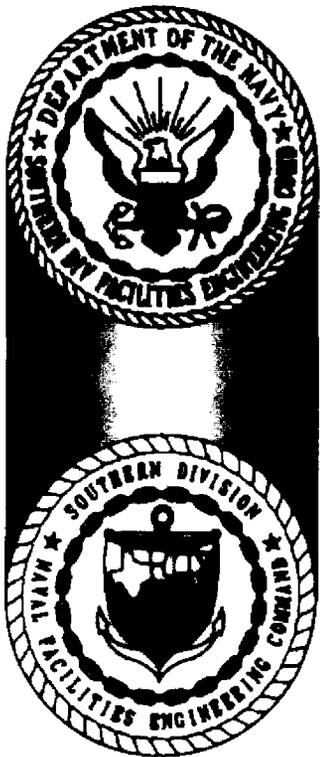


N61165.AR.003497  
CNC CHARLESTON  
5090.3a

RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT  
ADDENDUM - CORRECTIVE MEASURES STUDY WORK PLAN AOC 633, ZONE G CNC  
CHARLESTON SC  
10/22/2003  
CH2M HILL

# RFI REPORT ADDENDUM

## RFI Report Addendum and CMS Work Plan AOC 633. Zone G



***Charleston Naval Complex  
North Charleston, South Carolina***

SUBMITTED TO  
***U.S. Navy Southern Division  
Naval Facilities Engineering Command***

*CH2M-Jones*

*October 2003*

*Revision 1*

*Contract N62467-99-C-0960*



**CH2MHILL**

CH2M HILL  
115 Perimeter Center Place, NE  
Suite 700  
Atlanta, GA 30346-1278  
Tel 770.604.9095  
Fax 770.604.9282

October 22, 2003

Mr. David Scaturo  
Corrective Action Engineering Section  
South Carolina Department of Health and  
Environmental Control  
Bureau of Land and Waste Management  
8901 Farrow Road  
Columbia, SC 29203

Re: RFI Report Addendum and CMS Work Plan (Revision 1) - AOC 633, Zone G

Dear Mr. Scaturo:

Enclosed please find two copies of the RFI Report Addendum and CMS Work Plan (Revision 1) for AOC 633 in Zone G of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

Please contact me at 352/335-5877, extension 2280, if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

cc: Rob Harrell/Navy, w/att  
Gary Foster/CH2M HILL, w/att

---

**THE ATTACHED PAGES SHOULD BE INSERTED AS REPLACEMENTS IN THE  
RFI REPORT ADDENDUM AND CMS WORK PLAN, AOC 633, ZONE G, REVISION 0  
SUBMITTAL:**

- **REVISION 1 BINDER COVER/SPINE AND INSIDE COVER**
  - **REVISION 1 CERTIFICATION PAGE**
  - **REVISED TABLE OF CONTENTS PGS. IV AND VII**
    - **REVISED PG. 1-4**
    - **REVISED PGS. 3-3 THROUGH 3-5**
- **NEW APPENDIX M – CH2M-JONES RESPONSES TO SCDHEC COMMENTS ON RFI  
REPORT ADDENDUM AND CMS WORK PLAN, AOC 633, ZONE E, REVISION 0  
(AUGUST 2003)**



**CH2MHILL**

March 12, 2003

**CH2M HILL**  
3011 S.W. Williston Road  
Gainesville, FL  
32608-3928  
Mailing address:  
P.O. Box 147009  
Gainesville, FL  
32614-7009  
**Tel 352.335.7991**  
**Fax 352.335.2959**

Mr. David Scaturo  
South Carolina Department of Health and  
Environmental Control  
Bureau of Land and Waste Management  
2600 Bull Street  
Columbia, SC 29201

Re: RFI Report Addendum and CMS Work Plan (Revision 0), – AOC 633, Zone G

Dear Mr. Scaturo:

Enclosed please find four copies of the RFI Report Addendum and CMS Work Plan (Revision 0) for AOC 633 in Zone G of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

The principal author of this document is Bill Elliott. Please contact him at 352/335-5877, extension 2477, if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

cc: Dann Spariosu/USEPA, w/att  
Rob Harrell/Navy, w/att  
Gary Foster/CH2M HILL, w/att

# RFI REPORT ADDENDUM

## RFI Report Addendum and CMS Work Plan AOC 633, Zone G



***Charleston Naval Complex  
North Charleston, South Carolina***

SUBMITTED TO  
***U.S. Navy Southern Division  
Naval Facilities Engineering Command***

PREPARED BY  
***CH2M-Jones***

October 2003

Revision 1  
Contract N62467-99-C-0960  
158814.ZG.PR.03

# Certification Page for RFI Report Addendum and CMS Work Plan, Revision 1 – AOC 633, Zone G

I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina

P.E. No. 21428

  
\_\_\_\_\_  
Dean Williamson, P.E.

  
\_\_\_\_\_  
Date

# 1 Contents

---

2 Section	Page
3 <b>Acronyms and Abbreviations .....</b>	<b>viii</b>
4 <b>1.0 Introduction.....</b>	<b>1-1</b>
5     1.1 Background.....	1-1
6     1.2 Purpose of the RFIRA/CMSWP .....	1-2
7     1.3 Report Organization.....	1-2
8 Figure 1-1 Location of AOC 633, Zone G within the CNC .....	1-5
9 Figure 1-2 Aerial Photograph of AOC 633 .....	1-6
10 <b>2.0 Summary of RFI Conclusions for AOC 633.....</b>	<b>2-1</b>
11     2.1 Soil Sampling and Analysis.....	2-1
12     2.2 Groundwater Sampling and Analysis .....	2-2
13     2.3 Sediment Sampling and Analysis .....	2-2
14     2.4 Conclusions and Recommendations.....	2-3
15 Figure 2-1 RFI Sample Locations.....	2-4
16 <b>3.0 Summary of Interim Measures and UST/AST Removals at AOC 633 .....</b>	<b>3-1</b>
17     3.1 UST/AST Removals .....	3-1
18     3.2 EEG Delineation Sampling/Interim Measure .....	3-1
19     3.3 CH2M-Jones Phase I Interim Measure .....	3-2
20     3.4 CH2M-Jones Phase II Interim Measure .....	3-3
21     3.5 Post-IM COPC Summary.....	3-4
22         3.5.1 Aroclor-1260 in Subsurface Soil.....	3-5
23         3.5.2 LNAPL .....	3-5
24 Figure 3-1 Interim Measure PCB Soil Borings and Excavation.....	3-6
25 Figure 3-2 Interim Measure LNAPL Soil Borings and Excavation.....	3-7
26 <b>4.0 Summary of Additional Investigations.....</b>	<b>4-1</b>
27     4.1 EnSafe Additional Sampling.....	4-1
28         4.1.1 Surface Soil Results .....	4-1
29         4.1.2 Subsurface Soil Results.....	4-2
30     4.2 RFI Work Plan Addendum Sampling.....	4-2
31     4.3 Groundwater Investigation.....	4-3
32         4.3.1 Monitoring Well Installation.....	4-3
33         4.3.2 Groundwater Sampling and Analysis.....	4-3

# 1 Contents, Continued

---

2	4.3.3	Groundwater Sampling Results .....	4-4
3	4.3.4	LNAPL Sampling Results.....	4-5
4	Table 4-1	Organic Chemicals Detected in Surface Soil; Additional Investigations .....	4-6
5	Table 4-2	Inorganic Chemicals Detected in Surface Soil; Additional Investigations.....	4-8
6	Table 4-3	Organic Chemicals Detected in Subsurface Soil; Additional Investigations .....	4-14
7	Table 4-4	Inorganic Chemicals Detected in Subsurface Soil; Additional Investigations ..	4-15
8	Table 4-5	Aroclor-1260 Results in Soil at AOC 633; Additional Investigations.....	4-21
9	Table 4-6	Potentiometric Surface Elevations for AOC 633; October 2002 Sampling .....	4-22
10	Table 4-7	Organic Chemicals Detected in Groundwater; October 2002 and	
11		January 2003 Sampling .....	4-23
12	Table 4-8	Inorganic Chemicals Detected in Groundwater; October 2002 and	
13		January 2003 Sampling .....	4-25
14	Table 4-9	LNAPL Analytical Results from Well G633GW001 .....	4-28
15	Figure 4-1	Additional RFI Sample Locations .....	4-29
16	Figure 4-2	Potentiometric Surface Map (without G633GW001).....	4-30
17	<b>5.0</b>	<b>COPC/COC Refinement.....</b>	<b>5-1</b>
18	5.1	Surface Soil COPCs.....	5-1
19	5.1.1	Antimony .....	5-1
20	5.1.2	Chromium.....	5-2
21	5.2	Subsurface Soil COPCs .....	5-3
22	5.2.1	Antimony .....	5-3
23	5.3	Sediment COPCs.....	5-3
24	5.4	Groundwater COPCs .....	5-3
25	5.4.1	Aluminum .....	5-3
26	5.4.2	Aroclor-1260 .....	5-3
27	5.4.3	Fuel Hydrocarbons .....	5-4
28	5.4.4	Chlorobenzenes.....	5-4
29	5-5	Summary of COCs.....	5-4
30	<b>6.0</b>	<b>Summary of Information Related to Site Closeout Issues.....</b>	<b>6-1</b>
31	6.1	RFI Status .....	6-1
32	6.2	Presence of Inorganics in Groundwater.....	6-1
33	6.3	Potential Linkage to SWMU 37, Investigated Sanitary Sewers at the CNC.....	6-1
34	6.4	Potential Linkage to AOC 699, Investigated Storm Sewers at the CNC.....	6-2

