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NCBC DAVISVILLE
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Sampling Plan for PCB Grid Sampling - Site 13 NCBC Davisville, Rhode Island

Prepared for:

Department of the Navy
Northern Division
Naval Facilities Engineering Command
Lester, Pennsylvania

Prepared by:

Stone & Webster Environmental
Technology & Services
Boston, Massachusetts

Under contract with:

EA Engineering, Science, and Technology
Sparks, Maryland

09 February 1996
Contract No. N62472-92-D-1296
Contract Task Order No. 0041

SAMPLING PLAN
FOR
PCB GRID SAMPLING - SITE 13
AT
NCBC DAVISVILLE, RI

Prepared for:

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Naval Facilities Engineering Command
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Contract No. N62472-92-D-1296
Contract Task Order No. 0041

09 February 1996
FINAL
EA Project No. 296.0040
S&W Project No. 04291.09

SAMPLING PLAN
FOR
PCB GRID SAMPLING - SITE 13
AT
NCBC DAVISVILLE, RI

Contract No. N62472-92-D-1296
Contract Task Order No. 0041

Linda B. Gardiner for

Lisa O. Brandon, P.E.
CTO Manager

2/8/96
Date

for

C.W. Houlik, Jr., Ph.D., CPG
Program Manager

2/8/96
Date

09 February 1996
FINAL
EA Project No. 296.0040
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SECTION ONE

INTRODUCTION

1.1 AUTHORIZATION

Under Contract No. N62472-92-D-1296, Northern Division, Naval Facilities Engineering Command (Northern Division) issued Contract Task Order (CTO) No. 0041 to EA Engineering, Science and Technology (EA). EA has authorized Stone & Webster Environmental Technology & Services (Stone & Webster) to prepare this sampling plan and to perform the PCB grid sampling and analysis at Site 13 of the Naval Construction Battalion Center (NCBC) Davisville, Rhode Island.

1.2 SITE LOCATION

NCBC Davisville is located in the northeast section of the Town of North Kingstown, Rhode Island, approximately 18 miles south of the state capital, Providence. A significant portion of NCBC Davisville is adjacent to Narragansett Bay. Adjoining NCBC Davisville's southern boundary is the decommissioned Naval Air Station (NAS) Quonset Point which was transferred by the Navy to the Rhode Island Economic Development Corporation (RIEDC) during the period 1974 through 1978. A site locus map is included as Figure 1-1.

The site is located in NCBC Davisville, northwest of Buildings W-3, W-4 and T-1, and is bounded on the south by "A" Street, on the east by Exeter Street and on the north by Foster Road. A site plan is provided as Figure 1-2.

1.3 OBJECTIVES OF SAMPLING PLAN

The PCB grid sampling and analysis will be conducted at Site 13, NCBC Davisville focusing on near surface and subsurface soils. This sampling plan will provide procedures for PCB grid sampling and analysis for the possible area of PCB contamination at Site 13, the results of which will determine the extent of excavation required for the proposed removal action. Figure 1-2 presents the possible area of contamination at Site 13.

A three dimensional grid consisting of approximately 100 samples including quality assurance/ quality control (QA/QC) is proposed. Multiple level sampling will be performed; a composite sample will be collected for a 0 to 1 foot below ground surface (bgs) interval and also for a 1 to 2 feet bgs interval. The number of samples required and the location of each has been determined and is specified herein.

The interpretation of the laboratory results, as they relate to response objectives, includes numerical comparisons to the guidance number and figures which will highlight elevated levels of PCB found at the site. Laboratory data will be validated by Stone & Webster's staff chemist, who is experienced in data validation and is familiar with standard EPA protocols. If a "hot spot" exists, it will be delineated by drawing a box equidistant between two sampling points adjacent to the "hot spot". It is assumed that if none of the samples exceed the proposed cleanup standard for PCB of 10 parts per million (ppm), then a removal action with respect to PCB will not be required at this time. If elevated contamination is found, then further screening is anticipated during future removal actions.

A Sampling Report will be prepared following the sampling round. The Sampling Report will contain the following information:

- Objectives and Scope of Investigation.
- Summary of Site Background.
- Regional Geology/Hydrogeology.
- Summary of PCB Grid Sampling Field Activities.
- Findings and Laboratory Analysis of Soil Samples.
- Data Validation and Problems Encountered.
- Summary and Conclusions.
- Recommendations for Removal Action Activities.

1.4 KEY PERSONNEL AND RESPONSIBILITIES

The following are summaries of pertinent qualifications of the key personnel for this CTO:

CTO Manager: Ms. Lisa O. Brandon, P.E.

Ms. Brandon is a Registered Professional Chemical Engineer with over 11 years experience in chemical engineering, environmental engineering and hazardous waste management. She has implemented and managed a variety of hazardous waste remediation projects, including fast-tracked underground storage tank removals and soil and ground water remediation. Ms. Brandon has conducted hazardous waste management at Superfund/National Priorities List sites, such as Pease Air Force Base, Ft. Devens, and various Department of Energy sites. She is currently CTO Manager for tasks involving removal actions and remedial design at three Davisville sites and a basewide ground water study. She has also acted as Project Engineer for another task involving 38 tank removals at Davisville.

Senior Technical Reviewer: Mr. Kevin R. Bryson, P.E.

Mr. Bryson has over 20 years experience working with and directing multi-discipline teams on major environmental projects. He is a registered professional engineer in the State of Rhode Island. He is experienced in providing coordination between the client, regulatory agencies, the public, numerous subcontractors for design and field services, and the Stone & Webster staff of various engineering and scientific disciplines.

Project Engineer: Ms. Linda B. Gardiner

Ms. Gardiner is a civil engineer with experience in environmental engineering and hazardous waste management. She has previous experience working on hazardous waste site assessment and remediation projects, including the Gould Island Former Navy Torpedo Testing Facility in Narragansett Bay, Rhode Island. Ms. Gardiner supervised the field program for the removal of 38 oil storage tanks at NCBC Davisville and is currently Project Engineer for the removal action and remedial design work at three Davisville sites and the basewide ground water study.

Engineer: Ms. Monica C. Berube

Ms. Berube is a chemical engineer with experience in hazardous waste management and environmental engineering. She is currently supporting the removal action and remedial design work at three Davisville sites as well as the basewide ground water study.

Program Manager: C.W. Houlik, Ph.D., CPG

Dr. Houlik has more than 20 years of experience in the performance and management of multi-disciplinary investigations addressing environmental issues and in support of engineering design. He is a Certified Professional Geologist with extensive experience in waste management, contaminant assessment, impact assessment, environmental remediation, and facilities siting. His responsibilities include active participation in, and supervision of, site and regional geological investigations, surface and ground water hydrological evaluations for siting or design of facilities, impact assessment for existing and proposed facilities, Remedial Investigation/Feasibility Study (RI/FS), and remedial design.

1.5 SAMPLING PLAN ORGANIZATION

This sampling plan is organized as follows:

Section 1 presents the objectives of the investigation, the purpose and scope of the sampling plan, and key personnel.

Section 2 presents the site history and previous site investigations .

Section 3 presents the field sampling plan, and a discussion of objectives, data requirements, and data quality objectives.

Appendix A presents the acronyms and abbreviations used in this sampling plan.
Appendix B presents the PCB grid sampling design calculation.
Appendix C presents the standard operating procedures to be followed in accordance with this sampling plan.
Appendix D presents the Safety, Health, and Emergency Response Plan (SHERP).

1.6 PROJECT SCHEDULE

A proposed project schedule showing field activities, regulatory review, and activity duration dates is presented in the following table:

TABLE 1-1
PROPOSED SCHEDULE

ACTIVITY	DATE
Notice to Proceed	01 November 1995
Draft Sampling Plan including SHERP Submission to Navy, EPA, RIDEM	13 November 1995
Comments by Navy, EPA, RIDEM to Stone & Webster	15 December 1995
Final Sampling Plan including SHERP Submission to Navy, EPA, RIDEM	09 February 1996
Field Program completed	29 February 1996
Sampling Report and Recommendations to Navy	21 March 1996
Comments by Navy to Stone & Webster, Response to Comments, and Resolution of Response to Comments	28 March 1996
Final Sampling Report, Recommendations & Draft Revised Final Action Memorandum to Navy, EPA, RIDEM	04 April 1996
Comments by Navy, EPA, RIDEM to Stone & Webster	18 April 1996
Response to Comments	25 April 1996
Comment Resolution	2 May 1996
Final Revised Final Action Memorandum	9 May 1996
Public Comment Period Complete	8 June 1996

SECTION TWO

BACKGROUND INFORMATION

2.1 SITE HISTORY/DESCRIPTION

2.1.1 Site History

From 1945 to 1955, NCBC Davisville Construction Equipment Division (CED) was located in Buildings W-3, W-4 and T-1. Overhaul and repair activities were conducted in these buildings, vehicles were stored in the fields to the north and west, and drums of oils, thinner and solvents were stored adjacent to the buildings. Approximately 300 gallons of waste oils per month for a ten year period were reportedly spread on the fields northwest of the three buildings.

2.1.2 Site Description

Site 13 is approximately six acres in size and consists of a large grassy field bounded on three sides by paved roads. The area under investigation for the PCB contamination is approximately 1/6 acre in size. Small devegetated areas are evident within the site area.

The comprehensive Reuse Plan for NCBC Davisville specifies the area in which Site 13 is located is to be used for economic and industrial development.

2.2 PREVIOUS INVESTIGATIONS

Previous investigations at NCBC Davisville reported that a surface soil sample from Site 13, taken from 0-2 feet, was detected to have PCB concentrations that were in excess of state and federal recommended limits for industrial soil. TRC reported in the DAA that one sample collected in the eastern portion of the site exhibited a 1.2% (12,000 ppm) level of PCB during its original analysis. Due to laboratory QA/QC problems, the sample and a duplicate were recollected and reanalyzed, exhibiting 970 ppm and 720 ppm PCB, respectively. An average of these three concentrations of 4,563 ppm was considered by TRC to be representative of that sample location, and was in turn used to determine the possible area of PCB contamination at Site 13. Figure 1-2 illustrates Site 13 and the possible area exceeding action levels for PCB in soils. Refer to the Phase II RI and the DAA, both prepared by TRC, for more detailed information on the analytical findings of these investigations.

SECTION THREE

FIELD SAMPLING PLAN

3.1 INTRODUCTION

The objective of this Sampling Plan is to provide procedures to implement the PCB grid sampling and analysis for Site 13 described in Section 1.3. This field plan identifies the work required to perform the gridding and sampling at Site 13. A Sampling Report will be developed upon completion of the field sampling and laboratory analysis which will include PCB grid sampling, analytical testing and recommendations.

3.2 FIELD PROGRAM

PCB grid sampling will be performed on the possible area of contamination in order to verify the extent of contamination across Site 13. A surveyor's tape will be used to determine the layout of the sampling grid, marking the location of a corner of the grid in reference to the corner of a building in close proximity to the area. The samples will be obtained using a Geoprobe unit. Thirty-seven (37) sampling locations will be designated in the possibly PCB-contaminated area at Site 13. One 2 foot open tube sampler will be driven at each location and separated into 0 to 1 foot and 1 to 2 feet samples by the field staff. The field procedures are further detailed in Section 3.3 of this Sampling Plan.

The distance between adjacent sample points in the grid will be approximately 16 feet, and the distance between successive rows of samples will be approximately 14 feet. The number of samples required and the location of each was determined using the EPA report, "Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup", EPA-560/5-86-017, dated May 1986. The Grid Sampling Design Calculation illustrates how the report was used to determine the number and location of samples for the grid. The sampling locations are shown on Figure 3-1. Each sample location will be designated a unique identification number which will be documented in the field log book. Additional samples may be taken if deemed appropriate by the Navy.

In addition, 21 field samples will be collected for QA/QC, as detailed in the grid sampling design calculation which is included as Appendix B, according to the following:

- 8 duplicates/replicates (10%)
- 8 matrix spike/matrix spike duplicates (MS/MSD, 10%)
- 5 rinsate blanks (1/day)

If sampling is performed in less (or more) than the five days assumed, the number of rinsate blanks will be altered to total one per day.

Methodology used to determine the number of field QA/QC samples is modified level D from the *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program*, June 1988.

All PCB analyses will be performed by Mitkem laboratory using EPA Method 8080 as outlined in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Volume I, Section B, Part 4.3.1. Mitkem is certified in the State of Rhode Island and approved by the Navy. PCB Aroclors to be analyzed include: PCB-1016, 1221, 1232, 1242, 1248, 1254, and 1260. Analysis by gas chromatograph by electron capture detector (GC-ECD) is utilized for EPA Method 8080 with a 14-day sample holding time. The samples will be preserved at 4°C in sample containers with teflon-lined caps. The detection limits are 33 parts per billion (ppb) for all aroclors except 1221, which has a detection limit of 66 ppb. Laboratory data will be validated by Stone & Webster's staff chemist, who is experienced in data validation and is familiar with EPA protocols.

3.3 FIELD SAMPLING PROCEDURES

A Geoprobe unit and hand trowels will be used to obtain the soil samples. The Geoprobe unit consists of an open tube sampler within the unit mounted on a carrier vehicle. The sampler is driven to the desired depth by the hydraulically-powered Geoprobe unit. Included in Appendix C is the Standard Operating Procedure (SOP) for the Geoprobe sampling. This SOP details the applicability and procedures of the Geoprobe unit. The following briefly outlines the procedure for using the Geoprobe unit:

- Clear the area to be sampled of any surface debris (twigs, rocks, or litter).
- Perform Health and Safety screening as required. These requirements are discussed further in the SHERP included as Appendix D.
- Assemble the soil sampler and attach onto leading Geoprobe rod according to the SOP in Appendix C. Drive the sampler to the top of the sampling interval.
- After reaching the desired depth, carefully remove the drive cap and attach the extension rods until screwed into the stop-pin, and then remove the rods and the attached stop-pin as outlined in the SOP.
- Drive the probe rods and sampler the designated distance of 2', being careful not to overdrive the sampler. This could compact the soil sample in the tube making it difficult to extrude.
- Retract the probe rods from the hole and recover the sampler. Two soil samples will

be obtained from each Geoprobe sampler. The field team will collect one composite sample representative of the 0 to 1 foot bgs interval and one composite sample representative of the 1 to 2 feet bgs interval from the sampler.

- Soils will be composited in a stainless steel bowl or on polyethylene sheeting. Composites will be created for samples for 0 to 1 foot bgs and for 1 to 2 feet bgs. Place the sample into a sterile wide-mouth glass soil sample jar with screw-on cap.

- Check that a teflon liner is present in the cap of all analytical sample jars. Secure the cap tightly. Although chemical preservation of solids is generally not required, the samples should be refrigerated in iced coolers to 4°C and analyzed within the specified 14-day holding time.

- Label the sample bottle with a self-adhesive label, which will be provided by the laboratory and include the following information:

  - Date and time of sample collection
  - Sample identification number and location
  - Sample collector's initials

- Place clear plastic tape over label and over cap on bottle. Place bottles in plastic bags with zipper locking mechanism.

- Complete all chain-of-custody (COC) documents and record progress in the field log book. An SOP titled "Packaging and Shipment of Samples", which contains a sample COC, is included in Appendix C.

- Decontaminate equipment after each use and between samples (both vertical and horizontal). Decontamination procedures are as follows:

  - Rinse equipment with tap water.
  - Wash with a non-phosphate detergent.
  - Rinse with distilled water.
  - Rinse with pesticide grade hexane. Allow hexane to evaporate off the sampling equipment. Do not discharge hexane to the ground.
  - Rinse again with distilled water.

