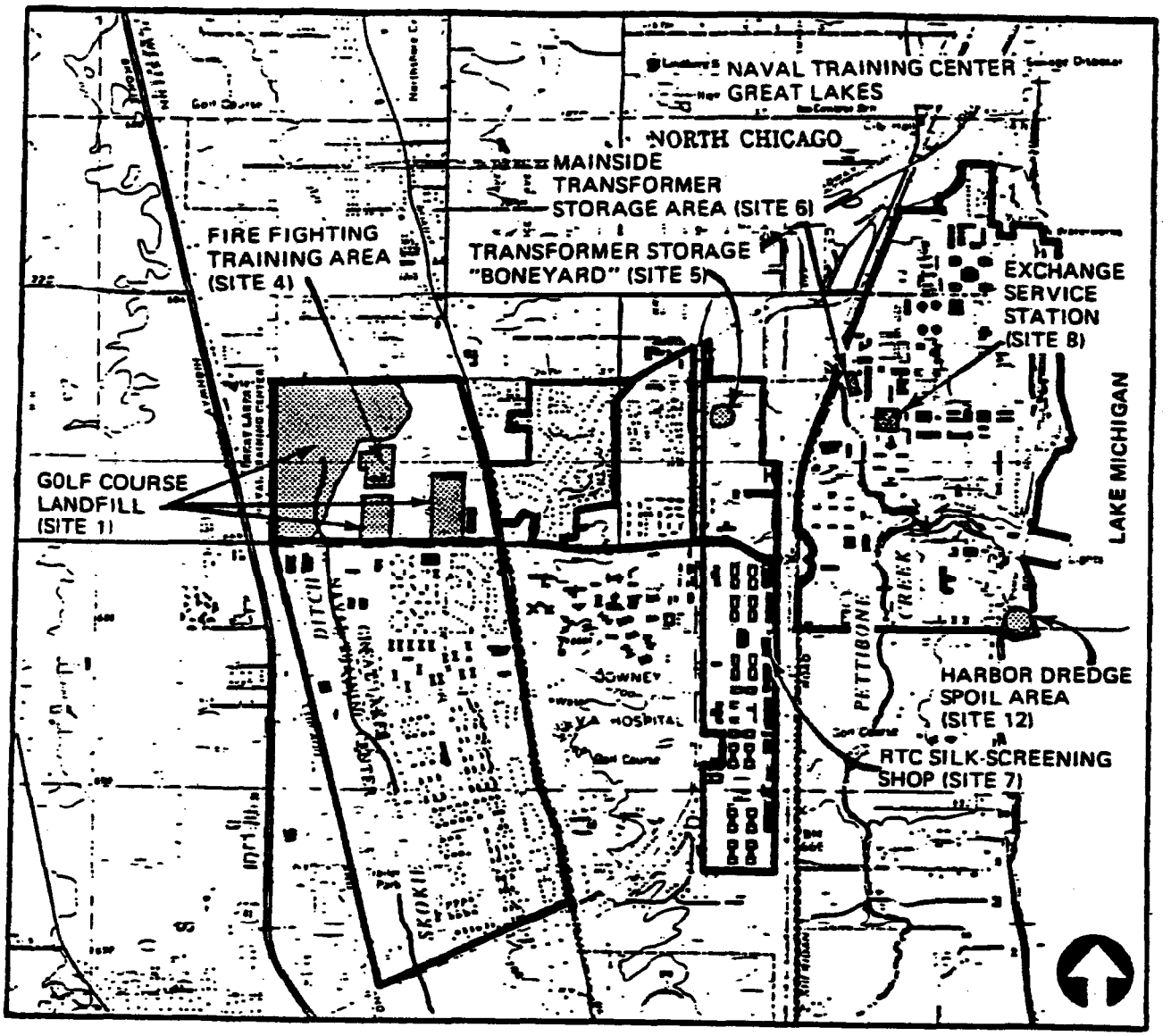


FIGURE 1-1
LOCATION OF STUDY SITES AT
NTC GREAT LAKES

REMEDIAL INVESTIGATION
NAVAL TRAINING CENTER
Great Lakes, Illinois