# 1 Contents, Continued

---

2	6.5	Potential Linkage to AOC 504, Investigated Railroad Lines at the CNC.....	6-2
3	6.6	Potential Migration Pathways to Surface Water Bodies at the CNC.....	6-2
4	6.7	Potential Contamination in Oil/Water Separators (OWSs).....	6-2
5	6.8	Land Use Controls (LUCs).....	6-3
6	<b>7.0</b>	<b>Recommendations.....</b>	<b>7-1</b>
7	<b>8.0</b>	<b>CMS Work Plan for AOC 633 Groundwater .....</b>	<b>8-1</b>
8	8.1	Remedial Action Objectives.....	8-1
9	8.2	Remedial Goal Options and Proposed Media Cleanup Standards.....	8-1
10	8.3	Corrective Measure Technology Focused Evaluation .....	8-2
11	8.4	Focused CMS Approach.....	8-2
12	8.5	Approach to Evaluating Corrective Measure Alternatives.....	8-3
13	8.5.1	Protection of Human Health and the Environment.....	8-3
14	8.5.2	Attain Media Cleanup Standards (RGOs).....	8-3
15	8.5.3	Control of the Source of Releases .....	8-4
16	8.5.4	Comply with Applicable Standards/Management of Wastes .....	8-4
17	8.5.5	Other Factors.....	8-4
18	8.6	Focused CMS Report for AOC 633 Groundwater .....	8-5
19	Table 8-1	Outline of Focused CMS Report for AOC 633 .....	8-6
20	<b>9.0</b>	<b>References.....</b>	<b>9-1</b>
21			
22	<b>Appendices</b>		
23	<b>A</b>	Excerpts from the <i>Zone G RFI Report, Revision 0 (EnSafe, 1998a)</i>	
24	<b>B</b>	Copies of the <i>Sampling Report: Site Delineation for PCBs at Area of Concern (AOC) 633,</i>	
25		<i>Charleston Naval Complex (EEG, 2000a), and the Interim Stabilization Measure: Area of</i>	
26		<i>Concern (AOC 633), Charleston Naval Complex (EEG, 2000b)</i>	
27	<b>C</b>	Copy of the <i>Phase I Interim Measure Work Plan, Subsurface Soil Removal, AOC 633,</i>	
28		<i>Zone G, Revision 0 (CH2M-Jones, 2001a)</i>	
29	<b>D</b>	Copy of the <i>Phase II Interim Measure Work Plan, LNAPL and LNAPL-Impacted Soil</i>	
30		<i>Removal, AOC 633, Zone G, Revision 0 (CH2M-Jones, 2002a)</i>	
31	<b>E</b>	Copy of the <i>Interim Measure Completion Report, AOC 633, Zone G, Revision 0 (CH2M-</i>	
32		<i>Jones, 2002b)</i>	

# 1 **Contents, Continued**

---

- 2 **F** CH2M-Jones' responses to SCDHEC comments regarding the *Zone G RFI Report,*
- 3 *Revision 0, and the Zone G RFI Work Plan Addendum*
- 4 **G** Analytical Data from EnSafe Additional Investigations
- 5 **H** Validation Reports from EnSafe Additional Investigation
- 6 **I** CH2M-Jones Monitoring Well Construction Logs
- 7 **J** Analytical Data for CH2M-Jones Groundwater/LNAPL Sampling (2002)
- 8 **K** Data Validation Summaries for CH2M-Jones Groundwater/LNAPL Sampling (2002)
- 9 **L** UCL<sub>95</sub> Calculations for Antimony and Chromium in Surface Soil
- 10 **M** CH2M-Jones Responses to SCDHEC Comments on *AOC 633 RFI Report Addendum*
- 11 *and CMS Work Plan Revision 0 (August 2003)*

# 1 **Acronyms and Abbreviations**

---

2	AEC	Area of ecological concern
3	AOC	Area of concern
4	AST	Aboveground storage tank
5	ATSDR	Agency for Toxic Substances and Disease Registry
6	BCT	BRAC Cleanup Team
7	BRAC	Base Realignment and Closure Act
8	BRC	Background reference concentration
9	CA	Corrective action
10	CMS	Corrective measures study
11	CNC	Charleston Naval Complex
12	COC	Chemical of concern
13	COPC	Chemical of potential concern
14	DAF	Dilution attenuation factor
15	DCB	Dichlorobenzene
16	DET	Environmental Detachment Charleston
17	EEG	Environmental Enterprise Group
18	EnSafe	Ensafe Inc.
19	EPA	U.S. Environmental Protection Agency
20	EPC	Exposure point concentration
21	ERA	Ecological risk assessment
22	ft <sup>2</sup>	Square feet
23	ft bls	Feet below land surface
24	ft msl	Feet above mean sea level
25	FDS	Fuel distribution system
26	HHRA	Human health risk assessment
27	HI	Hazard index
28	HQ	Hazard quotient

# 1 **Acronyms and Abbreviations, Continued**

---

2	ILCR	Incremental lifetime cancer risk
3	IMWP	Interim measure work plan
4	LNAPL	Light non-aqueous phase liquid
5	LUC	Land use control
6	MCL	Maximum contaminant level
7	MCS	Media cleanup standard
8	$\mu\text{g/L}$	Microgram per liter
9	mg/kg	Milligram per kilogram
10	NAVBASE	Naval Base
11	NFA	No further action
12	OWS	Oil/water separator
13	PAH	Polynuclear aromatic hydrocarbon
14	PCB	Polychlorinated biphenyl
15	ppm	Part per million
16	QC	Quality control
17	RAO	Remedial action objective
18	RBC	Risk-based concentration
19	RCRA	Resource Conservation and Recovery Act
20	RFA	RCRA Facility Assessment
21	RFI	RCRA Facility Investigation
22	RFIRA/CMSWP	RFI Report Addendum/CMS Work Plan
23	RGO	Remedial goal option
24	SCDHEC	South Carolina Department of Health and Environmental Control
25	SSL	Soil screening level
26	SSV	Sediment screening value
27	SVOC	Semivolatile organic compound
28	SWMU	Solid waste management unit
29	TSCA	Toxic Control Substances Act

# 1 **Acronyms and Abbreviations, Continued**

---

- |   |                   |                                   |
|---|-------------------|-----------------------------------|
| 2 | TSD               | Treatment, Storage, and Disposal  |
| 3 | UCL <sub>95</sub> | 95-percent Upper Confidence Limit |
| 4 | UST               | Underground storage tank          |
| 5 | VOC               | Volatile organic compound         |

# 1.0 Introduction

---

In 1993, Naval Base (NAVBASE) Charleston was added to the list of bases scheduled for closure as part of the Defense Base Realignment and Closure Act (BRAC), which regulates closure and transition of property to the community. The Charleston Naval Complex (CNC) was formed as a result of the dis-establishment of the Charleston Naval Shipyard and NAVBASE on April 1, 1996.

Corrective Action (CA) activities are being conducted under the Resource Conservation and Recovery Act (RCRA) with the South Carolina Department of Health and Environmental Control (SCDHEC) as the lead agency for CA activities at the CNC. All RCRA CA activities are performed in accordance with the Final Permit (Permit No. SC0 170 022 560).

In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation and remediation services at the CNC. This submittal has been prepared by CH2M-Jones to complete the RCRA Facility Investigation (RFI) for Solid Waste Management Unit (AOC) 633 in Zone G of the CNC. This report recommends that a Corrective Measures Study (CMS) be performed for shallow groundwater at AOC 633. Figure 1-1 illustrates the location of AOC 633 and Zone G within the CNC. An aerial view of AOC 633 is shown in Figure 1-2.

## 1.1 Background

AOC 633 is located near Building 451C, which is an electrical substation built in 1943. The RCRA Facility Assessment (RFA) defined the AOC as Building 451C itself, but additional work determined that the AOC 633 actually consists of an abandoned outdoor concrete slab and underground electrical vault, surrounded by a fenced yard, lying directly north of Building 451C. This former switchyard is approximately 45 feet by 60 feet (ft), and is visible on historic public works maps as early as 1955, but is no longer visible in 1987 maps. Building 451C is a block structure with a concrete roof and floor. Several high voltage switches, breakers and transformers are located in the two-room block structure.

The site also contains several outdoor steel electrical switch enclosures on concrete slabs immediately east of Building 451C. A review of the historical maps indicates that these were added in the 1980s, presumably to replace the older structure to the north. In 1989, an electrical transformer at this substation was destroyed by Hurricane Hugo. According to the *Final RCRA Facility Assessment Report, Volume II* (EnSafe Inc. [EnSafe]/Allen & Hoshall, 1995), several historical releases of polychlorinated biphenyls (PCBs) have been reported for

1 this site, including a large leak of 10C oil in 1981. No remedial activities were known to  
2 have occurred at this site prior to commencement of the Zone G RFI by EnSafe in 1997. The  
3 area where AOC 633 is located is zoned M-1, for marine industrial land use.