- If the rate of evaporation of decontamination fluids from the equipment is reduced to a level which causes a problem in the field, alternate methods of decontamination will be determined on-site upon Regulatory approval.

- Decontamination fluids containing solvents will be containerized for proper disposal. No decontamination fluids will be discharged into the soil column until they are determined to be low in PCB concentration by the laboratory.

SECTION FOUR

REFERENCES

Characterization of Hazardous Waste Sites - A Methods Manual, Volume II: Available Sampling Methods, EPA/600/X-83/018, U.S. Environmental Protection Agency, March 1983.

Compendium of ERT Soil Sampling and Surface Geophysics Procedures, EPA/540/P-91/006, U.S. Environmental Protection Agency, January 1991.

Draft Detailed Analysis of Alternatives, Naval Construction Battalion Center, Volume III, Site 13 - Disposal Area Northwest of Buildings W-3, W-4 and T-1, TRC Environmental Corporation, April 1994.

Standard Reference for Monitoring Wells, DEP Publication #WSC-310-91, Massachusetts Department of Environmental Protection, January 1991.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Volume I, Section B, 4.3.1.

Time-Critical Action Memorandum For Sites 02 and 13 At CBC Davisville, Rhode Island, Stone & Webster Environmental Technology & Services, June 1995.

FIGURES

APPENDIX A

LIST OF ACRONYMS AND ABBREVIATIONS

List of Acronyms and Abbreviations

bgs	below ground surface
CED	Construction Equipment Division
CTO	Contract Task Order
DAA	Detailed Analysis of Alternatives
EA	EA Engineering, Science and Technology
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FSP	Field Sampling Plan
msl	mean sea level
NAS	Naval Air Station
NCBC	Naval Construction Battalion Center
Northern Division	Northern Division, Naval Facilities Engineering Command
PCB	Polychlorinated biphenyls
QA/QC	Quality Assurance and Quality Control
RI	Remedial Investigation
RIDEM	Rhode Island Department of Environmental Management
RIEDC	Rhode Island Economic Development Corporation
SHERP	Safety, Health and Emergency Response Plan
SOP	Standard Operating Procedure
Stone & Webster	Stone & Webster Environmental Technology and Services
TRC	TRC Environmental Corporation
USGS	United States Geologic Survey

APPENDIX B

PCB GRID SAMPLING DESIGN CALCULATION

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION TITLE PAGE

*SEE INSTRUCTIONS ON REVERSE SIDE

▲ 5010.64 (FRONT)

CLIENT & PROJECT	PAGE 1 OF 17
NAVY BRAC - NCBC DAVISVILLE, RI	
CALCULATION TITLE (Indicative of the Objective): PCB GRID SAMPLING DESIGN SITE 13	QA CATEGORY (✓) ☐ I - NUCLEAR SAFETY RELATED ☐ II ☐ III ☑ NON-NUCLEAR OTHER

CALCULATION IDENTIFICATION NUMBER				OPTIONAL WORK PACKAGE NO.
J. O. OR W.O. NO.	DIVISION & GROUP	CURRENT CALC. NO.	OPTIONAL TASK CODE	
04291.0910	042	1	41	N/A

* APPROVALS - SIGNATURE & DATE			REV. NO. OR NEW CALC NO.	SUPERSEDES * CALC. NO. OR REV. NO.	CONFIRMATION *REQUIRED (✓)	
PREPARER(S)/DATE(S)	REVIEWER(S)/DATE(S)	INDEPENDENT REVIEWER(S)/DATE(S)			YES	NO
Linda B. Gardiner LINDA B. GARDINER 10/27/95	Monica C. Berube MONICA C. BERUBE 10/30/95		00	N/A		✓
Linda B. Gardiner LINDA B. GARDINER 2/8/96	Claudia N. Murray CLAUDIA N. MURRAY 2/8/96		01	N/A		✓

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CALCULATION SUMMARY

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J.O./W.O./CALCULATION NO.	REVISION	PAGE
04291.0910 - 1	00	2 OF 17

CLIENT/PROJECT
NAVY BRAC - NCBC DAVISVILLE, RI

QA CATEGORY/CODE CLASS

SUBJECT/TITLE
PCB GRID SAMPLING DESIGN

SITE 13

OBJECTIVE OF CALCULATION

THE PURPOSE OF THIS CALCULATION IS TO FIND THE NUMBER OF SAMPLES REQUIRED AND THE LOCATIONS OF EACH FOR THE PCB-CONTAMINATED AREA AT SITE 13. THE SITE CONSISTS OF SOIL AND GRASS WITH NO SURFACE WATER, BUILDINGS, OR HARD SURFACES.

CALCULATION METHOD/ASSUMPTIONS

THE EPA REPORT, "FIELD MANUAL FOR GRID SAMPLING OF PCB SPILL SITES TO VERIFY CLEANUP," EPA-560/5-86-017, BY GARY L. KELSO, et al. DATED MAY 1986, WAS USED AS A BASIS. ASSUMED AREA OF CONTAMINATION DETERMINED BY TRC ENVIRONMENTAL CORP. FOR THE APRIL 1994 DETAILED ANALYSIS OF ALTERNATIVES IS CORRECT.

SOURCES OF DATA/EQUATIONS

ALL EQUATIONS TAKEN FROM ABOVE REFERENCED EPA-560/5-86-017

ASSUMED AREA EXCEEDING ACTION LEVELS FOR PCBs IN SOILS WAS TAKEN FROM THE DETAILED ANALYSIS OF ALTERNATIVES FOR SITE 13, APRIL 1994, TRC ENVIRONMENTAL CORP. FIGURE 3-6 (ATTACHED AS FIGURE B-1).

CONCLUSIONS

THIRTY-SEVEN (37) SOIL SAMPLES ARE REQUIRED FOR THIS SITE. THE LOCATIONS OF SAMPLES ARE ILLUSTRATED ON FIGURE 2. NINE (9) QA/QC SAMPLES SHOULD BE COLLECTED IN ADDITION TO THE 37 SAMPLES.

NOTE: 2/8/96: TWO LAYERS, EACH OF 37 SAMPLES, WILL BE TAKEN AT SITE 13. QA/QC REQUIRED IS 21 SAMPLES. LBG

REVIEWER(S) COMMENTS

PREPARER	DATE
Linda B. Gardiner	10/27/95
REVIEWER/CHECKER	DATE
INDEPENDENT REVIEWER	DATE

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

L.B. GARDINER

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CALCULATION IDENTIFICATION NUMBER				PAGE 3
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
04291.0910	042	1	41	

PCB GRID SAMPLING DESIGN
SITE 13
NCBC DAVISVILLE, RHODE ISLAND

FIGURE B-1 (TRC FIGURE FROM DAA) ILLUSTRATES SITE 13 AND THE ASSUMED AREA EXCEEDING ACTION LEVELS FOR PCBs IN SOILS.

ASSUMPTION: THIS FIGURE, INCLUDING THE PCB-CONTAMINATED AREA IS CORRECT.

FIGURE B-2 ILLUSTRATES THE PCB-CONTAMINATED AREA, WITH SCALE, AND DIMENSIONS USED FOR THIS CALCULATION.

REFERENCE EPA REPORT EPA-560/5-86-017 WHICH WAS USED AS A BASIS FOR THIS CALCULATION. PARTS OF THIS REPORT ARE ATTACHED.

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CALCULATION SHEET

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L.B.GARDINER

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 5
042910910	042	1	41	

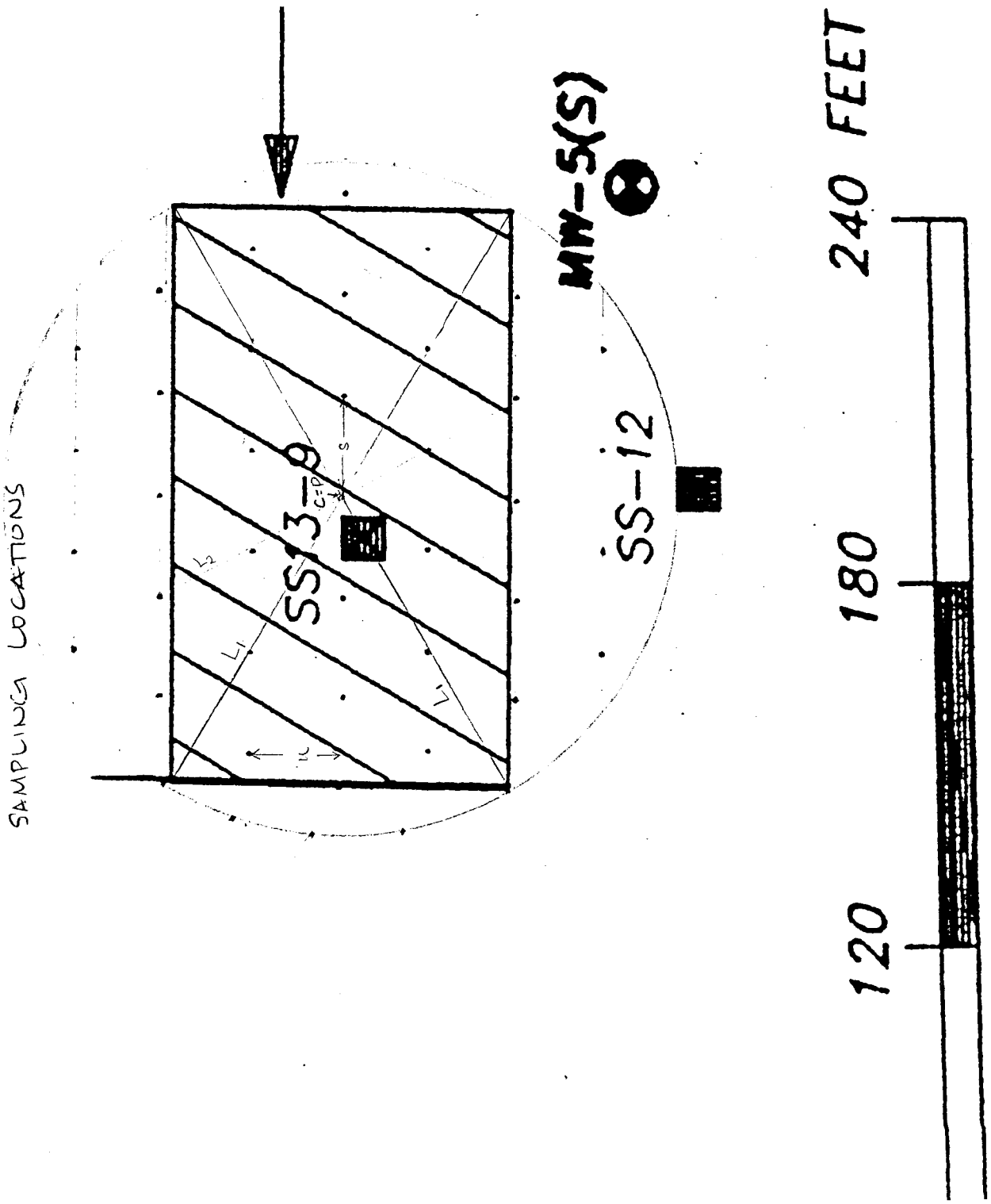

FIGURE B-2
SAMPLING LOCATIONS

CALCULATION IDENTIFICATION NUMBER				PAGE 6
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
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L_1 = LONGEST DIMENSION

P = MIDPOINT OF L_1

$L_2 \perp L_1$

C = MIDPOINT OF L_1

C = P (RECTANGLE)

$\frac{L_1}{2}$ = SAMPLING RADIUS = $\overline{L_1C}$ = r

r = 2.19"

SCALE: 2.4" = 60'
1" = 25'

r = 2.19" = 54.75'

SAY r = 55 ft.

FROM TABLE 1, p12, OF EPA-560/5-86-017, REPORT TITLED "FIELD MANUAL FOR GRID SAMPLING OF PCB SPILL SITES TO VERIFY CLEANUP"

r > 11, ∴ Number of Samples = 37

N = 37

DISTANCE, S, BETWEEN ADJACENT SAMPLE POINTS = 0.30r FROM TABLE 2, p.15, OF EPA-560/5-86-017.

S = 0.30 (55 ft) = 16.5 ft

DISTANCE, u, BETWEEN SUCCESSIVE ROWS = 0.26r FROM TABLE 2, p.15, OF EPA-560/5-86-017.

u = 0.26r = 0.26(55 ft) = 14.3 ft.

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CALCULATION SHEET

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CALCULATION IDENTIFICATION NUMBER				PAGE 7
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
04291.0910	042	1	41	

	DIMENSION ON PLOT (SCALE 1" = 25')
S = 16.5 Ft	0.660"
u = 14.3 Ft	0.572"

SEE FIGURE 1 FOR SAMPLING LOCATIONS

37 SAMPLES

9 QA/QC SAMPLES
- 3 FIELD BLANKS PER p37 EPA-560/5-86-017
- ASSUME 2 FIELD DUPLICATES
  2 MS/MSD
  2 TRIP BLANKS

46 TOTAL SAMPLES

LBG 2/8/96

TWO LAYERS OF 37 SAMPLES WILL BE TAKEN. QA/QC REQUIRED INCLUDES THE FOLLOWING:

10% DUPLICATE/REPLICATE	=	8
10% MS/MSD	=	8
1/day RINSATE, ASSUME 5 DAYS (MAX.)	=	5
TOTAL QA/QC SAMPLES	=	21
TOTAL FIELD SAMPLES, 37 x 2	=	74
TOTAL SAMPLES	=	95

LBG
2/8/96

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CALCULATION SHEET

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CALCULATION IDENTIFICATION NUMBER				PAGE 8
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	
04291.0910	042	1	41	

APPENDIX

EPA REPORT EXCERPTS

EPA 560/5-86-017

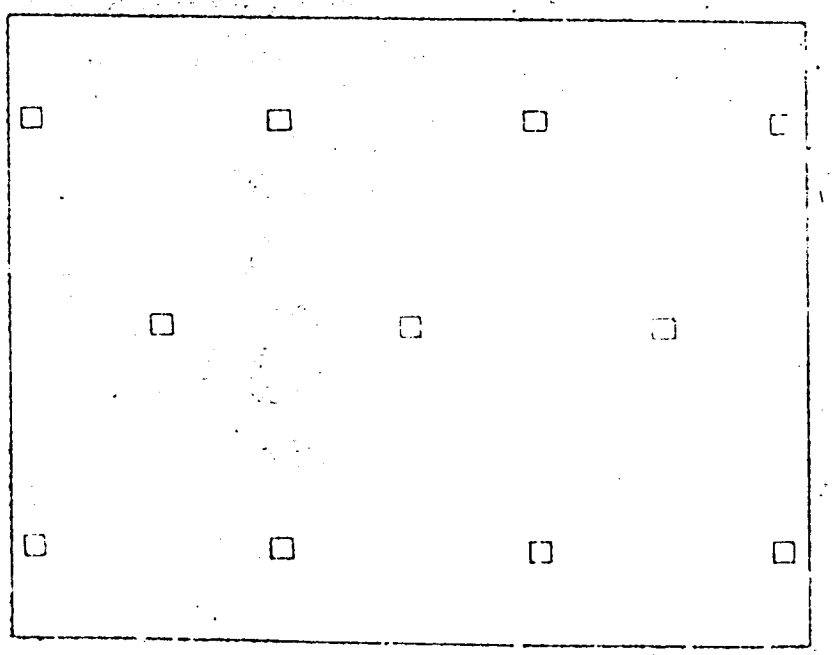
PB86-216942 9

United States
Environmental Protection
Agency

Toxic Substances

EPA

FIELD MANUAL FOR GRID SAMPLING OF PCB SPILL SITES TO VERIFY CLEANUP



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TECHNICAL REPORT DATA
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1. REPORT NO. EPA-560/5-86-017	2.	3. RECIPIENT'S ACCESSION NO. PB86-216942/AS
4. TITLE AND SUBTITLE Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup		5. REPORT DATE May 1986
		6. PERFORMING ORGANIZATION CODE 8501-A(37)
7. AUTHOR(S) Gary L. Kelso, Mitchell D. Erickson, David C. Cox*		8. PERFORMING ORGANIZATION REPORT NO. Interim Report No. 3
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16. ABSTRACT

The purpose of this manual is to provide detailed, step-by-step guidance to field staff for using hexagonal grid sampling at a PCB spill site. Guidance is given for preparing the sample design; collecting, handling, and preserving the samples taken; maintaining quality assurance and quality control; and documenting and reporting the sampling procedures used. An optional strategy for compositing samples is given in the appendix.

This is a companion document to the report "Verification of PCB Spill Cleanup by Sampling and Analysis" (EPA 560/5-85-026, August 1985, Second Printing). This "how-to" report concentrates on detailed guidance for field sampling personnel and does not attempt to provide background information on the techniques presented. The types of field sampling situations discussed in this manual are those typically found when a PCB spill results from a PCB article, PCB container, or PCB equipment spill. Unusual PCB spill situations, such as elongated spills on highways from a moving vehicle, large spills in waterways, and large, catastrophic spills, are not addressed.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
PCBs, polychlorinated biphenyls, spills, spill cleanup, field manual, sampling		

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FIELD MANUAL FOR GRID SAMPLING OF PCB SPILL SITES TO VERIFY CLEANUP

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4.3 Documentation Materials

The following documentation materials should be taken to the field site:

- Field log book
- Chain-of-custody forms
- Site description forms
- Sample analysis request forms
- Sample bottle labels
- Camera with film
- Yellow TSCA PCB marks

4.4 Trip Preparation

The EPA field inspector must assemble all the necessary equipment and materials prior to making the field sampling trip. Special attention should be given to assuring that all of the equipment and materials are available, and that the sample containers and sampling equipment have been properly precleaned. The equipment preparation should be documented in a log book (Section 9.1) prior to making the trip.

5.0 SAMPLE DESIGN

The methods to be used for determining the sample point locations at a PCB spill site are given in this section, and are based upon a hexagonal grid sample design which was recommended in the report "Verification of PCB Spill Cleanup by Sampling and Analysis." Although the grid design involves more samples and a more complicated layout than the usual grab sampling methods, the grid design is essential to obtaining a representative sample of the site and greatly increases the chance of detecting high levels of PCB contamination when they exist. For example, when 4% of the PCB spill site remains contaminated at 50 ppm after cleanup, analysis of samples from a 37-point

grid has a 98% chance of detection of this contamination level, while analysis of six random grab samples from the site has only a 3% chance of detection (Boomer et al. 1985).

The hexagonal grid sampling design is to be laid out within a sample circle centered on the spill site, and extending just beyond its boundaries. Preparation of the design requires the following steps:

Step 1: Diagram the Cleanup Site
Step 2: Diagram All Cleanup Surfaces in the Same Plane
Step 3: Find the Center and Radius of the Sampling Circle
Step 4: Determine the Number of Grid Sample Points to Use
Step 5: Lay Out the Sampling Points on the Diagram Constructed in Step 2
Step 6: Lay Out the Sampling Locations on the Site
Step 7: Consider Special Cases and Use Judgment for Sample Points

The discussion which follows gives the methods to be used in accomplishing each step of the hexagonal grid sampling design, using a three-dimensional spill surface as an example. Following this discussion, a simple example of laying out the sample design on a rectangular two-dimensional surface is given.

5.1 Step 1: Diagram the Cleanup Site

Draw a scale diagram of the cleanup site on graph paper, including vertical surfaces (walls, fences, etc.), noting important dimensions and different types of surfaces (sod, cement, asphalt, etc.). Such a diagram may sometimes be found in records of the cleanup. If not, site measurements should be taken. Great accuracy (e.g., using surveying instruments) is not necessary, however; the use of a tape measure and pacing should be adequate. An example diagram is shown in Figure 1 on a scale of 1 in. = 4 ft.

The site diagram should include as many reference points as necessary to relocate the spill area in the future, if necessary. For example, a spill site in an open field should be located with respect to nearby structures such as roads, telephone poles, buildings, etc. The direction of north should be indicated on the diagram.

If available, a detailed drawing or a survey plot of the spill site should be obtained from the individual(s) that cleaned the site.

5.2 Step 2: Diagram All Cleanup Surfaces in the Same Plane

The purpose of this second diagram is to determine and show the dimensions of the total cleanup area, including vertical surfaces, so that the required sample size can be found. The diagram also facilitates the determination of sampling locations on vertical surfaces. Constructing the diagram is analogous to flattening a cardboard box. All vertical surfaces are placed in the same plane as the adjoining horizontal surfaces. Figure 2, also on a scale of 1 in. = 4 ft, shows the example spill cleanup site diagrammed in the same plane. The actual site dimensions are shown in feet.

5.3 Step 3: Find the Center and Radius of the Sampling Circle

In practice, the contaminated area from a spill will be irregular in shape. In order to standardize sample design and layout in the field, samples are collected within a circular area surrounding the contaminated area. The sampling circle is, approximately, the smallest circle containing all cleanup surfaces diagrammed in Step 2.

A recommended procedure for finding the center and radius of the sampling circle is illustrated in Figure 3 and is described below:

1. Draw the longest dimension, L_1, of the site diagram in Step 2.

2. Find the midpoint, P, of L_1.

3. Draw a second dimension, L_2, through P perpendicular to L_1. L_2 extends to the boundaries of the site diagram.

4. The midpoint, C, of L_2 is the center of the sampling circle.

5. The distance from C to either end of the longest dimension, L_1, is the sampling radius, r.

Figure 4 illustrates the application of this procedure to a site with an irregular shape, and Figure 5 shows the procedure for a variety of irregularly shaped areas. These figures show that the center and radius determined are generally reasonable.

5.4 Step 4: Determine the Number of Grid Sample Points to Use

The number of grid samples to be taken at a site depends upon the radius of the sampling circle, which is determined from the scale diagram shown in Figure 3. The number of samples to be taken at a spill site should increase as the radius of the sample circle increases. The reason for this is that the probability of detecting residual PCB contamination at a given site increases as the number of grid samples increases. Table 1 shows the required number of grid samples for sampling circles with a radius of 4 ft or less (seven samples); greater than 4 ft to 11 ft (19 samples); and greater than 11 ft (37 samples).

Table 1. Required Number of Grid Samples Based on the Radius of the Sampling Circle

Sampling radius, r (ft)	Number of Samples
≤ 4	7
> 4 - 11	19
> 11	37

51

The radius, r, for the example site is 3-1/4 in. in Figure 3. Thus, the actual site sampling radius is 13 ft (3-1/4 in. x 4 ft/in.) and the number of grid samples required is 37.

Figures 6, 7, and 8 illustrate the hexagonal grid sampling design for the three sample sizes given in Table 1, for a sampling radius of 4, 10, and 20 ft, respectively.

5.5 Step 5: Lay Out the Sampling Points on the Diagram Constructed in Step 2

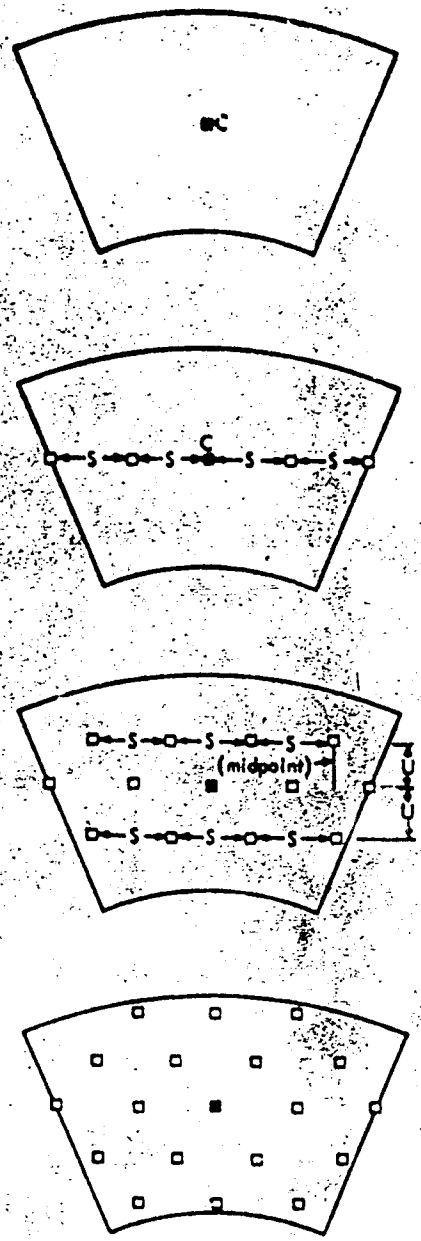
The geometric properties of the hexagonal designs can be used in many ways to lay out the sampling points. Perhaps the simplest way to proceed is as follows. Define s to be the distance between adjacent points and u to be the distance between successive rows of the design. The distances s and u are given in terms of the sampling radius, r, in Table 2 below for the given number of samples defined by the radius rule and listed in Table 1.

Table 2. Geometric Parameters of the Hexagonal Grid Designs, for Sampling Radius r

Number of samples	Distance, s, between adjacent sample points	Distance, u, between successive rows
7	0.87r	0.75r
19	0.48r	0.42r
37	0.30r	0.26r

The recommended method for laying out the sample points of the hexagonal grid on the scale diagram is illustrated in Figure 9 and is described below.

1. Draw a diameter of the sampling circle on the scale diagram. The orientation of the diameter (e.g., east-west) should be chosen to maximize the number of sample points which fall within the spill area, when practical.



(a) Center of cleanup area, C.

(b) Middle row of grid points located distance, s, apart.

(c) Next two grid rows perpendicular distance, u, from middle row.

(d) Completed 19 sample point grid.

Figure 9. Construction of sampling grid on a site diagram.

APPENDIX C

STANDARD OPERATING PROCEDURES

Geoprobe Soil Sampling Survey

1.0 Purpose

The purpose of this standard operating procedure (SOP) is to collect surface and subsurface soil samples with a Geoprobe in order to determine the extent of soil contamination in a shorter time period compared with conventional boring methods.

2.0 References

"Geoprobe GH-40, Soil Probing Hammer," Technical Bulletin 94-040A, Operating Instructions, April 1994.

"Geoprobe AT-660, Series Large Bore Soil Sampler," Technical Bulletin 93-660, Standard Operating Procedure, September 21, 1993.

3.0 Appendices

None

4.0 General

4.1 Definitions

Geoprobe - A hydraulic device used to advance a hollow stem probe into soil for the purpose of collecting a soil sample.

Probe-Drive Sampler - A soil sampling device designed for use with the Geoprobe.

4.2 Responsibilities

Site Manager - The Site Manager is responsible for ensuring that the field personnel have been trained in conducting the Geoprobe survey in accordance with the project requirements and this and related SOPs.

Field Team Leader - The Field Team Leader is responsible for ensuring that the Field Team conducts the Geoprobe survey in accordance with the project requirements.

4.3 Applicability

The Geoprobe unit utilizes the Probe-Drive sampler to retrieve approximately 100 gram (or larger) soil samples at the working depth of the Geoprobe. Unlike split-spoon samplers, the Probe-Drive sampler remains completely sealed by a piston tip at the end of the sample tube while it is pushed or driven to the desired sampling depth. A piston stop-pin at the opposite end of the sampler is removed by means of extension rods inserted down the inside diameter of the probe rods after the sampler has been driven to depth. This enables the piston to retract into the sample tube while the sample is taken.

The Geoprobe soil sampling system is not intended for collecting large sample volumes. The Standard Sampler will obtain approximately 100 grams of soil.

The Geoprobe is limited to sampling up to depths of approximately 40 feet in unconsolidated, sandy soils and to shallower depths in compacted gravelly soils and tills.

4.4 Equipment and Materials

Required Equipment - The usual Geoprobe rods and driving accessories with the following tools are required to sample soil using the Probe-Drive system:

Assembled Sampler
Extension Rods
Extension Rod Couplers
Extension Rod Handle
Extruder Rack*
Extruder Piston*

* Kansas Stainless and Large Bore Samplers feature removable hardened cutting shoes that thread onto the sample tube. Large Bore Sampler also utilizes an acetate liner inside of the sample tube for easy removal of soil sample.

4.5 Records

Information which should be documented includes, but not limited to, date and time of sampling, names of persons present, weather conditions, unusual conditions, and other information defined in this and other applicable SOPs.

5.0 Procedures

5.1 Set-up and Sampling

1. After decontaminating probe rods and sampler parts according to the Decontamination SOP, assemble the soil sampler. All parts must fit tightly. The stop-pin is reverse threaded and should be tightened with a wrench so that it exerts pressure against the piston rod. Damage could occur during probing if pin is not tight.

2. Attach assembled sampler onto leading Geoprobe probe rod. Place the drive cap on top of the probe rod. A 12-inch probe rod is recommended to start the Standard 24-inch and Large Bore Samplers. Replace the 12-inch rod with a 36-inch rod as soon as the sampler is driven below the surface.

3. Drive the sampler with the attached probe rods to the top of the interval to be sampled using manual probe rod driver or hydraulically-powered Geoprobe unit. The drive cap must be installed prior to driving the probe.

IMPORTANT: Some soil conditions may warrant using a retractable or solid drive point to preprobe the hole to the desired sampling depth. Do not drive the sampler into bedrock or other impenetrable layers.

4. If using the Geoprobe driver, move the driver unit back from the top of the probe rods to allow room to work, to allow for removal of stop-pin.

5. Remove the drive cap and lower extension rods into the inside diameter of the probe rods using couplers to join rods together.

6. Attach the extension rod handle to the top extension rod. Rotate the extension rod handle clockwise until the leading extension rod is screwed into the piston stop-pin downhole.

7. Continue to rotate the handle clockwise until the reverse-threaded stop-pin has disengaged from the drive head.

8. Remove the extension rods and attached stop-pin from the probe rods.

9. If the top of probe rod is already in the lowest driving position, attach another probe rod before driving for sampling. Replace the drive cap onto the top probe rod.

10. Mark the top probe rod with a marker or tape at the appropriate distance above the ground surface (i.e, 10 inches for Standard Sampler, 12 inches for Kansas Sampler, and 24 inches for Large Bore Sampler).

11. Drive the probe rods and sampler the designated distance. Be careful not to overdrive the sampler which could compact the soil sample in the tube making it difficult to extrude.

12. Retract probe rods from the hole and recover the sampler. Inspect the sampler to confirm that a sample was recovered.

5.2 Extrusion for Standard and Kansas Samplers

A. By Machine:

1. Disassemble the sampler. Remove all parts. Screen sampler with a photoionization detector (PID), if required.

2. Position the extruder rack on the foot of the Geoprobe derrick.

3. Insert the sample tube into the extruder rack with the cutting end up.

4. Position the extruder piston and push the sample out of the tube using the "probe" function on the Geoprobe.

5. Catch the sample as it is extruded beneath the extruder in the sample container or mixing bowl. Volatile organic compound samples will be collected directly into the sample container.

CAUTION: Use care when performing this task. Apply down pressure gradually. Use of excessive force could result in injury to the operator or damage to tools.

B. By Hand: (Good for use with sandy soils)

1. Disassemble the sampler. Remove all parts.

2. Screen sampler with a PID, if required.

3. Deposit sample into container by lightly tapping the side of the sample tube with a hammer.

5.3 Plugging Geoprobe Holes

When driving the Geoprobe through pavement or concrete, the resultant hole may be plugged with neat cement (cement and water mixture).