## 4 **1.2 Purpose of the RFI Report Addendum/CMS Work Plan**

5 This RFI Report Addendum/CMS Work Plan (RFIRA/CMSWP) provides information  
6 about AOC 633 that documents the conclusions from the *Zone G RFI Report, Revision 0*  
7 (EnSafe, 1998a), provides the results of additional sampling that was performed after  
8 completion of the RFI, and summarizes the IMs completed at AOC 633. A CMSWP for site  
9 groundwater at AOC 633 is included in Section 8.0 of this report.

10 Prior to changing the status of any site in the CNC RCRA CA permit, the BRAC Cleanup  
11 Team (BCT) agreed that the following issues should be considered:

- 12 • Status of the RFI
- 13 • Presence of metals (inorganics) in groundwater
- 14 • Potential linkage to Solid Waste Management Unit (SWMU) 37, Investigated Sanitary  
15 Sewers at the CNC
- 16 • Potential linkage to AOC 699, Investigated Storm Sewers at the CNC
- 17 • Potential linkage of AOC 504, Investigated Railroad Lines at the CNC
- 18 • Potential linkage to surface water bodies (Zone J)
- 19 • Potential contamination associated with OWSs
- 20 • Relevance or need for land use controls (LUCs) at the site

21 Information regarding these issues is provided in this RFIRA/CMSWP to expedite  
22 evaluation of closure of the site.

## 23 **1.3 Report Organization**

24 This RFIRA/CMSWP consists of the following sections, including this introductory section:

25 **1.0 Introduction** — Presents the purpose of the report and background information relating  
26 to the RFIRA/CMSWP.

27 **2.0 Summary of RFI Conclusions for AOC 633** — Summarizes the conclusions from the  
28 RFI investigations and risk evaluations for AOC 633 that were reported in the *Zone G RFI*  
29 *Report, Revision 0*.

1 **3.0 Summary of Interim Measures and UST/AST Removals at AOC 633** — Summarizes  
2 the IMs completed after submittal of the *Zone G RFI Report, Revision 0*. This section also  
3 provides a description of any underground storage tank (UST) or aboveground storage tank  
4 (AST) closure activities conducted at the site.

5 **4.0 Summary of Additional Investigations**—Presents results of additional  
6 delineation/confirmatory soil sampling and groundwater sampling completed after  
7 submittal of the *Zone G RFI Report, Revision 0*.

8 **5.0 COPC/COC Refinement**—Provides further evaluations of chemicals of potential  
9 concern (COPCs) based on RFI and additional data to assess them as chemicals of concern  
10 (COCs).

11 **6.0 Summary of Information Related to Site Closeout Issues**- Discusses various site  
12 closeout issues the BCT agreed to evaluate prior to site closeout.

13 **7.0 Recommendations**-Provides recommendations for proceeding with the RCRA CA  
14 process.

15 **8.0 CMS Work Plan for AOC 633 Groundwater**- Presents a focused CMSWP for the  
16 shallow groundwater at AOC 633.

17 **9.0 References**- Lists the references used in the preparation of this document.

18 **Appendix A** contains tables from the *Zone G RFI Report, Revision 0* listing chemicals  
19 detected in soil and sediment.

20 **Appendix B** contains a copy of the *Sampling Report: Site Delineation for PCBs at Area of*  
21 *Concern (AOC) 633, Charleston Naval Complex (EEG, 2000a), and the Interim Stabilization*  
22 *Measure: Area of Concern (AOC) 633, Charleston Naval Complex (EEG, 2000b).*

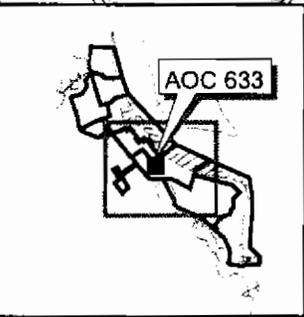
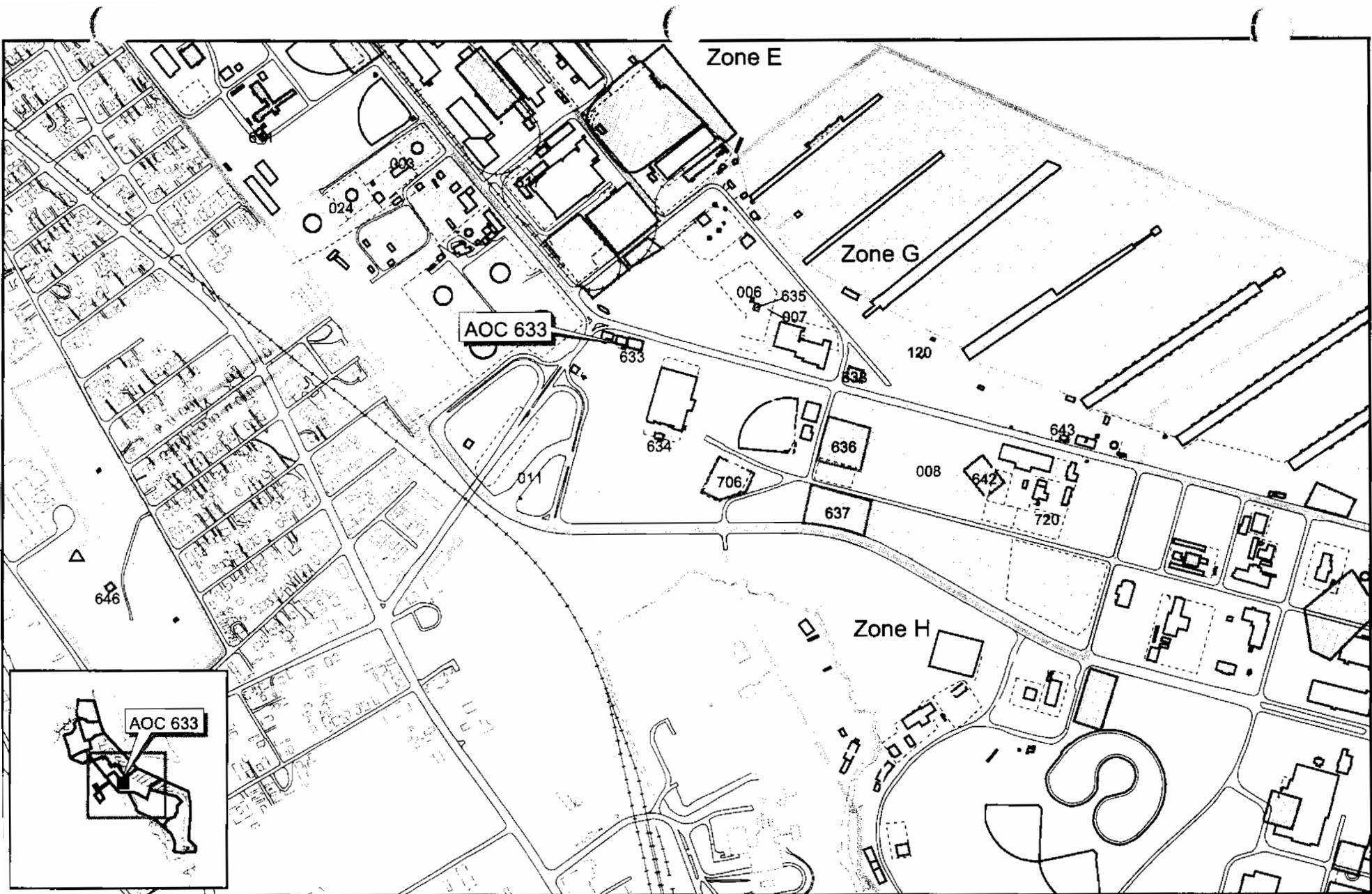
23 **Appendix C** contains a copy of the *Phase I Interim Measure Work Plan, Subsurface Soil*  
24 *Removal, AOC 633, Zone G, Revision 0 (CH2M-Jones, 2001a).*

25 **Appendix D** contains a copy of the *Phase II Interim Measure Work Plan, LNAPL and LNAPL-*  
26 *Impacted Soil Removal, AOC 633, Zone G, Revision 0 (CH2M-Jones, 2002a).*

27 **Appendix E** contains a copy of the *Interim Measure Completion Report, AOC 633, Zone G,*  
28 *Revision 0 (CH2M-Jones, 2002b).*

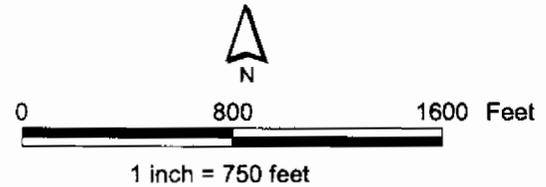
29 **Appendix F** presents CH2M-Jones' responses to SCDHEC comments regarding the *Zone G*  
30 *RFI Report, Revision 0* (in regard to the AOC 633 investigated area) and the *Zone G RFI Work*  
31 *Plan Addendum (EnSafe, 2000).*

- 1 **Appendix G** contains analytical data from additional EnSafe investigations.
- 2 **Appendix H** contains data validation summaries for the additional EnSafe investigations.
- 3 **Appendix I** contains monitoring well construction and boring logs for CH2M-Jones
- 4 monitoring wells installed in 2002.
- 5 **Appendix J** presents analytical data for the CH2M-Jones groundwater/LNAPL sampling
- 6 conducted in 2002.
- 7 **Appendix K** presents data validation summaries for the CH2M-Jones groundwater/  
8 LNAPL sampling conducted in 2002.
- 9 **Appendix L** presents the 95-percent Upper Confidence Limit (UCL95) calculations for
- 10 antimony and chromium in surface soil.
- 11 **Appendix M** presents CH2M-Jones' Responses to SCDHEC Comments on AOC 633 RFI
- 12 *Report Addendum and CMS Work Plan Revision 0* (August 2003).
- 13 All tables and figures appear at the end of their respective sections.