When driving the Geoprobe through surface soils, the resultant hole may be plugged with neat cement if the soils do not close the hole naturally.

5.4 Equipment Decontamination

Improperly cleaned and prepared sampling equipment can lead to misinterpretation of environmental data due to interference caused by cross-contamination.

Sampling equipment is decontaminated after each sample is taken.

The geoprobe is steam-cleaned prior to coming on-site and prior to leaving the site. The equipment is generally inspected by the Field Team Leader or other field personnel.

Decontamination

1.0 Purpose

The purpose of this Standard Operating Procedure (SOP) is to describe procedures for removing contamination from personnel and sampling equipment before and after sampling events. Decontamination is necessary to prevent spread of contaminants, to prevent cross-contamination of samples, and to protect the health and safety of site personnel.

2.0 References

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, DHHS (NIOSH) 85-115, October 1985.

Field Standard Operating Procedures (FSOP) 7, "Decontamination of Response Personnel", USEPA, January 1995.

"Hazardous Waste Site Workers Basis Health & Safety Course", The New England Consortium, 1990.

29 CFR Part 1910, "Hazardous Waste Operations and Emergency Response", March 1989.

Massachusetts Department of Environmental Protection, Standard Reference for Monitoring Wells, DEP Publication #WSC-310-91, January 1991.

U.S. Environmental Protection Agency, Compendium of ERT Soil Sampling and Surface Geophysics Procedures, EPA/540/P-91/006, January 1991.

3.0 Appendices

None

4.0 General

4.1 Definitions

None

4.2 Responsibilities

Personnel requirements for decontamination activities will vary depending upon the size and scope of the sampling effort. Designated field personnel are responsible for implementing all aspects of this SOP. In addition, all field activities must be carried out in accordance with a site-specific Health and Safety Plan (HASP). Ensuring the fulfillment of the requirements of the HASP is the responsibility of the site Health and Safety Officer who may also perform sampling and decontamination activities.

4.3 Applicability

This procedure serves as a general guidance on the proper methods of decontaminating personnel and sampling equipment. These procedures can be modified or expanded to meet specific project requirements. Such changes should be documented within the site-specific Sampling and Analysis Plan or Health and Safety Plan.

4.4 Equipment and Materials

Basic equipment necessary for decontaminating field equipment include:

Appropriate personnel protective clothing
Non-phosphate detergent
Selected solvents (e.g. nitric acid, acetone, hexane, or methanol)
Distilled/Deionized water and tap water
Brushes
Spray bottles for solvents and water
Wash basins
Plastic sheets
Emergency eyewash bottle
Trash containers
Paper towels

Additional equipment necessary for decontaminating personnel may vary depending upon the level of personnel protection clothing and equipment used onsite. These additional items are identified in relevant sections of this Standard Operating Procedure.

4.5 Records

None

5.0 Procedures

5.1 Decontamination Equipment Selection

1. In selecting decontamination equipment, consider whether the equipment itself can be decontaminated for reuse or if it can be easily disposed.

2. Table 1 lists recommended equipment for decontamination of personnel, PPE, and equipment.

3. Table 2 lists recommended equipment for decontamination of large equipment and vehicles.

5.2 Decontamination Facility Design

At a hazardous waste site, decontamination facilities should be located in the Contamination Reduction Zone (CRZ), i.e., the area between the Exclusion Zone (the contaminated area) and the Support Zone (the clean area) as described in the Site HASP.

5.3 Personnel Decontamination

Four levels of personnel protection, as discussed in the PPE procedure, are available for use at any given site. The following is a description of the decontamination process for Level D and modified Level D.

1. If required, an area will be designated for the removal of gloves and boot covers. Paper towels will be available for removal of this equipment.

2. A trash barrel at the site will be provided for all disposable noncontaminated PPE. This material will be disposed of in a normal trash receptacle at the plant before leaving the site.

3. Laundering of personal clothing should be completed as soon as possible once off-site.

4. Soap and water will be used to wash hands before eating, drinking or smoking, and before using the bathroom facilities.

5.4 Equipment Decontamination

5.4.1 General

1. Adequate supplies of all materials must be kept on hand. This includes all rinsing liquids and other required materials.

5.4.2 Standard Procedures

Solvent rinses are not necessarily required when organics are not a contaminant of concern and may be eliminated from the sequence specified below. Similarly, an acid rinse is not required if analysis does not include inorganics.

1. Remove any solid particles from the equipment or material by brushing and then rinsing with available tap water. This initial step is performed to remove gross contamination.

2. Wash equipment with a non-phosphate detergent solution.

3. Rinse with distilled/deionized water.

4. Use methanol if the sample will be analyzed for organics.

5. Rinse again with distilled/deionized water.

6. Dispose of all rinse and decontamination fluids in an appropriate manner specified in the site-specific Sampling and Analysis Plan.

Sampling equipment that requires the use of plastic tubing should be disassembled and the tubing replaced with clean tubing, before commencement of sampling and between sampling locations.

5.4.3 Sanitizing Procedures

1. Reusable clothing and other personal articles must be decontaminated and sanitized before reuse.

2. If practical, reusable protective clothing should be machine washed after a thorough decontamination. Otherwise, clean the clothing by hand.

5.5 Quality Assurance

1. The effectiveness of any decontamination method used at a site should be assessed at the beginning of a project and periodically throughout the life of a project.

2. The Site Health & Safety Officer shall monitor project procedures to determine their effectiveness.

3. If a decontamination method is not considered effective, the decontamination program must be revised.

4. Visual observation, wipe sampling, cleaning solution analysis, and permeation testing are the typical methods used to determine the effectiveness of decontamination.

5.6 Disposal Methods

1. All equipment used for decontamination must be decontaminated and/or disposed of properly.

2. As necessary, buckets, brushes, clothing, tools, and other contaminated equipment should be collected, placed in containers, and labelled.

3. All spent solutions and wash water should be collected and disposed of properly. Clothing that is not completely decontaminated should be placed in plastic bags, pending further decontamination and/or disposal.

4. Hazardous wastes generated through decontamination activities are governed by RCRA requirements with regard to packaging, labeling, transporting, storing and record keeping as stated in 40CFR262 ("Standards Applicable to Generators of Hazardous Wastes").

5. Potentially hazardous wastes that are accumulated through decontamination activities shall be staged/stored in a secure and protected area provided on-site.

6. Containers used to store the hazardous materials shall be of an approved design and shall be prominently labeled with the words "HAZARDOUS WASTE" or with other words which clearly and accurately identify the contents of the container and the date upon which the period of accumulation of the material began.

7. The containers holding the hazardous waste shall be cared for and maintained in a fashion that will prevent leaks or any discharge of the material to the ground surface. Should leaks occur, the materials in the container shall be transferred to a container in good condition or be placed in an overpack drum. The containers, in all cases, shall be compatible with the materials to be stored.

8. All containers holding hazardous waste shall remain closed during storage, except when it is necessary to add or remove waste. All containers holding hazardous waste or intended to contain hazardous waste shall not be opened or stored in a fashion which may rupture the container or allow it to leak.

9. Wastes determined to be incompatible shall be separated or protected from each other.

10. Decontamination generated contaminated material, once collected and properly stored, shall be subjected to analytical testing to determine the requirements for transportation and ultimate disposal.

11. The hazardous nature of materials shall be determined by the methods published in U.S. EPA SW-846.

TABLE 1

SOME RECOMMENDED EQUIPMENT FOR DECONTAMINATION OF PERSONNEL PPE AND EQUIPMENT

- Drop cloths of plastic or other suitable materials
- Collection containers, such as drums or trash cans
- Lined box with adsorbents
- Large galvanized tubs, stock tanks or children's wading pools
- Wash solutions appropriate for the contaminants present
- Rinse solutions appropriate for the contaminants present
- Long handled, soft-bristled brushes
- Paper and/or cloth towels
- Lockers and cabinets
- Metal or plastic cans or drums
- Plastic sheeting or sealed pads with drains
- Shower facilities or at a minimum personal wash sinks
- Soap or wash solution, wash cloths, and towels
- Tape
- Traffic cones
- Warning signs
- Hoses
- Rope
- Ladders
- Shovels
- Spare breathing apparatus air cylinders (if used)

TABLE 2

SOME RECOMMENDED EQUIPMENT FOR DECONTAMINATION OF HEAVY EQUIPMENT AND VEHICLES

- Storage tanks or appropriate treatment systems
- Drains or pumps
- Long handled brushes
- Wash solutions appropriate for the contaminants present
- Rinse solutions appropriate for the contaminants present
- Pressurized sprayers for washing and rinsing
- Curtains, enclosures or spray booths
- Long handled rods and shovels
- Containers to hold contaminants and contaminated soils
- Wash and rinse buckets
- Brooms
- Containers for storage and disposal of contaminated material

Packaging and Shipment of Samples

1.0 Purpose

This Standard Operating Procedure (SOP) is concerned with procedures associated with the packaging and shipment of samples. Two general categories of samples exist: environmental samples consisting of air, water and soil; and waste samples which include nonhazardous solid wastes and hazardous wastes as defined by 40 CFR Part 261.

2.0 References

"Field Sampling Procedures Manual," New Jersey Department of Environmental Protection and Energy, May 1992.

3.0 Appendices

None

4.0 General

4.1 Definitions

Sample - A material to be analyzed that is contained in single or multiple containers representing a unique sample identification number.

Sample Custody - A sample is under custody if:

1. It is in your possession.
2. It is in your view, after being in your possession.
3. It was in your possession and you locked it up.
4. It is in a designated secure area.

Chain-of-Custody Record - Form used to document the transfer of custody of samples from one individual to another.

Custody Seal - A custody seal is a tape-like seal that is part of the chain-of-custody process and is used to prevent tampering with samples after they have been packed for shipping.

4.2 Responsibilities

It is the responsibility of the project manager to assure that proper packaging and shipping techniques are utilized for each project. The site operations manager shall be responsible for the enactment and completion of the packaging and shipping requirements outlined in the project specific Sampling Plan. The site operations manager shall be responsible to research, identify and follow all applicable U.S. Department of Transportation (DOT) regulations regarding shipment of materials classified as waste.

4.3 Applicability

Due to the evidentiary nature of samples collected during environmental investigations, possession must be traceable from the time the samples are collected until their derived data are introduced as evidence in legal proceedings. To maintain and document sample possession, sample custody procedures are followed.

4.4 Equipment and Materials

Chain-of-custody form
Coolers
Sample containers
Extra coolers for shipping
Air bills, plastic air bill covers
Fiber tape
Chain-of-custody seals
Return address stickers
Extra plastic bags for samples and ice
Waterproof markers

4.5 Records

As discussed in Section 5.0, the documentation for supporting the sample packaging and shipping will consist of chain-of-custody records and shipper's records. In addition, a description of sample packaging procedures will be written in the field logbook. All documentation will be retained in the project files following project completion.

5.0 Procedures

It is preferred that all shipping be done by ground. Air shipment may be used if all other methods of shipment have been exhausted.

As appropriate, the following procedures will be used:

1. Place plastic bubble wrap matting over the base and bottom corners of each cooler or shipping container, as needed, to manifest each sample.

2. Obtain a chain-of-custody record, as shown in Figure 1, and enter all the appropriate information as discussed in this SOP. Chain-of-custody records will include complete information for each sample. One or more chain-of-custody records shall be completed for each cooler or shipping container, as needed, to manifest each sample.

3. Wrap each sample bottle individually and place standing upright on the base of the appropriate cooler, taking care to leave room for some packing material and ice or equivalent. Rubber bands or tape should be used to secure wrapping completely around each sample bottle.

4. Place additional bubble wrap and/or styrofoam pellet packing material throughout the voids between sample containers within each cooler.

5. Place ice or cold packs in heavy duty zip-lock type plastic bags, close the bags, and distribute such packages over the top of the samples.

6. Add additional bubble wrap/styrofoam pellets or other packing materials to fill the balance of the cooler or container.

7. To complete the chain-of-custody form, enter the type of analysis required for each sample, by container, under the "ANALYSES" section. Under the specific analysis, enter the quantity/volume of sample collected for each corresponding analysis.

   If shipping the samples where travel by air or other public transportation is to be undertaken, sign the chain-of-custody record, thereby relinquishing custody of the samples. Relinquishing custody should only be performed when directly transmitting custody to a receiving party or when transmitting to a shipper for subsequent receipt by the analytical laboratory. Shippers should not be asked to sign chain-of-custody records.

8. Remove the last copy from the chain-of-custody record and retain with other field notes. Place the original and remaining copies in a zip-lock type plastic bag and place the bag on top of the contents within the cooler or shipping container.

9. Close the top or lid of the cooler or shipping container and, with another person, rotate/shake the container to verify that the contents are packed so that they do not move. Improve the packaging if needed and reclose.

   When transporting samples by automobile to the laboratory, and where periodic changes of ice are required, the cooler should only be temporarily closed so that reopening is simple. In these cases, chain-of-custody will be maintained by the person transporting the sample and chain-of-custody tape need not be used. If the cooler is to be left unattended, then chain-of-custody procedures should be enacted.

10. Place the chain-of-custody tape at two different locations on the cooler or container lid and overlap with transparent packaging tape. For coolers with hinged covers, if the hinges are attached with screws, chain-of-custody tape should also be used on the hinge side.

11. Packaging tape should be placed entirely around the sample shipment containers. A minimum of one to two full wraps of packaging tape will be placed at least two places on the cooler. Shake the cooler again to verify that the sample containers are well packed.

12. If shipment is required, transport the cooler to an overnight express package terminal or arrange for pickup. Obtain copies of all shipment records as provided by the shipper. **Note that samples should be picked up on-site by the contracting laboratory, whenever possible.**

13. Upon receipt of the samples, the analytical laboratory will open the cooler or shipping container and will sign "received by laboratory" on each chain-of-custody form. The laboratory will verify that the chain-of-custody tape has not been broken previously and that the chain-of-custody tape number corresponds with the number on the chain-of-custody record. The analytical laboratory will then forward the back copy of the chain-of-custody record to the sample collector to indicate that sample transmittal is complete.

6.0 Special Notes

The objective of sample packaging and shipping protocol is to identify standard procedures, which will minimize the potential for sample spillage or leakage, and maintain field sampling program compliance with U.S. EPA and U.S. DOT regulations.

The extent and nature of sample containerization will be governed by the type of sample, and the most reasonable projection of the sample's hazardous nature and constituents. The EPA regulations (40 CFR Section 261.4(d)) specify that samples of solid waste, water, soil or air, collected for the sole purpose of testing, are exempt from regulation under the Resource Conservation and Recovery Act (RCRA) when all of the following conditions are applicable:

1. Samples are being transported to a laboratory for analysis.

2. Samples are being transported to the collector from the laboratory after analysis.

3. Samples are being stored: (1) by the collector prior to shipment for analyses, (2) by the analytical laboratory prior to analyses, (3) by the analytical laboratory after testing but prior to return of sample to the collector or pending the conclusion of a court case.

Qualification for Categories 1 and 2 above require that sample collectors comply with U.S. DOT and U.S. Postal Service (USPS) regulations or comply with the following items if U.S. DOT and USPS regulations are found not to apply.

The following information must accompany all samples and will be entered on a sample specific basis on chain-of-custody records:

- Sample collector's name, mailing address and telephone number
- Analytical laboratory's name, mailing address and telephone number
- Quantity of sample
- Date of shipment
- Description of sample
- Project number
- Record number and total number of records being shipped for the day

- Project name/location or code number
- Overnight courier's airbill number, if applicable
- Sample type (matrix) and reference number. Include reference number if requested on the Chain-of-Custody Record
- Sample identification number
- Date of sample collection
- Time of sample collection in military time
- Appropriate sample designation - composite or grab
- Parameters for analysis and the number of containers submitted for each analysis
- Other remarks (e.g., sample depth)
- Type of preservative added by reference number and sample pH. Use the remarks column if no space is dedicated to preservative.

In addition, all samples must be packaged so that they do not leak, spill or vaporize.

MITKEM CORPORATION
175 Metro Center Boulevard • Warwick, Rhode Island 02886-1755
(401) 732-3400 • Fax (401) 732-3499
1232 East Broadway Road • Suite 210 • Tempe, Arizona 85282
(602) 303-9535 • Fax (602) 921-2883

CHAIN-OF-CUSTODY RECORD

INVOICE TO		REPORT TO		
COMPANY	PHONE	COMPANY	PHONE	LAB REFERENCE #:
NAME	FAX	NAME	FAX	
ADDRESS		ADDRESS		TURNAROUND TIME:
CITY/ST/ZIP		CITY/ST/ZIP		

CLIENT PROJECT NAME:	CLIENT PROJECT #:	CLIENT P.O.#:

REQUESTED ANALYSES

SAMPLE IDENTIFICATION	DATE/TIME SAMPLED	COMPOSITE	GRAB	WATER	SOIL	OTHER	LAB ID	# OF CONTAINERS														COMMENTS
	/																					
	/																					
	/																					
	/																					
	/																					
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TSF#	RELINQUISHED BY	DATE/TIME	ACCEPTED BY	DATE/TIME	ADDITIONAL REMARKS:	COOLER TEMP:
1st		/		/		
2nd		/		/		
3rd		/		/		

WHITE: LABORATORY COPY YELLOW: REPORT COPY PINK: CLIENT'S COPY

APPENDIX D

SAFETY, HEALTH, AND EMERGENCY RESPONSE PLAN

SITE SAFETY, HEALTH AND EMERGENCY RESPONSE PLAN (SHERP) FOR PCB SAMPLING

NCBC DAVISVILLE
DAVISVILLE, RI

Prepared for:

Department of the Navy
Northern Division
Naval Facilities Engineering Command

Prepared by Linda B. Gardiner Date 2/8/96
Site Safety and Health Officer

Approved by Linda B. Gardiner for Date 2/8/96
CTO Manager
Stone & Webster Environmental Technology and Services

Approved by Marilyn L. D. FOR J SKRABAK Date 2/8/96
Program Certified Industrial Hygienist
Stone & Webster Environmental Technology and Services

Prepared by:

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES

in association with

EA Engineering, Science & Technology

Site Safety, Health and Emergency Response Plan (SHERP)

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1.0 INTRODUCTION

1.1 PURPOSE

This Site Safety, Health and Emergency Response Plan (SHERP) was developed by Stone & Webster Environmental Technology & Services (Stone & Webster) to establish health and safety procedures required to minimize any potential risk to personnel performing activities associated with sampling of soil for potential polychlorinated biphenyls (PCB) contamination at Site 13 of the Navy Construction Battalion Center (NCBC) Davisville, Rhode Island. This SHERP was developed based on knowledge of the specific chemical and physical hazards that are currently known or anticipated for the operations to be conducted for soil sampling.

For the purpose of soil sampling, this SHERP conforms to EA's Program Safety and Health Management Plan for Base Realignment and Closure Multi-Year Comprehensive Long-Term Environmental Contract Northern Division, Naval Facilities Engineering Command.

1.2 SCOPE AND APPLICATION

This SHERP applies to all team personnel (including field personnel, contractors, subcontractors, etc.) who may potentially be exposed to safety and/or health hazards related to activities described in Section 3 of this SHERP. Personnel covered by this SHERP who cannot or will not comply will be excluded from site activities.

1.3 APPROVALS AND DISSEMINATION

Prior to being issued, this SHERP shall be reviewed, approved, and signed by the Program Certified Industrial Hygienist (CIH), the Stone & Webster Contract Task Order (CTO) Manager and the Contractor Representative. It is the responsibility of the Stone & Webster CTO Manager to provide copies of this SHERP to all contractors prior to visiting the site and to all subcontractors who are covered by it. At least one copy of the SHERP must be available on site at all times.

1.4 DOCUMENTATION OF EMPLOYEE APPRAISAL

Prior to performing site work, all personnel covered by this SHERP (e.g. contractors, sub-contractors, field personnel) shall attend a pre-entry briefing to inform them of the contents of the SHERP. This briefing shall be conducted by the Site Safety and Health Officer. Attendance at this briefing shall be documented by the Site Safety and Health Officer on a pre-entry briefing sheet contained in Appendix A of this SHERP. Personnel acknowledge that they have attended the briefing and understood the health and safety hazards as described in the SHERP and agree to perform work according to the requirements outlined in the SHERP.

1.5 MODIFICATION OF THE SHERP

This SHERP applies only to the activities/tasks and site-specific hazards described in Sections 5 and 6 of this plan. If any other activities or tasks are identified during the course of the project, a revision to the SHERP shall be required before those tasks and activities are initiated. All revisions to this SHERP shall be prepared by the Site Safety and Health Officer. All revisions shall be reviewed and approved by the Certified Industrial Hygienist and the Stone & Webster CTO Manager before they are implemented.

2.0 ORGANIZATION AND RESPONSIBILITIES

The organization and responsibilities for implementing and enforcing the SHERP requirements are described below. Health and safety at this site will be an integrated effort among the Stone & Webster CTO Manager, Field Operations Leader, Certified Industrial Hygienist, Site Safety and Health Officer, and Field Personnel.

2.1 Stone & Webster CTO MANAGER

The Stone & Webster CTO Manager has the primary responsibility for ensuring the overall health and safety of this project. Specific responsibilities include ensuring that an adequate SHERP is developed and is implemented and enforced at the site. Stone & Webster CTO Manager shall also maintain a high level of health and safety awareness among project personnel and maintain frequent communications with the Site Safety and Health Officer and Stone & Webster Certified Industrial Hygienist.

2.2 FIELD OPERATIONS LEADER

The Field Operations Leader is responsible for enforcing the requirements of the SHERP and shall:

- Ensure that all on-site personnel have received and read a copy of the SHERP, as well as completed the SHERP sign-off sheet.
- Ensure that all personnel have attended a briefing apprising them of the SHERP contents and potential site hazards prior to working on the site.
- Ensure that sufficient personal protective equipment (PPE) and monitoring instrumentation are available as required by this SHERP.
- Maintain a high level of health and safety awareness among site personnel.
- Maintain frequent communications with the Site Safety and Health Officer and Stone & Webster Certified Industrial Hygienist.

2.3 CERTIFIED INDUSTRIAL HYGIENIST

The Certified Industrial Hygienist is responsible for the preparation, interpretation, and any review modifications of this SHERP. Specific duties include:

- Advise Stone & Webster CTO Manager and Site Safety and Health Officer on site health and safety matters.
- Recommend appropriate PPE and air monitoring equipment and procedures.
- Maintain frequent contact with the Field Operations Leader and Site Safety and Health Officer to evaluate new information on site conditions that might require modifications to the SHERP.
- Work with the Field Operations Leader and Site Safety and Health Officer to ensure that sufficient PPE and monitoring equipment are available to project personnel.

2.4 SITE SAFETY AND HEALTH OFFICER

The Site Safety and Health Officer, a member of the project field team, ensures implementation of the SHERP requirements once on-site work begins. The Site Safety and Health Officer will oversee all

personnel on site with respect to health and safety matters and shall notify the Field Operations Leader immediately of all situations where noncompliance with the SHERP is noted and has the authority to stop work at once in cases where an immediate danger is perceived. The Site Safety and Health Officer must establish communications with potential emergency response organizations within the Navy and otherwise. Specific responsibilities include:

- Conduct daily inspection of the site.
- Procure and distribute PPE as required.
- Procure required air monitoring instrumentation and perform air monitoring if needed.
- Perform personal exposure monitoring where required and deemed necessary to determine the adequacy of protective measures and PPE specified by this SHERP.
- Verify effectiveness of PPE, safety equipment and decontamination.
- Notify the Field Operations Leader and the Certified Industrial Hygienist of all noncompliance and immediate danger situations.
- Supervise and monitor the safety performance of all personnel to ensure that required safety and health procedures are followed and correct any deficiencies.
- Conduct accident/incident investigations and prepare accident/incident reports.
- Initiate emergency response procedure notification.
- Conduct briefings (initial and at least weekly) to inform personnel of SHERP contents and site hazards.
- Modify the SHERP as dictated by changing site conditions and with approval of Field Operations Leader and Certified Industrial Hygienist.
- Maintain a file that documents that the provisions of this SHERP have been satisfied. This file shall contain:
  - Signed copy of pre-entry briefing attendance sheet
  - Personnel Injury/Exposure Reports, Incident Reports
  - Records of safety violations and remedial actions taken
  - Field log book combining such information as names of employees on site, types of protection worn, non-productive times, monitoring results, etc.

2.5 FIELD PERSONNEL

All field personnel are responsible for following the SHERP and for performing their work in a safe and responsible manner. Specific responsibilities include:

- Attend pre-entry briefing regarding SHERP contents and potential site hazards.
- Read the SHERP in its entirety prior to the start of on-site work. Sign acknowledgment that they have read and understood contents of the SHERP.
- Voice questions or concerns regarding SHERP contents to the Field Operations Leader or the Site Safety and Health Officer prior to the start of work.
- Report accidents and incidents to the Site Safety and Health Officer.
- Comply with the SHERP and requests of the Site Safety and Health Officer.
- Use required controls and safety devices, including personal protective equipment.

3.0 SCOPE OF WORK

3.1 TASK TO BE PERFORMED

The primary objective of this task is to perform soil sampling for potential PCB contamination at Site 13, NCBC Davisville. The intent of this SHERP is to provide protection to all field personnel entering the site and the surrounding environment during specified field activities. The details of these tasks are described in the Sampling Plan.

The task for the PCB sampling covered by this SHERP include:

- Near Surface and Shallow Subsurface Soil Sampling

Site related activities which will be covered by this SHERP are listed in Section 6 of this SHERP. Activities other than those described in Section 6 are not anticipated and not addressed in this SHERP.

3.2 PLANNED DURATION OF SITE ACTIVITY

The overall duration of the work covered under this SHERP is anticipated to be approximately one week.

3.3 ADDITIONAL WORK

This SHERP will be revised, as necessary, to reflect the potential hazards associated with additional tasks which may be required to complete the project.

4.0 SITE DESCRIPTION AND HISTORY

A summary of the site and its history is described below.

4.1 LOCATION

Site 13 is located at NCBC Davisville, Rhode Island. It is within a mixed residential/light commercial area approximately four (4) miles south of East Greenwich.

4.2 SURROUNDING POPULATION

The surrounding area is moderately populated and consists of commercial and residential areas.

4.3 SITE HISTORY

The site is part of NCBC Davisville, a Formerly Used Defense Site, which housed the Naval Construction Battalion Center. Site 13, the Disposal Area Northwest of Buildings W-3, W-4, and T-1 contains a field upon which waste oils, approximately 300 gallons per month during the period 1945 to 1955 were reportedly spread. Also, vehicles awaiting repair, and drums of oils, thinner and solvents were stored in the area. The buildings adjacent to the area are not associated with the removal action. It should be noted that Building T-1 was demolished in 1994 and Building T-1A was demolished in 1995.

5.0 HAZARD IDENTIFICATION

This section identifies those hazards which are likely to be encountered on site during the project. A Task Hazard Analysis for Specific Task Activities is given in Section 6.

5.1 CHEMICAL HAZARDS

This section describes the chemical hazards known or suspected to be present and gives an assessment of the potential for exposure.

TABLE 5-1
SUSPECTED OR KNOWN SITE CONTAMINANTS

Contaminant	Form or Medium	Maximum Concentration (ppm)
Beryllium	Soil	2.1
Lead	Soil	183
PCB	Soil	4563
Toluene	Soil	0.006
Xylenes	Soil	0.002
Total Petroleum Hydrocarbons (TPH)	Soil	193
Polynuclear Aromatic Hydrocarbons (PAH)	Soil	2.847

5.1.1 CONTAMINANT CHARACTERIZATION

Table 5-2 summarizes the Permissible Exposure Limits (PEL) and Threshold Limit Values (TLV) for key site contaminants.

TABLE 5-2
PUBLISHED EXPOSURE LIMITS FOR POTENTIAL SITE CHEMICALS

Chemical	Airborne Exposure Limit*
Beryllium	0.002 mg/m^3
Lead	0.050 mg/m^3
PCB	0.5 mg/m^3
Toluene	100 ppm, 150 ppm STEL
Xylenes	100 ppm, 150 ppm STEL
Total Petroleum Hydrocarbons (TPH)	300 ppm, 500 ppm STEL (as gasoline) 100 ppm (as Stoddard Solvent)

*Lower of either OSHA Permissible Exposure Limit or ACGIH Threshold Limit Value. All values listed are 8-hour Time Weighted Averages unless otherwise noted.

5.1.2 CHEMICALS TO BE BROUGHT ON-SITE

The following materials are anticipated to be used during specific tasks during the project:

- Detergent wash
- Methanol

5.1.3 HEALTH EFFECTS OF POTENTIAL CONTAMINANTS

This section describes the human health effects of over-exposure to chemicals that may be present on site. Task specific Hazard Analyses are provided in Section 6 of this SHERP. Personal protective equipment (PPE) and action levels selected to minimize the potential of over exposure to the chemicals for this project, and are described in Section 7 and 8 respectively.

5.1.3.1 Total Petroleum Hydrocarbons

TPH may cause headaches and giddiness if inhaled. Ingestion has been known to cause nausea, vomiting, cramping, and depression of the central nervous system ranging from mild headache to anesthesia, coma, and death. Contact with skin may cause a slight irritation and/or reddening.

5.1.3.2 Polychlorinated Biphenyls

PCB are irritants to the skin and have been known to cause chloracne upon repeated exposure to the skin. They are potentially damaging to the liver and kidneys and are suspected carcinogens.

5.1.3.3 Lead

Lead exposure has been shown to cause severe damage to the brain, central nervous system, peripheral nervous system, kidneys and hematopoietic system. Evidence concludes that lead salts are carcinogenic in mice and rats through tumor growth after oral and parenteral administration. The EPA has classified lead as a probable human carcinogen via oral and inhalation routes.

5.1.3.4 Beryllium

Exposure to beryllium has been shown to cause respiratory damage, weakness and weight loss.

5.1.4 POTENTIAL FOR CHEMICAL EXPOSURE

This section evaluates the overall potential for exposure to the chemicals identified on the site. Task specific Hazard Analyses are provided in Section 6 along with precautions to be taken for the chemical and physical hazards associated with each task.

For the purposes of this evaluation various assumptions have been made regarding the nature and extent of exposure to hazards. These assumptions have been made to ensure a conservative evaluation with respect to the potential exposure of employees to chemicals identified on the site and to provide an adequate margin of safety.

The potential contaminants listed above may be released during field activities, however, it is not anticipated that the PEL listed in Table 5-2 will be exceeded.

5.1.5 POTENTIAL EXPOSURE LEVEL FOR MULTI-CHEMICAL EXPOSURES

In the case of worker exposure to a mixture of airborne chemicals for which PELs are listed in 29 CFR 1000 Tables Z-1 and Z-2, OSHA requires that the maximum allowable exposure be based on an Equivalent Exposure calculated from the 8 hour Time Weighted Average (TWA) concentration of each chemical and the PEL for the chemical. The Equivalent Exposure must be less than one. The preliminary Equivalent Exposure would be calculated from the estimates of airborne concentration.