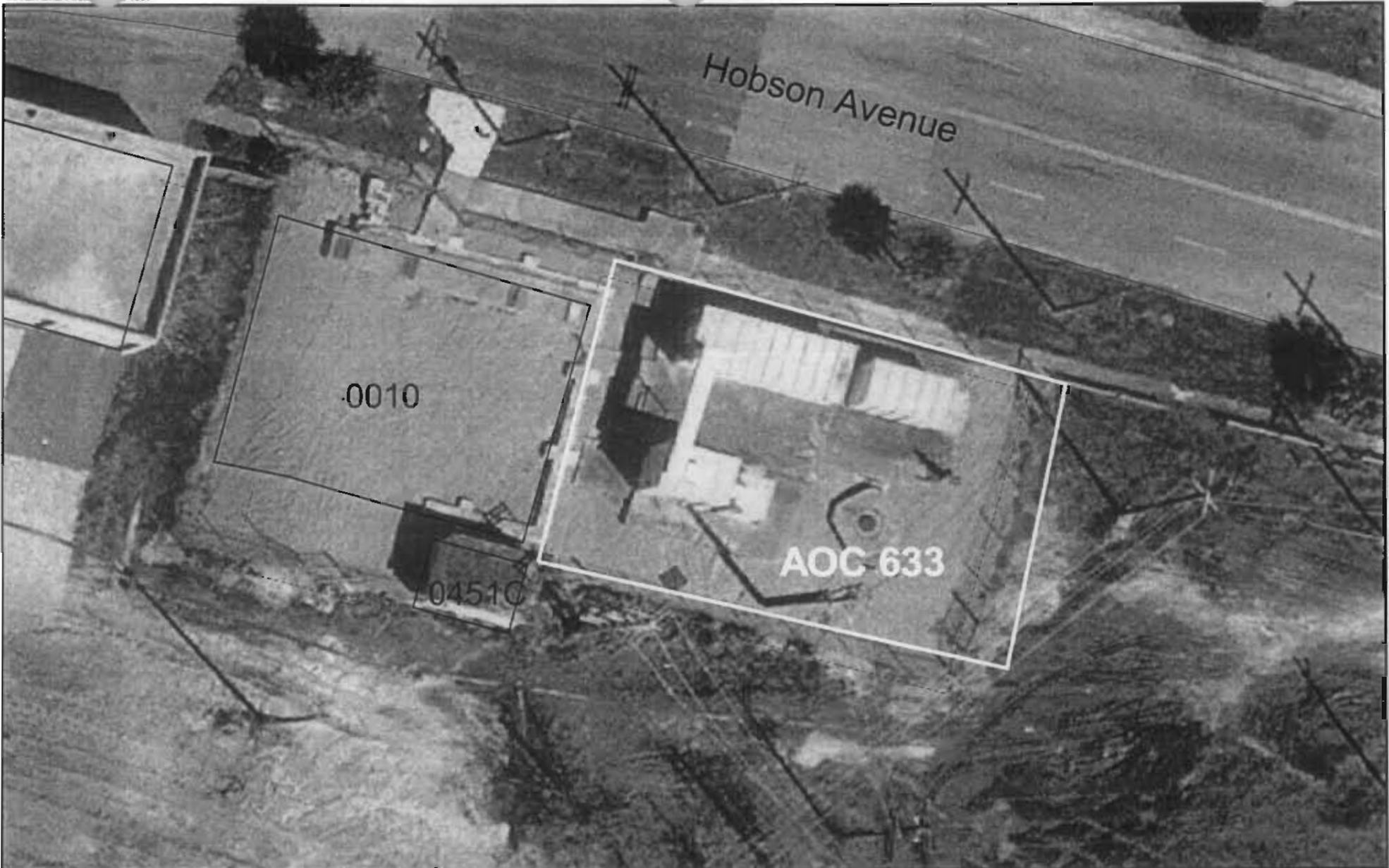


**Figure 1-1**  
 Location of AOC 633  
 Zone G  
 Charleston Naval Complex

- Fence
- Railroads
- Roads
- Shoreline
- Buildings
- AOC Boundary
- SWMU Boundary
- Zone Boundary
- Zone G



**CH2MHILL**



-  Fence
-  Roads - Lines
-  SWMU / AOC
-  Buildings



1 inch = 25 feet

**Figure 1-2**  
Aerial Photograph  
AOC 633, Zone G  
Charleston Naval Complex



## 2.0 Summary of RFI Conclusions for AOC 633

---

The RFI conducted by the Navy/EnSafe team in 1997 and 1998 investigated the nature and extent of environmental contamination at the site, and whether corrective actions were required to eliminate or minimize unacceptable risks to human health or the environment. The field investigation at AOC 633 included collection and analysis of surface (0 to 1 ft below land surface [bls]) and subsurface (3 to 5 ft bls) soil samples from the AOC 633 vicinity. Sediment samples were also collected from a drainage ditch that passes near AOC 633. These samples are identified with a "633" sample ID, even though some were collected up to 600 feet away from AOC 633 (see Figure 2-1). Appendix A includes tables from the *Zone G RFI Report, Revision 0* showing chemicals detected in site soils and sediments.

### 2.1 Soil Sampling and Analysis

Numerous soil samples were collected at the site and subsequently analyzed over the course of several investigations. The locations of the 10 original RFI samples collected at AOC 633 are presented in Figure 2-1. The samples were analyzed for pesticides and PCBs.

The RFI screening criteria for surface soil consisted of U.S. Environmental Protection Agency (EPA) Region III (October 1997) residential risk-based concentrations (RBCs) (with a hazard index [HI]=0.1 for non-carcinogens) for organic and inorganic chemicals, and the Zone G RFI background reference concentrations (BRCs) for inorganics.

The screening criteria for organic chemicals in subsurface soil consisted of soil screening levels (SSLs) and, for inorganics, SSLs and the Zone G RFI BRCs. The SSLs used were based on a dilution attenuation factor (DAF) of 20. Inorganic chemical concentrations were compared with the greater of their Zone G RFI BRC or SSL values.

The *Zone G RFI Report, Revision 0* presented the results of soil sampling and conclusions concerning the extent of contamination and risk at the site. The conclusions from the RFI report are summarized below:

- The nature of contamination section (10.2.3.1) reported that six pesticides were detected in surface soil samples and five pesticides were detected in subsurface soil. No surface or subsurface soil pesticide concentrations were reported to exceed their respective residential RBC or the SSLs.

1 Aroclor-1260 was detected in surface soil above its RBC and in subsurface soil above its  
2 SSL. Aroclor-1260 concentrations ranged from 0.041 to 0.48 milligrams per kilogram  
3 (mg/kg) in surface soil, and from 0.31 to 25 mg/kg in subsurface soil.

4 The fate and transport section of the RFI report (10.2.5) concluded that the soil-to-  
5 groundwater migration pathway may be of concern, as one subsurface sample  
6 (633SB00702) contained Aroclor-1260 above its SSL.

- 7 • The human health risk assessment (HHRA) section (10.2.6) identified Aroclor-1260 as  
8 the only COPC in surface soil. No COPCs were identified in subsurface soil.

9 The HHRA further evaluated the COPCs to determine which compounds would be  
10 considered COCs. The COCs were identified as any chemical with an incremental lifetime  
11 cancer risk (ILCR) of  $1^{-6}$  (one person in one million) or greater, or whose hazard quotient  
12 exceeds 0.1.

13 This evaluation resulted in no COCs being identified for soil at AOC 633 based on an  
14 unrestricted (i.e., residential) land use scenario. The Aroclor-1260 exceedance of its SSL in  
15 one subsurface soil was determined not to represent an unacceptable exposure risk.

## 16 **2.2 Groundwater Sampling and Analysis**

17 Groundwater samples were not collected as part of the original RFI investigations at AOC  
18 633.

## 19 **2.3 Sediment Sampling and Analysis**

20 Six sediment samples were collected from locations presumed to be topographically  
21 downgradient for stormwater runoff from AOCs 633, 634, and 706. The sediment samples  
22 were collected to identify contaminants which may have been introduced to the nearby  
23 Area of Ecological Concern (AEC)-IV-1 from AOC 633 and the two other nearby AOCs (634  
24 and 706). The locations of the sediment samples in the vicinity of AOC 633 are illustrated in  
25 Figure 2-1. The sediment samples were analyzed for metals, pesticides/PCBs, semivolatile  
26 organic compounds (SVOCs), and volatile organic compounds (VOCs).

27 The conclusions from the RFI report are summarized below:

- 28 • The nature of contamination section (10.2.4.1) reported that two VOCs (2-butanone and  
29 carbon disulfide) were detected in sediment samples. No VOCs were detected above  
30 appropriate sediment screening values (SSVs).

1 Three SVOCs (bis[2-ethylhexyl]phthalate, fluoranthene, and pyrene) were detected in  
2 sediment samples above their respective SSVs.

3 Five pesticides (alpha-chlordane, gamma-chlordane, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT)  
4 were detected in sediment samples. All five pesticides exceeded their respective SSVs.  
5 Aroclor-1260 was also detected in sediment above its SSV.