5.1.6 OTHER POTENTIAL CHEMICAL EXPOSURES

Exposure to chemicals brought on-site may occur during field activities. The precautions described under each Task Hazard Analysis in Section 6 shall ensure that potential exposure to chemicals brought on-site is minimized.

5.2 PHYSICAL HAZARDS

In addition to the chemical hazards identified above, numerous physical hazards are associated with the activities to be performed under this SHERP. The hazards listed below are common to all activities:

- Pinch, smash and cut hazards associated with hand tools.
- Slip, trip and fall hazards.
- Injuries from scattered debris.
- Thermal/cold stress (See discussion below).

Additional task specific hazards are noted as a part of each Task Hazard Analysis.

5.3 ANTICIPATED WEATHER CONDITIONS DURING PROJECT (POTENTIAL FOR HEAT AND COLD STRESS)

Field work shall be performed during the months of December and January which are generally cold with a chance of freezing conditions. Precipitation in the form of snow and/or rain is common.

These conditions can create a hazard to the health and safety of Stone & Webster employees. These conditions are very dangerous to the to the stability of the body system; they include hypothermia and frostbite as well as others. It is of vital importance that adequate precautions be taken to alleviate the effect of cold environments. If the proper measures are taken, personnel can work safely and efficiently.

Main factors contributing to cold injury:

- exposure to humidity
- exposure to high winds
- contact with wetness or metal
- inadequate clothing
- age
- general health

Physical conditions that worsen the effect of cold exposure:

- allergies
- vascular disease
- excessive smoking
- excessive drinking
- specific drugs and medicines

Workers with blood vessel abnormalities (i.e. Raynauds phenomenon and acrocyanosis) should take special precautions to avoid chilling.

5.3.1 Requirements

- Do not take alcoholic products including cough medication containing alcohol prior to work in cold environments. Alcohol dilates blood vessels near the skin surface which increases heat loss and lowers body temperature.

- Do not take sedative drugs prior to working in cold extremes. Sedative drugs interfere with transmission of impulses to the brain.

- If employees become fatigued while working, remove them to a warm environment to rest. As exhaustion approaches, the body experiences rapid loss of heat and the cooling process begins.

- Double shifts and overtime should be avoided in cold environments.

- Rest periods in warm environments shall be frequent to prevent cold stress disorders.

- The outer layer of clothing shall be removed when entering heated shelter. The other layers should be loosened to allow for sweat evaporation.

- Avoid sitting or standing for prolonged periods of time in cold environments.

5.3.2 Wind Chill Index

- Air temperature is not sufficient enough to assess the cold hazard in a certain environments. Therefore the Wind Chill Index along with the air temperature must be used. Heat loss from convection is the greatest and most deceptive factor in loss of body heat.

- Wind Chill factor is the cooling effect of any combination of temperature and wind velocity or air movement.

- The Wind Chill Index shall be used to evaluate the cold hazard.

5.3.3 Control Measures

Engineering Controls - Cold stress can be reduced by controls such as the following:

- The work area shall be shielded if the air velocity at the site is increased by the wind, draft or ventilation equipment.
- At temperatures below 40°F, metal handles of tools and control bars shall be covered with thermal insulation.
- When necessary, equipment and processes shall be substituted, isolated, relocated, or redesigned to reduce the cold stress.
- Heated warming shelters such as tents, automobiles, or trucks shall be made available if work is performed continuously in an equivalent chill temperature of 30°F or below. Workers shall be encouraged to use them.

Administrative Controls - These controls include work practices and rules designed to reduce total cold stress burden on the body. Some of these include:

- a work rest schedule to reduce the peak of cold stress; enforcing scheduled work breaks
- enforcing frequent intake of warm, sweet, caffeine-free, non alcoholic drinks or soup which should be provided at regular intervals
- scheduling the coldest work for the warmest part of the day
- moving work to warmer areas whenever possible; pre-plan the activities prior to entering the cold environment
- assigning extra workers to highly demanding jobs
- allowing workers to pace themselves, and take extra work breaks when needed
- making relief workers available for workers when they need a break
- teaching workers the basic principles of preventing cold stress and emergency response to cold stress
- maintaining protective supervision or a buddy system for those who work at 20°F or below
- allowing new employees time to adjust to conditions before they work full-time in cold environments
- arranging work to minimize sitting still or standing for long periods at a time
- reorganizing work procedures so as much of a job as possible is performed in a warm environment
- include the weight and bulkiness of clothing when estimating work performance criteria

5.3.4 Personal Protective Equipment for the Cold

It is the responsibility of the employee to dress in the clothing appropriate to the expected work conditions. The following are suggestions for cold environment clothing:

- The correct clothing depends on the specific cold stress situation.

- It is important to preserve the air space between the body and the outer layer of clothing in order to retain body heat.

- The most important parts of the body to protect are the feet, hands, head, and face. The hands and feet are the farthest from the heart and become cooled the most easily. Keeping the head covered is important because as much as 40 percent of heat is lost when the head is exposed to the elements.

- All clothing and equipment should be properly fitted and worn to avoid interfering with circulation.

- Clothing shall be of the loose fitting type. Tight clothing of synthetic fabrics interferes with evaporation.

- Socks with high wool content are best.

- Wool or thermal trousers are preferred. The best kind is either quilted or specially lined.

- When wearing a hard hat, liners shall be worn.

- A face mask or scarf is vital when working in cold wind. A ski mask gives better visibility than a snorkel hood. Face protectors shall be removed periodically to check to see if frostbite is evident.

- Safety glasses with sideshields shall be worn when out-of-doors. Special safety goggles to protect against ultraviolet light and glare are required when there is snow coverage which could cause a potential eye exposure hazard.

5.3.5 Cold Disorder Symptoms

Symptoms of some cold disorders are presented below.

Frostbite - This disorder entails an excessive drop in tissue temperature resulting in damage. Symptoms of frostbite include: skin discoloration to a white or grayish-yellow, progresses to reddish-violet and finally black as tissue dies; pain may be felt at first, but subsides; blisters may appear; the affected part is cold and numb.

When the outer layer of skin becomes frostbitten, the skin has a waxy or whitish appearance and is firm to the touch (the skin underneath is still resilient). In cases of deep frostbite, the tissues are cold, pale and solid. Frostbitten skin is highly susceptible to infection, and therefore gangrene.

The first symptom is usually an uncomfortable sensation of coldness, followed by numbness. There may be a tingling, stinging, aching feeling or cramping sensation. The victim is usually unaware of the frostbite.

Hypothermia - This disorder involves the lowering of the body's core temperature. The symptoms include uncontrolled shivering fits, sense of cold, heart beat slows, vague or slow speech, glassy stare, apathy, memory lapses, incoherence, drowsiness, cool skin, slow irregular breathing, sometimes irregular pulse, weakened pulse, apparent exhaustion, and fatigue after rest.

Pain in extremities can be first warning of overexposure.

5.3.6 First Aid for Cold Disorders

Frostbite

a. Never rub affected area. Rubbing may cause further damage to soft tissue
b. Warm area gently by soaking in water. The water should start out cold and about every 5 minutes add water that is 5 ° warmer. Do not immerse affected part in water that is more than 105 °F. If you do not have a thermometer, test the water temperature with your hand. If the water temp if uncomfortable for you, it is too hot.
c. Keep affected area under water until it looks red and feels warm.
d. Loosely bandage area with dry, sterile dressing. If finger and toes are frostbitten, place cotton or gauze between them before the loose bandage.
e. Do not break blisters.
f. Get professional help immediately.

Hypothermia

a. Remove any wet clothing and dry victim.
b. Warm the body gradually by wrapping the victim in blankets or putting on dry clothing and moving individual to a warmer place. Do not warm body quickly by immersing the person in hot water. Rapid warming can cause dangerous heart problems.
c. If available, apply heating pads or other heating source to body. Keep protective barrier, such as towel, blanket or clothing between heat source and victim to avoid burning the individual.
d. If victim is alert, give warm liquid to drink. Never give liquids to an individual who is unconscious or semi-conscious.
e. Handle victim gently.
f. Get professional help immediately.

5.4 BIOLOGICAL HAZARDS

Potential biological hazards which may be encountered during field work include poisonous plants, insects and animals.

5.5 CONFINED SPACES

Confined Space Entry will not be required for this field work.

6.0 TASK HAZARD ANALYSIS

This section provides a Hazard Analysis for the field task to be performed. Common hazards associated with nearly all site activities have been identified in Section 5. Task specific hazards are identified in the Activity Hazard Analysis along with control measures to be implemented to minimize the potential hazards.

6.1 FIELD SAMPLING ACTIVITIES

6.1.1 TASK DESCRIPTION

This task involves sampling of soils at Site 13 for potential PCB contamination.

6.1.2 POTENTIAL HAZARDS

The site activities associated with this task will entail sampling of soil for PCB. Therefore, there is a chance of personnel exposure to chemicals contained on-site. Hazards include dangers of contact with contaminated soil. Other hazards affiliated with sampling activities and general physical hazards associated with the work include:

- Physical hazards associated with use of hand tools and other equipment.
- Cold stress.

6.1.3 CONTROL MEASURES

- Personnel will be informed of potential hazards associated with the task and required precautions prior to initiating the work.
- Site workers performing the sampling activities will be in the line of sight of other personnel.
- Long-sleeved shirts and protective gloves will be worn during field activities to minimize contact with site contaminants.
- Air monitoring will be performed to ensure that personnel exposure does not exceed action levels identified in Table 8-1. If lower action levels are exceeded, work will cease and conditions will be reassessed.
- Personal Protective Equipment will be used for field activities as described in Section 7.

7.0 PERSONAL PROTECTIVE EQUIPMENT

Site activities include the use of a variety of personal protective equipment ensembles. The selection of these ensembles for various activities is the responsibility of the Site Safety and Health Officer and has been based on the Hazards Analyses described in previous sections. Field personnel shall use PPE as directed by the Site Safety and Health Officer.

If any disposable contaminated PPE or contaminated disposable sampling equipment is created, it will be disposed of in the designated drums.

The following is a description of the specific components of what shall be considered Level D and modified Level D protection as required in this SHERP.

Disposable PPE used during Level D or Modified Level D will be used for a maximum of 4-5 hours. The PPE will then be properly disposed. Therefore, at a minimum, prior to the lunch break and at the end of the work day, all disposable equipment will be discarded or decontaminated. All decontamination fluids will be containerized at the site. Personnel will be instructed to use good personal hygiene practices upon exiting the site to remove potential contaminants from their person. If minimal contamination has occurred, PPE can be set aside during breaks (excluding lunch break) and reused. If PPE becomes grossly contaminated prior to this time frame, equipment will be discarded or decontaminated sooner.

7.1 LEVEL D PROTECTION

General site reconnaissance shall be performed in Level D protection. This level of protection will include use of:

- Steel-toed work boots
- Gloves
- Long pants and long sleeve work shirt
- Hard hat
- Safety glasses (with side shields) - no contact lenses
- Additional appropriate outdoor dress as required by weather conditions.

7.2 MODIFIED LEVEL D PROTECTION

If necessary, soil sampling will be performed in Modified Level D protection. Modified Level D protection shall include all of the items for Level D as well as:

- Disposable outer boots
- Chemically resistant gloves with latex undergloves
- Tyvek or Saranex-coated coveralls (taped at wrists and ankles).

8.0 AIR MONITORING

8.1 Real Time Air Monitoring

8.1.1 Tasks to be Monitored

Real-time air monitoring shall be performed for all activities where there is the potential for exposure to airborne chemicals. An ongoing air monitoring program will ensure that personnel working on the site are not exposed to chemicals in excess of the exposure limits in Table 5-1. Real-time air measurements will be done in the breathing zone of personnel performing work who are most likely to receive the highest exposures. Measurements shall be made each day at the start of site activities and periodically throughout field activities. In addition, air monitoring of the sampling hole will be performed. The measurements will be recorded in the log book. They are:

- Weather data and date
- Name and signature of person performing the air monitoring
- The measuring instrument
- Parameter monitored
- Time and location of measurement
- Activity taking place.

All monitoring equipment will be calibrated and maintained in accordance with standard industrial hygiene practice and manufacturers' recommendations.

8.1.2 Chemical Substance Action Levels

Table 8-1 designates specific action levels for the chemical substances to be monitored on-site and the appropriate level of PPE protection. Levels of protection to be worn shall be determined by the Site Safety and Health Officer based on real time air monitoring results and personal discretion.

TABLE 8-1 CONTAMINANT ACTION LEVELS			
CONTAMINANT	MEASUREMENT METHOD	ACTION LEVEL	ACTION REQUIRED
PCB, Heavy Metals	Miniram	2 mg/m^3	Stop work, decontaminate, move to support zone, Re-evaluate hazard
TPH	Photoionization	10 ppm	Same as above

9.0 SITE CONTROLS

9.1 FACILITY ACCESS

Work vehicles/equipment will be permitted on-site during the completion of tasks. Prior to being removed from the site, equipment will be properly decontaminated by parties responsible for equipment.

9.2 WORK PRACTICES

In addition to the precautions described in each task hazard analysis, the following work practices shall be established and enforced on-site for all activities.

- Maintain safety awareness at all times and obey all instructions from the Site Safety and Health Officer and the Field Operations Leader.
- Do not violate any posted zones or restricted areas.
- Notify Site Safety and Health Officer immediately of any perceived safety concerns.
- Do not remove any material from the base without authorization from the NCBC Environmental Engineer.
- No eating, drinking, smoking, chewing gum or tobacco, or applying cosmetics shall be allowed except in specifically designated areas for such activities, such as lunch rooms or break areas.
- Personnel assigned to work at the site shall obey all of the NCBC health and safety rules.

10.0 TRAINING

The following minimum training requirements shall be met by all on-site personnel, including visitors. The Site Safety and Health Officer is responsible for briefing field personnel regarding potential contamination that may be encountered at the site, and site safety and emergency response procedures.

A thorough understanding of the types of hazards most likely to be encountered at hazardous waste sites and the personal protective measures needed to protect on-site personnel are the first requirements of a complete Health and Safety Program. This section describes the minimum training that each project team member is required to complete prior to working on the site.

10.1 GENERAL SITE TRAINING REQUIREMENTS

All on-site personnel are required to have participated in a 40 hour comprehensive training course that complies with OSHA 29 CFR 1910.120 and the project's health and safety Program requirements. This training consists of off-site classroom instruction and exercises to demonstrate the worker's familiarity with PPE and potential hazards to which they may be exposed.

In addition to the initial off-site training, all general site workers must have a minimum of three days actual field experience under the direct supervision of a trained, experienced supervisor.

Documentation of 40-hour training shall be provided by all site personnel prior to the start of work.

10.2 ANNUAL REFRESHER TRAINING

Refresher Training is an integral part of OSHA training and is also required for all on-site personnel. Site personnel are required to have participated in a minimum of eight hours of refresher training meeting the requirements of OSHA 29 CFR 1910.120, following the completion of the comprehensive training requirements described in Section 10.1, if the comprehensive training was completed more than 12 months prior to the commencement of work. Documentation of this training shall be provided by all workers prior to the start of work.

10.3 MANAGEMENT AND SUPERVISOR TRAINING

The Field Operations Leader, Site Safety and Health Officer and Task Managers shall have had eight hours of additional training pertaining to the management of health and safety and their responsibilities under the project health and safety program meeting the requirements of 29 CFR 1910.120.

10.4 SITE SPECIFIC TRAINING

Prior to the initiation of any given task, all workers expected to participate in that task shall be required to attend a Site Specific Training Session. The Site Specific Training shall be conducted by the Site Safety and Health Officer or Certified Industrial Hygienist and shall cover the contents of this SHERP including:

- Task activities to be performed
- Site chain of command
- Site specific hazards
- Chemicals hazards identified at the site
- PPE Requirements
- Action Levels requiring upgrade/downgrades
- Standard operating procedures to be used
- Emergency response procedures
- Hazard Communication Program and MSDS.

10.5 VISITOR TRAINING

Authorized visitors shall receive a safety briefing from the Site Safety and Health Officer to inform them of the hazards associated with the site area they intend to visit and site emergency procedures.

10.6 HAZARD COMMUNICATION PROGRAM

The NCBC Security Office will be contacted in the case of an emergency at (401) 465-0120. Such emergencies include:

- Fire, explosion, etc.
- First aid, ambulance
- Police
- Emergency spill response (HAZMAT).

Stone & Webster will not provide emergency response assistance unless warranted by the Security Office.

10.7 FIRST AID/CPR

At least two field person on-site will be currently certified in both basic first aid, including bloodborne pathogens training, and CPR by the American Red Cross or equivalent organization.

11.0 DECONTAMINATION

Decontamination of equipment and personnel shall be performed outside of a designated Exclusion Zone. The specific procedure used will depend on level of protection used and task in progress. All spent decontamination fluids and contaminated disposable PPE will be containerized at the site.

11.1 PERSONNEL DECONTAMINATION

11.1.1 LEVEL D AND MODIFIED LEVEL D OPERATIONS DECONTAMINATION

Decontamination procedures for higher levels of protection (i.e., Level C) are discussed in the following paragraphs. A minimum decontamination for Level D and Modified Level D site work will consist of proper removal and disposal of Tyvek coveralls, outer boots, and gloves.

11.2 EQUIPMENT DECONTAMINATION

Personal Protective Equipment

- Brush and scrub gloves and boots with decontamination solution, and rinse twice with clean water.
- Rinse thoroughly. Use disinfectant on inside of gloves. Occasionally use dilute chlorine bleaches on inside of boots to alleviate odor problems. Be sure to rinse thoroughly after using dilute chlorine bleach. Hang boots and gloves to dry on drying rack. Dry other equipment with paper towels.

Sampling Equipment will be decontaminated as described in the Sampling Plan.

11.3 PERSONAL HYGIENE

Personal hygiene primarily entails washing and is not strictly considered decontamination. Hands, face and any other exposed skin surfaces should be thoroughly washed and rinsed under running water for 3 to 5 minutes.

12.0 MEDICAL SURVEILLANCE

12.1 GENERAL SITE MEDICAL REQUIREMENTS

Personnel working on the site shall participate in a medical monitoring program, consistent with the requirements of OSHA 29 CFR 1910.120 and the Project's Health & Safety Program. The medical surveillance program shall be performed by or under the direction of a board certified occupational medicine physician. All personnel shall have a written statement from a qualified physician indicating they are qualified to perform the work they are assigned to do and use respiratory protection.

12.2 SITE SPECIFIC MEDICAL MONITORING

No specialized medical monitoring shall be performed for Level D activities. If action levels for dust is exceeded personnel involved in those activities shall be monitored for the chemical action level exceeded. A complete medical examination shall also be performed in the event of an exposure incident.

:Y RESPONSE

ions detail only specific emergency guidelines and information for this project. of the emergency response plan as well as lessons-learned from the exercise or actual ›rmed.

:RGENCIES

ecurity Office which will be contacted in the case of an emergency at (401) 465-0120. e will provide services for:

›sion, etc.
ambulance

y spill response (HAZMAT).

emergency, the Field Operations Leader or Site Safety and Health Officer will order appropriate action which could include any or all of the following:

the work zone to a safe place of refuge.
:BC Davisville Security Office of the need for emergency services through the facility y notification number (465-0120).
he nature of the emergency to NCBC Davisville Security Office.
he location of the emergency to NCBC Davisville Security Office.

de assistance is required, Stone & Webster CTO Manager, Certified Industrial Hygienist lanager of Health and Safety shall be notified as soon as possible. The CTO Manager report the emergency to the Program Manager.

re additional emergency telephone numbers for NCBC Davisville:

		(401) 294-3311
		(401) 294-3344
nce		(401) 294-3344
		(401) 465-0120
l:	Kent County Memorial Hospital Warwick, RI	(401) 737-7000
Caretaker's Office		(401) 294-1056

lures designed

stress or who
:er should be
n's respirator

13.2.2 DUTIES OF FIELD OPERATIONS LEADER OR SITE SAFETY AND HEALTH OFFICER

The Field Operations Leader or Site Safety and Health Officer is to immediately make contact with the NCBC Security Office (465-0120) to alert them of the situation. He/She should relay the following information:

- Location of the victim
- Nature of the emergency
- Whether the victim is conscious or not
- The specific conditions contributing to the emergency, if known.

The Field Operations Leader or Site Safety and Health Officer shall request any required assistance from the NCBC's emergency response personnel.

13.2.3 NONLIFE-THREATENING INCIDENT

Should it be determined that no threat to life is present, the Field Operations Leader shall direct the injured person through such decontamination procedures as are consistent with the nature of the illness or accident.

13.2.4 ACCIDENT SITE TO REMAIN UNDISTURBED

The area surrounding any accident site is not to be disturbed until any changes to the site have been cleared by the Field Operations Leader.

13.3 FIRE EMERGENCY

Site personnel are not trained, professional firefighters. If there is any doubt whether a fire can be quickly contained and extinguished, personnel are to notify the Security Office and/or local fire department, and evacuate the area.

Anyone who sees a fire shall notify the Security Office (465-0120). Only persons properly trained in fire suppression will attempt to contain and extinguish fires.

13.3.1 CONTAINED AND EXTINGUISHED FIRE

In the event of a small fire that the worker extinguishes, the Site Safety and Health Officer is to be summoned and the Field Operations Leader is to be notified. All fires must be reported to the Site Safety and Health Officer and CTO Manager.

13.4 EMERGENCY EVACUATION

Emergency evacuations at this site will be conducted in the event of an uncontrolled fire, explosion, or other major catastrophe. In the event of these incidents, the main objective is to remove site personnel

in the most expedient manner without regard to equipment shut-down. Chemical decontamination shall be considered a secondary objective to removing personnel from immediate life threatening hazards. Decontamination should be achieved through the most expedient and practical means available once site personnel are no longer at immediate risk.

13.4.1 ACCOUNTING PROCEDURE FOR PERSONNEL

Personnel will regroup into work groups. Each contractor will conduct a count of his/her personnel and report this information to the Field Operations Leader.

The Field Operations Leader, and Site Safety and Health Officer will report to the Security Office either all present and accounted for or the number, names and status of missing personnel.

13.5 SPILL AND DISCHARGE CONTROL PLAN

For the purposes of this SHERP, it is assumed that the quantities of hazardous materials or fuels to be brought onto the site will not exceed those which require a formal SPCC or Spill Prevention Plan under the Clean Water Act (CWA) or the Resource Conservation and Recovery Act (RCRA). However, a list of emergency telephone numbers is included in Section 13.1.

14.0 RECORD KEEPING

The following records shall be kept by the Site Safety and Health Officer:

- Names of visitors
- Attendance at pre-entry briefing
- Training and medical records for field personnel
- Personal injury/exposure reports
- Records of safety violations
- Field log containing names of employees on-site, levels of protection worn, and stay times in the various facilities.
- MSDS and a list of hazardous substances present on-site.

15.0 References

1. CHRIS Hazardous Chemical Data, Commandant Instruction M.16465.12A, U.S. Department of Transportation and United States Coast Guard.

2. Code of Federal Regulations, 29 CFR 1910, "Safety and Health Standards for General Industry."

3. Code of Federal Regulations, 29 CFR 1926, "Safety and Health Standards for the Construction Industry."

4. Patty's Industrial Hygiene & Toxicology, Volume 1, Parts A & B, 4th edition, John Wiley & Sons, 1991.

5. Patty's Industrial Hygiene & Toxicology, Volume 2, Parts A & B, 4th edition, John Wiley & Sons, 1981.

6. Patty's Industrial Hygiene & Toxicology, Volume 3, Parts A & B, 4th edition, John Wiley & Sons, 1985.

7. NIOSH/OSHA/USCG/EPA, "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," 1985.

8. Safety and Health Management Plan for Base Realignment and Closure Comprehensive Long-Term Environmental Action, Navy Contract No. N62472-92-D-1296, EA Engineering, Science, and Technology, 27 May 1994.

Appendix A

Site Safety, Health and Emergency Response Plan (SHERP)
Sign-off Sheet for
NCBC Davisville, Rhode Island

Stone & Webster Engineering Technology & Services

I have received a copy of the Site Safety, Health and Emergency Response Plan (SHERP) prepared for the above referenced site. I have read and understand its content and I agree that I will abide by its requirements. I have also attended a pre-entry briefing which reviewed and reinforced the contents of the SHERP.

NAME DATE	SIGNATURE	SOCIAL SECURITY NO.

Pre-Entry Briefing given by _____

Signature/Date_____

Appendix B

Site and Area Maps

Appendix C

Material Safety Data Sheets

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 354
Methyl Alcohol

Issued: 11/77 Revision: D, 11/91

Section 1. Material Identification

36

Methyl alcohol (CH_3OH) Description: Derived from destructive distillation of wood, oxidation of hydrocarbons, or high-pressure catalytic synthesis from hydrogen and carbon dioxide or carbon monoxide. Used as a solvent in manufacturing industrial chemicals and chemical pharmaceuticals, a raw material for making formaldehyde and methyl esters, a softening agent for pyroxylin plastics, a dehydrator for natural gas, a feedstock for manufacturing synthetic proteins by continuous fermentation, an octane booster in gasoline, an extractant for animal and vegetable oils; in antifreeze for automotive radiators, air brakes, gasoline, and diesel oil; and in denaturing ethanol.
Other Designations: CAS No. 67-56-1, carbinol, Columbian spirits, methanol, methyl hydroxide, methylol, monohydroxymethane, pyroxylic spirit, wood alcohol, wood naphtha, wood spirit.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

R 1
I 2
S 1*
K 4
* Skin absorption

NFPA
3 / 1 / 0 / -

HMIS
H 2
F 3
R 0
PPG†
† Sec. 8

Cautions: Methyl alcohol is moderately toxic by ingestion and mildly toxic by inhalation and skin absorption. It is flammable, volatile, and a dangerous fire hazard.

Section 2. Ingredients and Occupational Exposure Limits

Methyl alcohol, ca 100%

1990 OSHA PELs (Skin)
8-hr TWA: 200 ppm (260 mg/m³)
15-min STEL: 250 ppm (310 mg/m³)

1990 IDLH Level
25,000 ppm

1991-92 ACGIH TLVs (Skin)
TWA: 200 ppm (262 mg/m³)
STEL: 250 ppm (328 mg/m³)

1990 DFG (Germany) MAK
200 ppm (260 mg/m³)

1990 NIOSH RELs (Skin)
TWA: 200 ppm (260 mg/m³)
Ceiling: 250 ppm (325 mg/m³)

1985-86 Toxicity Data*
Human, inhalation, TC_{Lo}: 300 ppm caused eye (visual field change), CNS (headache), and pulmonary effects
Human, oral, LD_{Lo}: 428 mg/kg causes CNS (headache) and pulmonary (respiratory change) effects
Rat, oral, TD_{Lo}: 7500 mg/kg administered continuously to the female during the 17th to 19th day of gestation produced behavioral effects on newborns
Rat, inhalation, TC_{Lo}: 20,000 ppm/7 hr administered continuously to the female during the 1st to 22nd day of gestation produced specific developmental abnormalities

* See NIOSH, *RTECS* (PC1400000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: 148 °F (64.5 °C)
Freezing Point: -144.04 °F (-97.8 °C)
Vapor Pressure: 29 mm Hg at 68 °F (20 °C)
Vapor Density (air = 1): 1.11
Viscosity: 0.00593 P at 68 °F (20 °C)

Molecular Weight: 32.05
Density: 0.7924 at 68 °F (20 °C)
Water Solubility: Soluble
Other Solubilities: Soluble in ethanol, ether, benzene, ketones, and most organic solvents

Appearance and Odor: Clear, colorless, volatile liquid with a slight alcohol odor when pure, a disagreeably pungent odor when crude, and a low 10-ppm odor threshold.

Section 4. Fire and Explosion Data

Flash Point: 54 °F (12 °C), CC	Autoignition Temperature: 878 °F (470 °C)	LEL: 6% v/v	UEL: 36.5% v/v

Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO_2), water spray, or alcohol-resistant foam. For large fires, use water spray, fog, or alcohol-resistant foam. Do not scatter material with any more water than needed to extinguish fire.
Unusual Fire or Explosion Hazards: Methyl alcohol is a dangerous fire hazard when exposed to heat, flame, or oxidizers. It is explosive in its vapor form when exposed to heat or flame. Vapors may travel to an ignition source and flash back.
Special Fire-fighting Procedures: Since fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Also, wear full protective clothing. Structural firefighters' protective clothing is *ineffective* for fires involving methyl alcohol. If possible without risk, remove container from fire area. Apply cooling water to sides of fire-exposed container until fire is well out. Stay away from ends of tanks. Leave area immediately if you hear a rising sound from venting safety device or see any tank discoloration due to fire. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Methyl alcohol is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Methyl alcohol is incompatible with beryllium dihydride, metals (such as potassium or magnesium), oxidants (such as barium perchlorate, bromine, chlorine, hydrogen peroxide, and sodium hypochlorite), potassium tertbutoxide, carbon tetrachloride + metals; reacts explosively with chloroform + heat, and diethyl zinc; and reacts violently with alkyl aluminum salts, acetyl bromide, chloroform + sodium hydroxide, cyanuric chloride, and nitric acid.
Conditions to Avoid: Avoid vapor inhalation and contact with oxidizers and other incompatibles.
Hazardous Products of Decomposition: Thermal oxidative decomposition of methyl alcohol can produce carbon oxides (CO and CO_2), possible formaldehyde (HCHO) and acrid smoke, and irritating fumes.