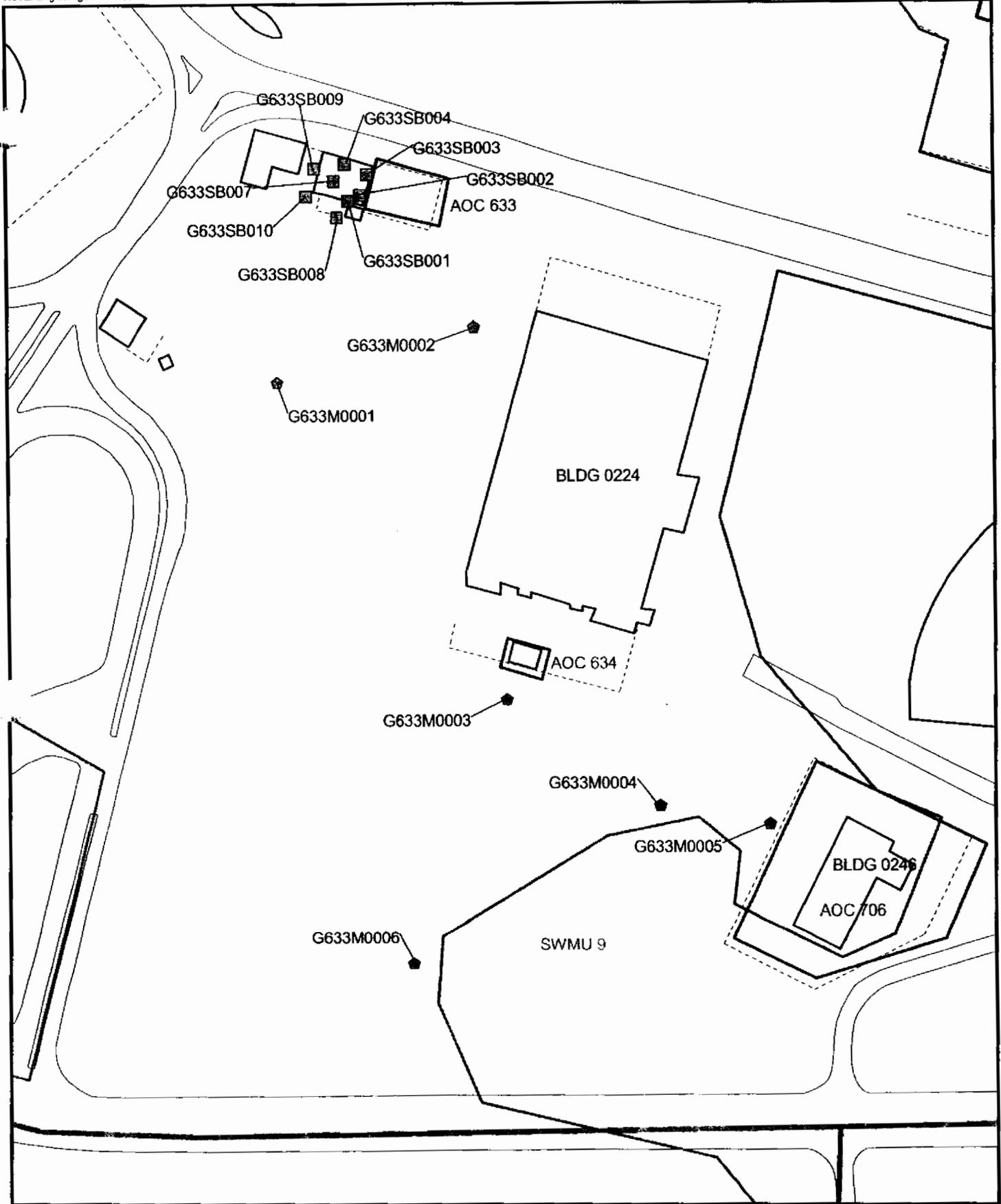
6 Nine metals (antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel,  
7 and zinc) were detected at concentrations that exceed their respective SSVs.

- 8 • The fate and transport section (10.2.5) reported that although several constituents were  
9 detected in sediment, it was not possible to assign the source to any AOCs or SWMUs,  
10 as the area receives runoff from several sites. Therefore, the evaluation of the sediment  
11 results focused on the consequent risk to ecological receptors. The Ecological Risk  
12 Assessment (ERA) was presented in Section 8 of the *Zone G RFI Report, Revision 0*.

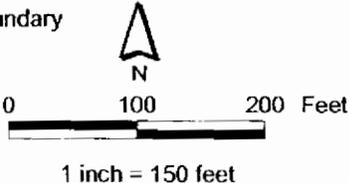
## 13 **2.4 Conclusions and Recommendations**

14 The *Zone G RFI Report, Revision 0* concluded that no COCs requiring further evaluation were  
15 present at AOC 633, and the site was recommended for No Further Action (NFA) status.

NOTE: Original figure created in color



- |               |                        |               |
|---------------|------------------------|---------------|
| Soil Boring   | AOC Boundary - Active  | Zone Boundary |
| Sediment      | SWMU Boundary - Active |               |
| Fence         | AOC Boundary - NFA     |               |
| Railroads     | SWMU Boundary - NFA    |               |
| Roads - Lines | Buildings              |               |
| Shoreline     | Surrounding Area       |               |



**Figure 2-1**  
RFI Sample Locations  
AOC 633, Zone G  
Charleston Naval Complex

**CH2MHILL**



## 3.0 Summary of Interim Measures and UST/AST Removals at AOC 633

---

### 3.1 UST/AST Removals

Neither the *Final RCRA Facility Assessment Report, Volume II* (EnSafe/Allen & Hoshall, 1995) nor the *Zone G RFI Report, Revision 0* (EnSafe, 1998a) refer to the presence or possible presence of any USTs or ASTs at AOC 633. No UST or AST removals are known to have occurred at this site.

### 3.2 EEG Delineation Sampling/Interim Measure

The Environmental Enterprise Group (EEG) (formerly known as the Environmental Detachment Charleston [DET]) was tasked with conducting an IM at AOC 633 to address the PCB (Aroclor-1260) contamination reported in the subsurface sample at boring location G633SB007 during the Zone G RFI. EEG proposed to remove the PCB contamination by excavating a 10-ft x 10-ft area surrounding boring G633SB007 to a depth of 5 ft bls, and collecting confirmation samples.

Prior to implementing the removal IM, two phases of delineation soil sampling were conducted. The results of the first phase of sampling in January 2000 revealed that the areal and vertical extent of the PCB contamination was greater than expected. PCB concentrations also were discovered to exceed 50 parts per million (ppm) at some locations, requiring more stringent handling and disposal of the contaminated soil in accordance with RCRA and the Toxic Substances Control Act (TSCA) hazardous waste regulations.

Numerous subsurface obstacles and debris were encountered at the site. A second phase of delineation sampling was conducted in February 2000, which resulted in sufficient information to define the extent of contamination and the limits of excavation required for completion of the IM. A total of 17 soil samples were collected and analyzed for PCBs, and the results were presented in a *Sampling Report, Site Delineation for PCBs at Area of Concern 633, Charleston Naval Complex* (EEG, 2000a). The locations of the 17 EEG IM samples are presented in Figure 3-1, and a copy of the complete sampling report is presented as Appendix B.

1 The EEG IM Work Plan (IMWP), entitled *Interim Stabilization Measure, Area of Concern 633,*  
2 *Charleston Naval Complex*, was updated and resubmitted in September 2000 (EEG, 2000b),  
3 detailing a plan to excavate and remove contaminated soils to a 1-ppm cleanup standard,  
4 based upon *Title 40 Code of Federal Regulations Part 761 (40 CFR 761)* and an unrestricted  
5 (residential) land use scenario (see Appendix B). Details of the EEG IMWP included  
6 stripping off and stockpiling the gravel surface cover and the first two feet of underlying  
7 soils, determined to be clean fill. An estimated 240 tons of PCB-contaminated soils would be  
8 removed from a 900-square foot (ft<sup>2</sup>) area, and loaded for direct transport to a permitted  
9 treatment, storage, and disposal (TSD) facility. Confirmatory grab samples would be  
10 collected from the excavation, and the site would be backfilled to grade with clean fill. EEG  
11 did not implement their IMWP because the site was reassigned to CH2M-Jones. The results  
12 of the EEG sampling were incorporated into an IMWP prepared by CH2M-Jones, with  
13 sampling locations presented in Figure 2-1 of that document, entitled the *Phase I Interim*  
14 *Measure Work Plan, Subsurface Soil Removal, AOC 633, Zone G, Revision 0* (CH2M-Jones,  
15 2001a). The CH2M-Jones Phase I IMWP is discussed below, and a copy of this document is  
16 included as Appendix C.

### 17 **3.3 CH2M-Jones 2001 Phase I Interim Measure**

18 In September 2001, CH2M-Jones submitted the *Phase I Interim Measure Work Plan, Subsurface*  
19 *Soil Removal, AOC 633, Zone G, Revision 0* (CH2M-Jones, 2001a), which presented a technical  
20 approach to remove PCB-impacted subsurface soils from the site. The surface soil results  
21 indicated that PCB-impacted surface soil was not present at the site in excess of EPA's 1  
22 ppm unrestricted (residential) land use action level for PCBs. The PCBs in subsurface soils  
23 do not present a direct exposure pathway. A site-specific SSL of 15.4 mg/kg was calculated.