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Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC, NTP, and OSHA do not list methyl alcohol as a carcinogen.
Summary of Risks: Methyl alcohol is toxic mainly to the nervous system, particularly optic nerves, where damage can progress to permanent blindness. Poisoning may also result in metabolic acidosis. Methyl alcohol oxidizes in the body to form formaldehyde and formic acid. These derivatives are believed responsible for many of methyl alcohol's poisonous and toxic effects. Since it is eliminated slowly from the body, methyl alcohol is considered a cumulative poison. The fatal ingestion dose is 100 to 250 ml, although death is reported from less than 33 ml.
Medical Conditions Aggravated by Long-Term Exposure: None reported
Target Organs: Eyes, central nervous system, skin, and digestive tract.
Primary Entry Routes: Inhalation, ingestion, skin absorption.
Acute effects: Inhalation can cause irritation of eyes and nose, headache, fatigue, nausea, visual impairment (optic nerve neuropathy or visual field changes) or complete and possibly permanent blindness, acidosis, convulsions, circulatory collapse, respiratory failure, and death. Ingestion can cause gastrointestinal (GI) irritation followed by the symptoms described for inhalation and possible kidney impairment. Skin contact results in a feeling of coldness, dryness, and cracking possibly leading to dermatitis. Methyl alcohol can absorb through skin and may cause headache, fatigue, and visual disturbances. Eye contact causes irritation and watering of eyes, inflamed lids, and painful sensitization to light.
Chronic Effects: Chronic inhalation or skin absorption may produce visual impairment or complete blindness.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Do not let victim rub or keep eyes tightly shut. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Since methyl alcohol is volatile and flammable, carefully dispose of contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Consider administering 10% ethanol in D5W intravenously to maintain ethyl alcohol blood level at 100 mg/dl. Check formic acid in urine and measure blood pH and plasma bicarbonate. After ingestion, there is typically an 18- to 48-hr latency period before clinical toxicity

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate area, deny entry, and stay upwind. Shut off all ignition sources—no flares, smoking, or flames in hazard area. Cleanup personnel should wear fully encapsulating, vapor-protective clothing for spills or leaks with no fire. Water spray may reduce vapor, but not prevent ignition in closed spaces. For small spills, use nonsparking tools to take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers for later disposal. For large spills, dike far ahead of spill and await disposal. Follow applicable OSHA regulations (29 CFR 1910.120).
Environmental Degradation: Aquatic toxicity rating: TLm 96, over 1000 ppm.
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33): Hazardous Waste No. U154
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Select the respirator based on its suitability to provide adequate worker protection for the given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent all skin contact.
Ventilation: Provide general and local explosion-proof exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Remove this material from your shoes and clean personal protective equipment.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Avoid physical damage to containers. Store in cool, dry, well-ventilated flammables storage area, away from strong oxidizers and other incompatibles. To prevent static sparks, electrically ground all equipment used in methyl alcohol storage, manufacture, and transportation. Use nonsparking tools.
Engineering Controls: To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control hazardous airborne contaminants and to maintain concentrations at the lowest practical level.
Other Precautions: Consider preplacement and periodic medical examinations of exposed workers emphasizing neurological, kidney, liver, and visual function. Practice good personal hygiene and housekeeping procedures. If respirators are used, institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Methyl alcohol
DOT Hazard Class: Flammable liquid
ID No.: UN1230
DOT Label: Flammable liquid
DOT Packaging Exceptions: 173.118
DOT Packaging Requirements: 173.119

IMO Shipping Name: Methanol
IMO Hazard Class: 3.2
ID No.: UN1230
IMO Label: Flammable Liquid, Poison
IMDG Packaging Group: II

MSDS Collection References: 26, 38, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 140, 143, 146, 148, 149, 153, 159, 163
Prepared by: M Gannon, BA; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: AC Darlington, MD, MPH; Edited by: JR Stuart, MS

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n. The fatal ingestion dose is 100 to 250 ml, although death is reported from less than 33 ml.
ng-Term Exposure: None reported
ystem, skin, and digestive tract.
estion, skin absorption.
ation of eyes and nose, headache, fatigue, nausea, visual impairment (optic nerve neuropathy or visual permanent blindness, acidosis, convulsions, circulatory collapse, respiratory failure, and death. Ingestion followed by the symptoms described for inhalation and possible kidney impairment. Skin contact results acking possibly leading to dermatitis. Methyl alcohol can absorb through skin and may cause headache, ntact causes irritation and watering of eyes, inflamed lids, and painful sensitization to light.
skin absorption may produce visual impairment or complete blindness.

immediately and continuously with flooding amounts of water until transported to an emergency medical eyes tightly shut. Consult a physician immediately.
othing. Since methyl alcohol is volatile and flammable, carefully dispose of contaminated clothing. Rinse least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
o fresh air and support breathing as needed.
outh to an unconscious or convulsing person. If ingested, have that *conscious and alert* person drink 1 to 2 g.
lant, paramedic, or community medical support.
stering 10% ethanol in D5W intravenously to maintain ethyl alcohol blood level at 100 mg/dl. Check formic acid sma bicarbonate. After ingestion, there is typically an 18- to 48-hr latency period before clinical toxicity

l Disposal Procedures

isolate area, deny entry, and stay upwind. Shut off all ignition sources—no flares, smoking, or flames in ld wear fully encapsulating, vapor-protective clothing for spills or leaks with no fire. Water spray may reduce sed spaces. For small spills, use nonsparking tools to take up with earth, sand, vermiculite, or other absorbent, n suitable containers for later disposal. For large spills, dike far ahead of spill and await disposal. Follow FR 1910.120).
atic toxicity rating: TLm 96, over 1000 ppm.
a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

	OSHA Designations
e (40 CFR 261.33): Hazardous	Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

0 CFR 302.4): Not listed
tance (40 CFR 355): Not listed
72.65): Not listed

ction Data

ses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since troversial, establish your own policy.
vice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if ed respirator. Select the respirator based on its suitability to provide adequate worker protection for the given orne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
boots, aprons, and gauntlets to prevent all skin contact.
l local explosion-proof exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs n is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
parate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing.
shoes and clean personal protective equipment.
smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, plying cosmetics.

cautions and Comments

physical damage to containers. Store in cool, dry, well-ventilated flammables storage area, away from strong les. To prevent static sparks, electrically ground all equipment used in methyl alcohol storage, manufacture, and g tools.
uce potential health hazards, use sufficient dilution or local exhaust ventilation to control hazardous airborne concentrations at the lowest practical level.
preplacement and periodic medical examinations of exposed workers emphasizing neurological, kidney, liver, and personal hygiene and housekeeping procedures. If respirators are used, institute a respiratory protection program naintenance, inspection, and evaluation.

portation Data (49 CFR 172.101, .102)

alcohol	IMO Shipping Name: Methanol
le liquid	IMO Hazard Class: 3.2
	ID No.: UN1230
	IMO Label: Flammable Liquid, Poison
173.118	IMDG Packaging Group: II
ts: 173.119	

38, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 140, 143, 146, 148, 149, 153, 159, 163
dustrial Hygiene Review: DJ Wilson, CIH; Medical Review: AC Darlington, MD, MPH; Edited by: JR Stuart, MS

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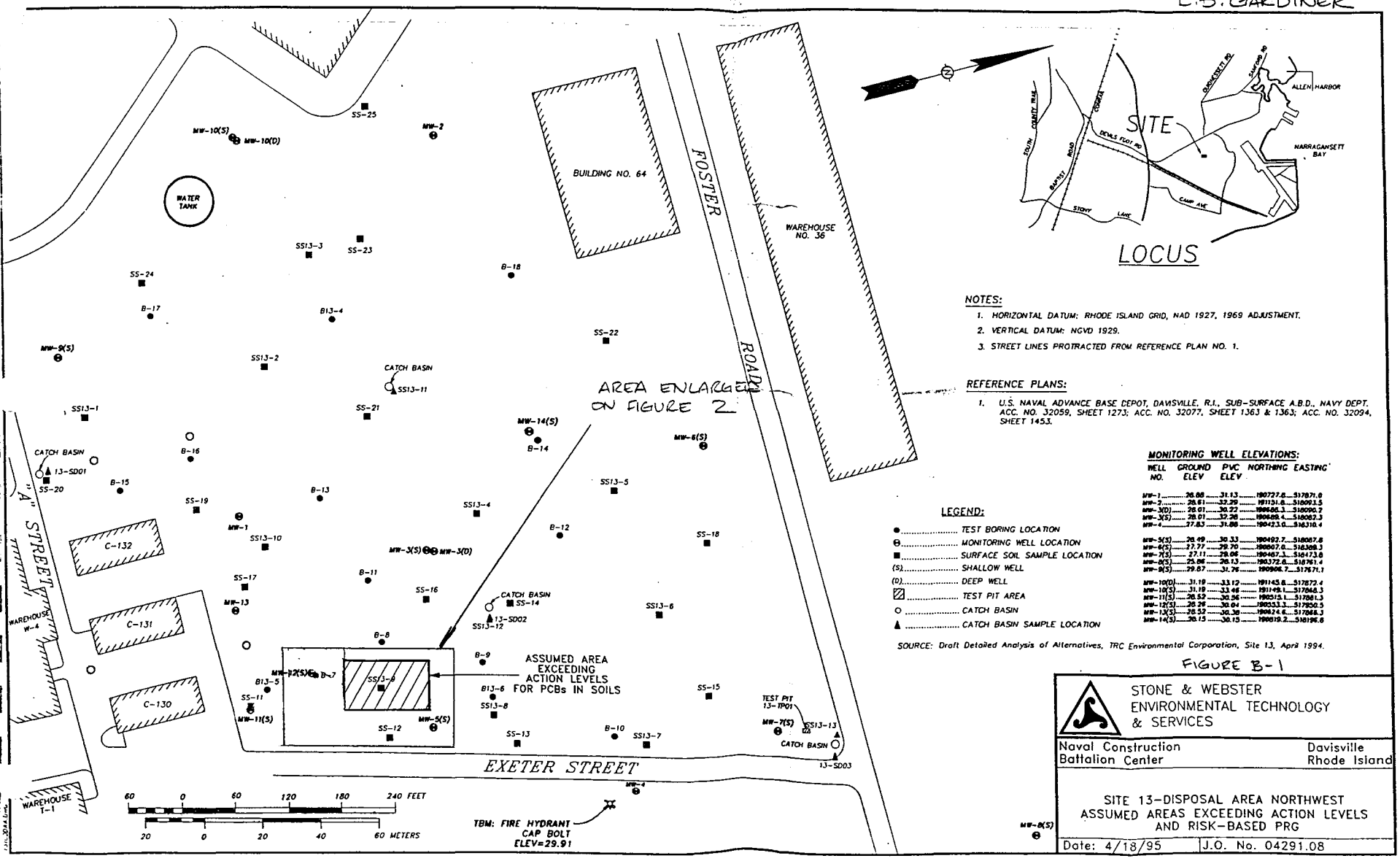
FIGURE B-1
04291.0910-1

PAGE 4
L.B. GARDINER



NOTES:

1. HORIZONTAL DATUM: RHODE ISLAND GRID, NAD 1927, 1969 ADJUSTMENT.
2. VERTICAL DATUM: NGVD 1929.
3. STREET LINES PROTRACTED FROM REFERENCE PLAN NO. 1.

REFERENCE PLANS:

1. U.S. NAVAL ADVANCE BASE DEPOT, DAVISVILLE, R.I., SUB-SURFACE A.B.D., NAVY DEPT. ACC. NO. 32059, SHEET 1273; ACC. NO. 32077, SHEET 1363 & 1363; ACC. NO. 32094, SHEET 1453.

MONITORING WELL ELEVATIONS:

WELL NO.	GROUND ELEV	PVC ELEV	NORTHING	EASTING
MW-1	26.88	31.13	190727.6	517871.0
MW-2	28.61	32.29	191131.6	518093.5
MW-3(D)	28.01	30.22	190686.3	518090.2
MW-3(S)	28.01	32.26	190689.4	518087.3
MW-4	27.83	31.86	190423.0	518310.4
MW-5(S)	26.49	30.33	190492.7	518087.8
MW-6(S)	27.77	29.70	190807.0	518388.3
MW-7(S)	27.11	28.06	190467.3	518473.8
MW-8(S)	25.88	28.13	190372.8	518761.4
MW-9(S)	29.67	31.76	190906.7	517671.1
MW-10(D)	31.19	33.12	191145.8	517872.4
MW-10(S)	31.19	33.46	191149.1	517868.3
MW-11(S)	26.57	30.56	190515.1	517881.3
MW-12(S)	26.29	30.64	190553.3	517850.5
MW-13(S)	26.52	30.38	190824.6	517868.3
MW-14(S)	26.15	30.15	190819.2	518196.8

LEGEND:

- ● TEST BORING LOCATION
- ⊖ MONITORING WELL LOCATION
- ■ SURFACE SOIL SAMPLE LOCATION
- (S) SHALLOW WELL
- (D) DEEP WELL
- ▨ TEST PIT AREA
- ○ CATCH BASIN
- ▲ CATCH BASIN SAMPLE LOCATION

SOURCE: Draft Detailed Analysis of Alternatives, TRC Environmental Corporation, Site 13, April 1994.

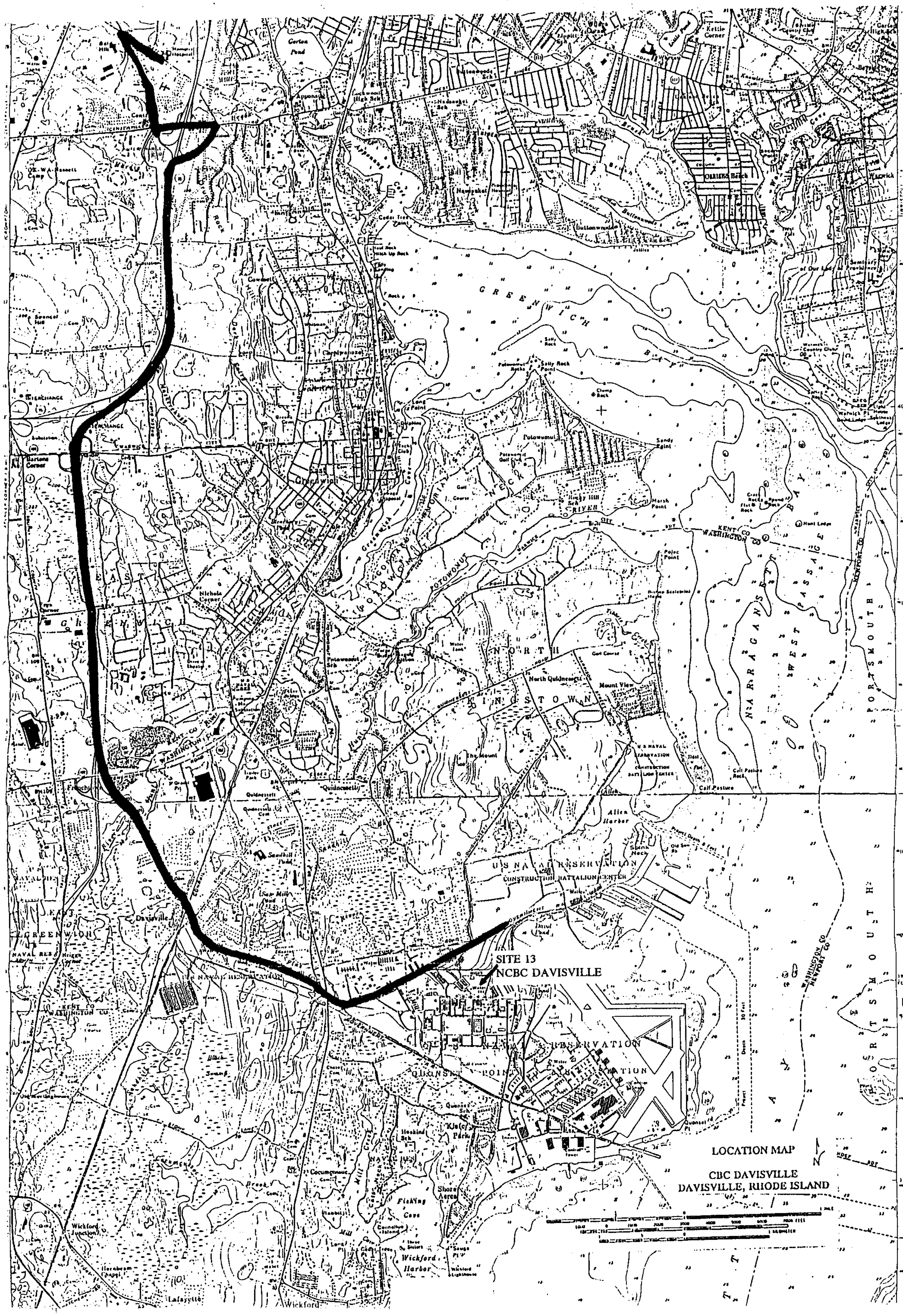
FIGURE B-1

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES

Naval Construction Battalion Center — Davisville, Rhode Island

SITE 13-DISPOSAL AREA NORTHWEST
ASSUMED AREAS EXCEEDING ACTION LEVELS AND RISK-BASED PRG

Date: 4/18/95 | J.O. No. 04291.08



LOCATION MAP

CBC DAVISVILLE
DAVISVILLE, RHODE ISLAND