24 This SSL was later revised to 9.9 mg/kg, because of a change in the assumed infiltration rate  
25 at the CNC from 0.1 ft/year to 0.45 ft/year (as described in the *Phase II Interim Measure Work*  
26 *Plan, LNAPL and LNAPL-Impacted Soil Removal, AOC 633, Zone G, Revision 0* ([CH2M-Jones  
27 2002a])). The 9.9 mg/kg value was used as the media cleanup standard (MCS) for subsurface  
28 soils.

29 The technical approach included collection and analysis of 10 subsurface (3 to 5 ft bls) soil  
30 delineation/confirmation samples to more accurately define the horizontal and vertical  
31 excavation limits, and to confirm results at EEG sample locations where PCB concentrations  
32 exceeded 50 ppm. The existing data were geostatistically kriged to estimate the extent of  
33 excavation required to meet the 9.9 mg/kg cleanup level, and to develop an excavation  
34 footprint, which was used to position the samples.

1 The top 2 feet of soil was removed and stockpiled onsite for use as fill material. The  
2 excavation of one larger and one smaller area was conducted, with the larger area being  
3 excavated to the water table, and the smaller area being excavated to a depth of  
4 approximately 4 ft bls. Figure 3-1 depicts the excavated areas. The completion of this IM was  
5 previously described in the *Interim Measure Completion Report, AOC 633, Zone G, Revision 0*  
6 (CH2M-Jones, 2002b).

7 The results of confirmation sampling indicated that subsurface soils at all sampling  
8 locations where exceedances were measured had been excavated, with the exception of  
9 sample 00EEG00017-6, which had a residual Aroclor-1260 concentration of 17 mg/kg,  
10 (exceeding the 9.9 mg/kg MCS). The IM data indicated that this was a very small area of  
11 impacted subsurface soil that does not pose a leaching or exposure risk, when the average  
12 concentrations of all residual PCB detections are considered. The average residual PCB  
13 concentration in subsurface soil was calculated as 1.54 mg/kg (see Table 3-1 in the AOC 633  
14 IM Completion Report [CH2M Jones 2002b]).

15 Near the completion of the soil excavation, light non-aqueous phase liquid (LNAPL) was  
16 observed entering the excavation near delineation/confirmatory boring locations  
17 G633SB031 and G633SB027. LNAPL and groundwater samples were collected from the  
18 excavation and submitted for analysis. The LNAPL analytical results indicated the presence  
19 of PCBs and other organic chemicals. The LNAPL was determined to be weathered diesel  
20 fuel.

21 The IM objective of the removal of PCB-impacted soil was successful, thus the excavation  
22 was backfilled. The *Phase II Interim Measure Work Plan, LNAPL and LNAPL-Impacted Soil*  
23 *Removal, AOC 633, Zone G, Revision 0* (CH2M-Jones 2002a) was developed to address the  
24 delineation and removal of LNAPL and LNAPL-impacted soils. This Phase II IM is  
25 discussed below.

### 26 **3.4 CH2M-Jones 2002 Phase II Interim Measure**

27 To address the LNAPL discovered during the Phase I IM excavation, CH2M-Jones  
28 developed and submitted the *Phase II Interim Measure Work Plan, LNAPL and LNAPL-*  
29 *Impacted Soil Removal, AOC 633, Zone G, Revision 0* (CH2M-Jones, 2002a). A copy of the Phase  
30 II IMWP is included as Appendix D of this RFIRA/CMSWP. Twelve soil borings were  
31 advanced around the perimeter of the excavation site to assess the extent and source of the  
32 LNAPL. Samples were collected from the top of the water-bearing zone (3 to 5 ft bls) except

1 at location G633SB037, where a subsurface obstruction was encountered. A water sample  
2 was also collected from a subsurface electrical vault.

3 The Phase II IMWP also proposed excavation and removal of LNAPL-impacted soils. Seven  
4 sequential backhoe excavations were made to the water table at various locations to assess  
5 the extent of the LNAPL. Figure 3-2 shows the LNAPL soil borings and excavation areas. A  
6 thin layer of LNAPL was encountered in Excavations 1 and 2, near LNAPL delineation  
7 borings G633SB033 and G633SB043, which are in turn close to the location where LNAPL  
8 was encountered in the original PCB excavation.

9 No LNAPL or visible LNAPL soil staining was encountered in Excavations 2 through 7, or  
10 in confirmatory samples that were collected from the excavations. Product recovery from  
11 Excavation 1 was attempted using a pump and absorbent pads, with approximately 190  
12 gallons of product/water mixture (largely water) being removed, drummed, and properly  
13 disposed of.

14 A review of the confirmation samples indicated no LNAPL constituent contamination in  
15 excess of SSLs in soils; the excavations were backfilled, and the contaminated soil was  
16 properly disposed of.

17 A copy of the *Interim Measure Completion Report, AOC 633, Zone G, Revision 0* (CH2M-Jones,  
18 2002b) for this phase of the IM is included as Appendix E to this RFIRA/CMSWP, and  
19 presents all sampling, excavation, and disposal information for the PCB and LNAPL IMs  
20 (Phases I and II, respectively). The conclusions presented in the IM Completion Report  
21 (IMCR) regarding the LNAPL were that the LNAPL presence was due to a previous small  
22 onsite spill of diesel fuel, which had been adequately addressed by the IM.

### 23 **3.5 Post-IM COPC Summary**

24 The IMs sufficiently addressed Aroclor-1260- and LNAPL-impacted soil at AOC 633, as  
25 described in the IMCR. Therefore, no additional action for site soils is proposed. The  
26 potential for impacts to site groundwater from the presence of LNAPL was addressed  
27 separately by a groundwater investigation consisting of installation and sampling of four  
28 monitoring wells, as discussed further in Section 4.3.1 of this RFIRA/CMSWP. No new  
29 COPCs were identified for surface soil. The following sections summarize the discussions  
30 previously presented in the IMCR.

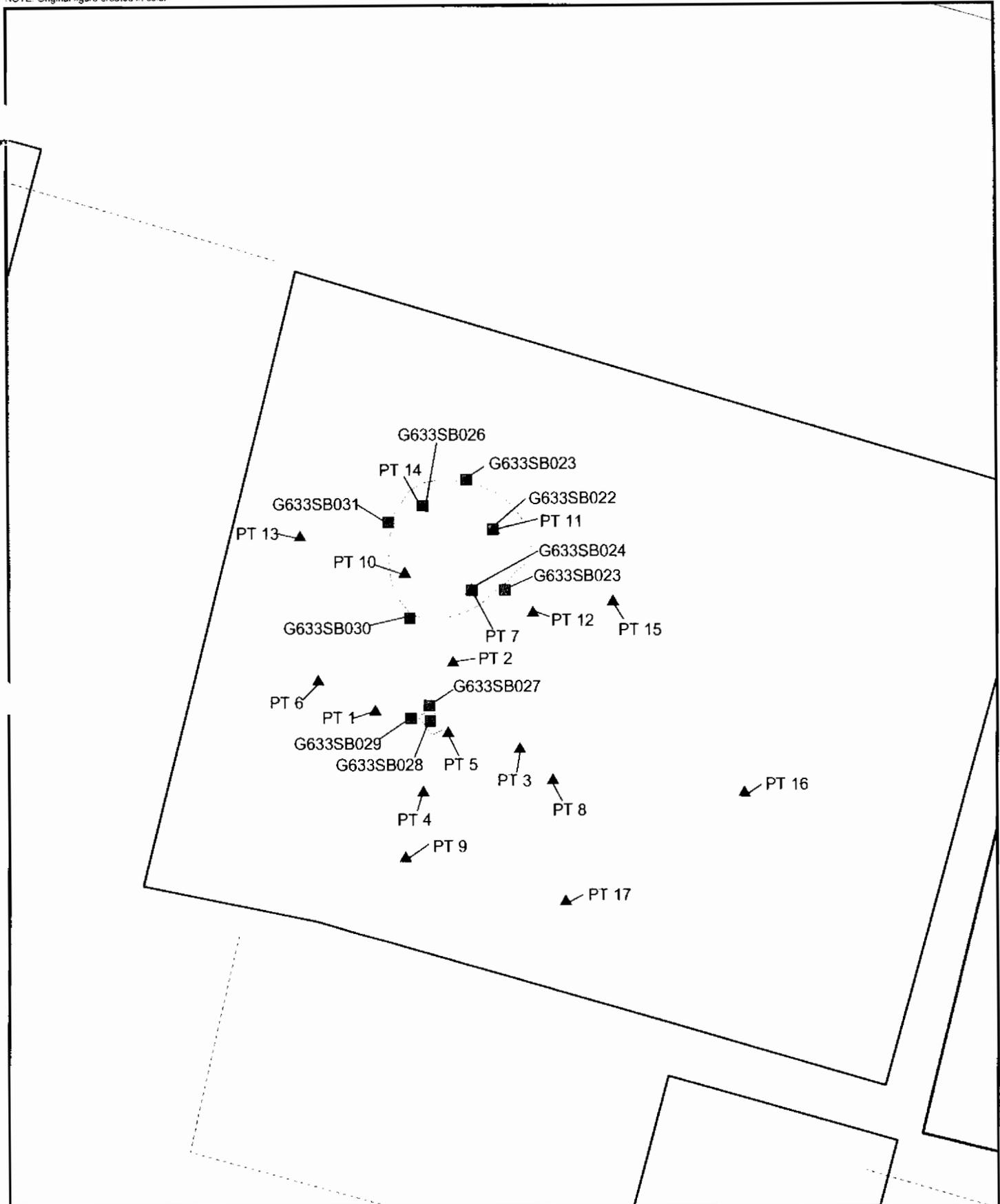
1 **3.5.1 Aroclor-1260 in Subsurface Soil**

2 Following the removal of subsurface soil at AOC 633, one residual subsurface soil sample  
3 (00EEG00017-6, 17 mg/kg) remains in place that exceeds the site-specific SSL (9.9 mg/kg).  
4 As discussed in the Phase I IMWP (CH2M-Jones, 2001a), the data in this area indicate a very  
5 small area of PCB-impacted soil.

6 **3.5.2 LNAPL**

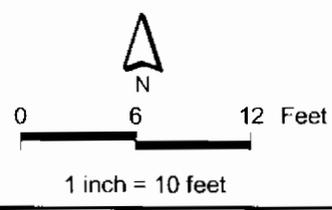
7 The observations made during the Phase II IM indicate that the LNAPL discovered during  
8 the initial IM was likely the result of a small onsite spill of diesel fuel. The LNAPL was  
9 removed to the extent practical during the Phase II IM. The analytical results from the  
10 LNAPL delineation borings and the excavation confirmation samples did not indicate a  
11 residual presence of PCBs, polynuclear aromatic hydrocarbons (PAHs), or VOCs in site soils  
12 above conservative screening criteria.

13 Based on this information, the LNAPL-impacted soil has been adequately remediated, and  
14 no further investigative or remedial actions are warranted for LNAPL-impacted soil at AOC  
15 633, as is described in the IMCR. The LNAPL that continues to slowly accumulate in  
16 monitoring well G633MW001 continues to be removed and will be further addressed during  
17 the CMS phase of the work.

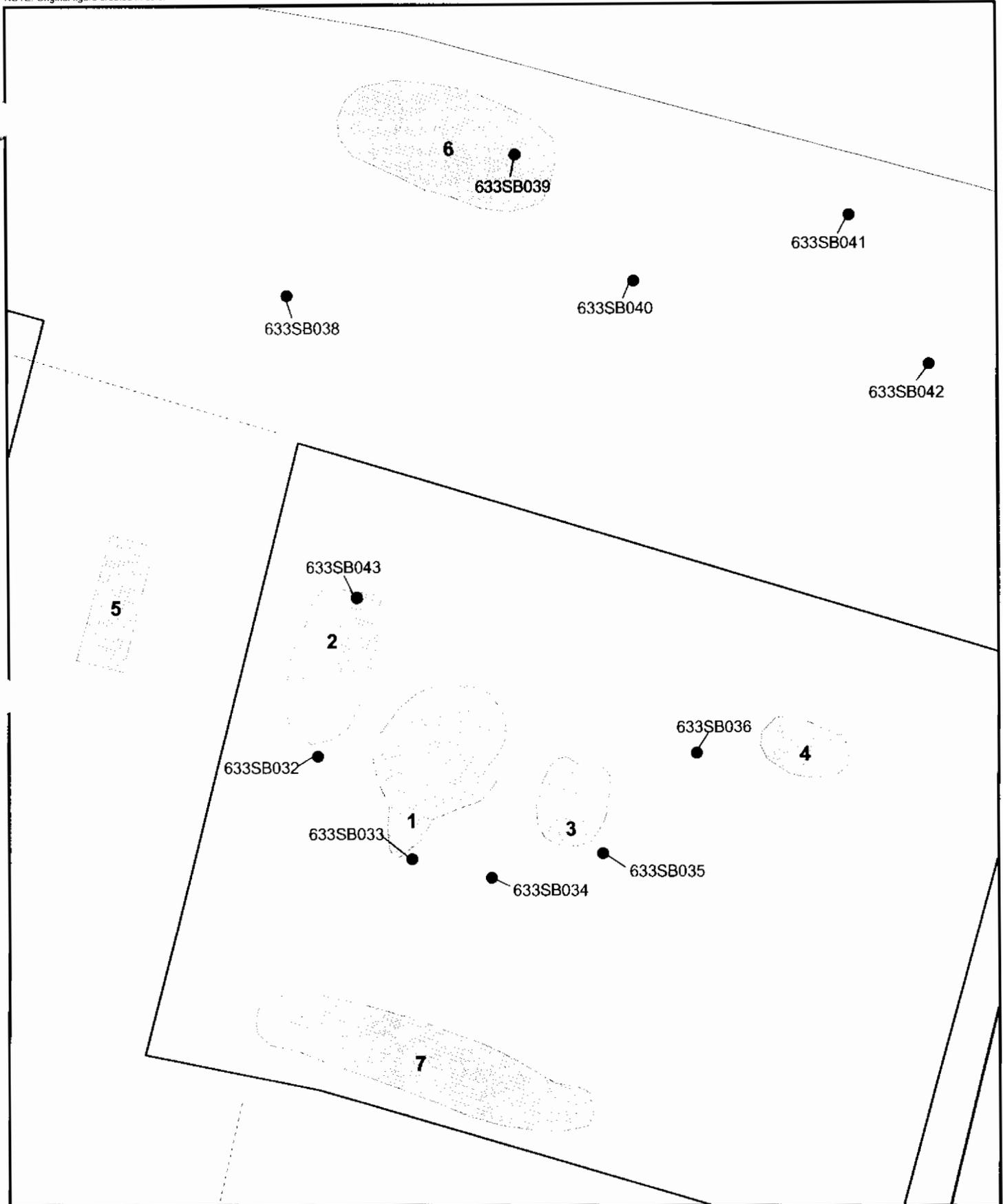


**Figure 3-1**  
Interim Measure PCB Soil Borings & Excavation  
AOC 633, Zone G  
Charleston Naval Complex

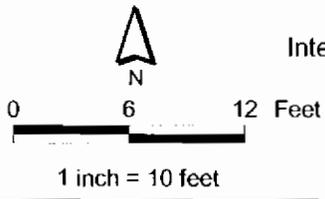
- ▲ EEG PCB IM Borings
- CH2M-Jones PCB IM Borings
- ⋯ PCB Excavation
- - - Fence
- Roads - Lines
- ▭ AOC Boundary - Active
- ▭ Buildings



NOTE: Original figure created in color



- CH2M-Jones LNAPL IM Borings
- ▨ LNAPL Excavations
- ▭ Fence
- ▭ Roads - Lines
- ▭ AOC Boundary - Active
- ▭ Buildings



**Figure 3-2**  
Interim Measure LNAPL Soil Borings & Excavations  
AOC 633, Zone G  
Charleston Naval Complex

**CH2MHILL**



## 4.0 Summary of Additional Investigations

Additional sampling activities were conducted after the completion of the *Zone G RFI Report, Revision 0* (EnSafe, 1998a). Several of these were related to the IM activities, however other sampling activities were conducted in accordance with regulatory comments made regarding the original RFI effort. Appendix F contains a copy of CH2M-Jones' responses to SCDHEC comments regarding the *Zone G RFI Report, Revision 0*, in regard to the AOC 633 investigated area. In addition, a groundwater investigation was implemented by the CH2M-Jones team to assess groundwater conditions at the site. These activities are described below.

### 4.1 EnSafe Additional Sampling

Eleven additional soil borings (G633SB011 through G633SB021) were installed by the Navy/EnSafe team after the submission of the *Zone G RFI Report, Revision 0*. The purpose of these samples was to further evaluate the presence of pesticides and PCBs. One additional soil boring was installed for PCB delineation as recommended in the *Zone G RFI Work Plan Addendum* (EnSafe, 2000).

Nine of the samples (G633SB013 through G633SB021) were also analyzed for metals and were collected topographically downgradient of the site to evaluate possible overland migration of site contaminants in stormwater runoff. The locations of the soil borings are presented in Figure 4-1, and as can be seen in the figure, borings G633SB013 through G633SB021 are located well outside the original AOC 633 transformer yard. Borings G633SB013 and G633SB014 are located approximately 900 feet south of AOC 633; borings G633SB019 and G633SB020 are located within the SWMU 9 boundary. The results of chemical analyses of the additional samples are discussed below.

A summary of detected chemicals is provided in Tables 4-1 and 4-2 for surface soils, and tables 4-3 and 4-4 for subsurface samples. Appendix G contains the analytical data summary tables for borings G633SB013 through G633SB021, and Appendix H contains the data validation summary.

#### 4.1.1 Surface Soil Results

The analytical results from the additional surface soil samples were compared to EPA Region III residential RBCs, SSLs (generic, based on DAF=10 or site-specific [Aroclor-1260]), and the Zone G range of background concentrations (inorganics only). An individual

1 constituent was identified as a COPC if its detected concentration was above the range of  
2 background concentrations and above either the RBC or SSL, or both. This section presents  
3 the results of this comparison.

4 Twenty-four inorganic chemicals were detected in the additional samples collected at AOC  
5 633. Four samples contained one or more metals at concentrations that exceed screening  
6 criteria. Five metals were detected at levels above screening criteria. Antimony was  
7 detected in sample 633SB01601 (14.4 mg/kg) above its range of background concentrations  
8 (0.79 to 5.7 mg/kg), its residential RBC (3.1 mg/kg, HI=0.1), and its SSL (2.5 mg/kg,  
9 DAF=10). Chromium was detected in sample 633SB01801 (45.5 mg/kg) above its range of  
10 background concentrations (7 to 39 mg/kg), its residential RBC (23 mg/kg, HI=0.1), and its  
11 SSL (19 mg/kg, DAF=10). Antimony and chromium are considered COPCs and are further  
12 discussed in Section 5.0. No PCBs or pesticides were detected in surface soil at levels above  
13 screening criteria.

#### 14 **4.1.2 Subsurface Soil Results**

15 The analytical results from the additional subsurface soil samples were compared to generic  
16 SSLs (based on DAF=10), or in the case of Aroclor-1260, a site-specific SSL, and the Zone G  
17 range of background concentrations (inorganics only). An individual constituent was  
18 identified as a COPC if its detected concentration was above both its range of background  
19 concentrations and above its SSL. This section presents the results of this comparison.

20 Antimony was detected above its SSL (2.5 mg/kg) in a single subsurface sample  
21 (633SB02002, 6.8 mg/kg). Antimony was not detected in the Zone G grid-based  
22 (background) samples. Therefore, subsurface soil background concentrations were not  
23 available for comparison. Antimony was determined to be a COPC in subsurface soil based  
24 on comparison to available screening criteria, and is further discussed in Section 5.0. No  
25 PCBs or pesticides were detected in subsurface soil above screening criteria at these  
26 locations.

## 27 **4.2 RFI Work Plan Addendum Sampling**

28 The *Zone G RFI Work Plan Addendum* (EnSafe, 2000) recommended collecting samples  
29 (surface and subsurface) from one additional location, at soil boring (G633SB021). The  
30 purpose of the proposed samples was to delineate the extent of Aroclor-1260 previously  
31 found at soil boring G633SB001. The samples were analyzed for PCBs only. PCBs were not  
32 detected in either the surface soil or the subsurface soil sample collected at G633SB021.  
33 Table 4-5 presents a summary of the analytical results for Aroclor-1260 during the  
34 additional sampling events.

## 4.3 Groundwater Investigation

After completion of the soil IMs, four new shallow monitoring wells were installed to evaluate potential impacts to site groundwater from the PCBs and LNAPL identified in site soils. The locations of the new wells are shown in Figure 4-2.

### 4.3.1 Monitoring Well Installation

Three of the wells were installed outside of the fenced transformer yard to determine local groundwater gradients, and to evaluate shallow groundwater quality as it leaves the site. The fourth well was installed inside the fence in the vicinity of LNAPL Excavation 1 to monitor source area groundwater, and to check for recurrence of free-floating LNAPL on groundwater. The well was constructed to facilitate LNAPL removal if necessary.

The wells were constructed of 2-inch inside diameter flush-threaded Schedule 40 PVC, to depths of 12 to 13 ft bls. Each well has a 10-ft screen positioned across the water table, with 1 ft of additional sand filter pack above the top of the screen to account for water table fluctuations and the possible presence of LNAPL. Due to site activity and vehicular considerations, the wells are finished with an 8-inch diameter flush-mounted manhole vault. After completion, the wells were surveyed for horizontal position and top-of-casing elevation, relative to mean sea level. The boring logs and well construction diagrams for these wells are presented as Appendix I of this RFIRA/CMSWP.

### 4.3.2 Groundwater Sampling and Analysis

After development, the wells were sampled in early October 2002, with samples analyzed for VOCs, SVOCs, PCBs, and metals. During the sampling effort, a thin layer of LNAPL, approximately 0.1 to 0.2-ft thick, was encountered in monitoring well G633GW001, which is inside the AOC fence. Due to the presence of LNAPL, a groundwater sample was not collected from the well at this time. However, a groundwater sample was collected from this well in January 2003 after LNAPL was removed from the well and groundwater (three well volume casings) was purged from the well.

Prior to sampling, depth-to-water information was collected from wells G633GW002 through G633GW004, and used to develop the potentiometric surface contours that are shown on Figure 4-2. Because of the free product layer in well G633GW001, water level data from this well were not used in the potentiometric surface figure. Water level information used to develop the potentiometric surface map is presented in Table 4-6.

### 4.3.3 Groundwater Sampling Results

A summary of the organic chemicals detected during the October 2002 and January 2003 groundwater sampling events is presented in Table 4-7; detected inorganics are presented in Table 4-8. The complete analytical results are presented in Appendix J, with data validation summaries for the data included as Appendix K. The analytical results were compared to EPA Primary Drinking Water Maximum Contaminant Levels (MCLs), EPA Region III Tap Water RBCs if no MCL was available, and to Zone G RFI grid well reference concentration ranges (inorganics only).

In monitoring wells G633GW002 and G633GW003, detected chemicals were limited to metals, with aluminum (7,840 micrograms per liter [ $\mu\text{g}/\text{L}$ ]) exceeding its tap water RBC and background range in well G633GW002, and potassium exceeding its background range in wells G633GW002 and G633GW003. No MCL or tap water RBC is available for potassium, as it is typically considered a nutrient. Based on these results, aluminum is identified as a groundwater COPC, and is evaluated further in Section 5.0.

In monitoring well G633GW001, which was installed in the area where LNAPL-impacted soil was excavated, small amounts of LNAPL have been observed to accumulate in the well. A LNAPL sample was collected and analyzed; results of its analysis are described in the following subsection.

After removal of LNAPL from this well and standard groundwater well purging, a groundwater sample from monitoring well G633GW001 was collected and analyzed for PCBs, VOCs, SVOCs, and metals. Detected analytes are summarized in tables 4-7 and 4-8. Several organic chemicals, including Aroclor-1260, 1,3-dichlorobenzene (1,3-DCB), 1,4-DCB, BEHP, chlorobenzene, and toluene were detected in the groundwater sample. Only Aroclor-1260 exceeded its MCL or RBC. No inorganic parameters from this well exceeded its respective MCL or RBC.

In monitoring well G633GW004, there were no exceedances of criteria for inorganic chemicals, but several organic chemicals were detected at levels above MCLs or tap water RBCs, as indicated in Table 4-7. The detected chemicals are largely fuel-related hydrocarbons. SVOCs were the most frequently detected group of organic chemicals. Napthalene was detected at 2,510  $\mu\text{g}/\text{L}$ , which is the maximum for any detected chemical, and phenanthrene was detected at 206  $\mu\text{g}/\text{L}$ . Other fuel-related hydrocarbons detected in well G633GW004 include benzene, which at 23.8  $\mu\text{g}/\text{L}$  exceeded its MCL of 5  $\mu\text{g}/\text{L}$ ; ethylbenzene; toluene; and xylenes.

1 The detection of fuel-related hydrocarbons at well G633GW004 does not appear to be  
2 related to a release of contamination at AOC 633, but rather is most likely due to a fuel-  
3 related release from a Fuel Distribution System (FDS) pipeline that runs adjacent to the site  
4 along Hobson Avenue, close to where well G633MW004 was installed. The lack of  
5 detections of these hydrocarbons in well G633MW001, which is where the weathered diesel  
6 LNAPL was found at the location of the soil IMs, indicates that the detected chemicals in  
7 well G633GW004 are not related to the previous releases at the site. Because petroleum  
8 hydrocarbons are not regulated by RCRA, it is appropriate to address the hydrocarbons  
9 detected in groundwater at well G633GW004 under the South Carolina petroleum program.

#### 10 **4.3.4 LNAPL Sampling Results**

11 During the October 2002 groundwater sampling event, LNAPL was encountered on the  
12 water surface in well G633GW001. A sample of the LNAPL was collected for chemical  
13 analysis using a bailer. The sample was analyzed for VOCs, SVOCs, and PCBs to determine  
14 potential leaching impacts to site groundwater. The constituents detected in the LNAPL  
15 sample are presented in Table 4-9, and include components of weathered diesel fuel at a  
16 concentration of 1,000,000 mg/kg, 1,3-DCB and 1,4-DCB at 25 and 100 mg/kg, respectively,  
17 and Aroclor-1260 at 3,500 mg/kg. The plasticizer chemical bis(2-ethylhexyl) phthalate was  
18 the other detected chemical, at 68 mg/kg, but is believed to be associated with the PVC well  
19 construction materials. Extended contact with organic chemicals can leach this chemical out  
20 of the PVC pipe. The elevated results may also be due to the large dilution factor necessary  
21 to analyze the LNAPL. The complete analytical results and data validation summaries for  
22 the LNAPL analyses are presented in Appendices I and J.

23 Several LNAPL gauging and recovery efforts at the affected well have been completed since  
24 October 2002; the product thickness has fluctuated between 0.1 and 0.2 feet, and minimal  
25 amounts of product have been recovered by bailing/absorbent pads. The LNAPL  
26 occurrence in monitoring well G633GW001 will be further addressed in Section 8.0, which  
27 presents a CMSWP for groundwater at AOC 633.

**TABLE 4-1**  
 Organic Chemicals Detected in Surface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	EPA Region III Residential RBC <sup>a</sup> (HI=0.1)	Soil to Groundwater SSL <sup>b</sup> (DAF=10)
Alpha-chlordane <sup>c</sup>	G633SB015	0.022	J	1.8	5
	G633SB016	0.011	J		
	G633SB017	0.023	J		
	G633SB018	0.002	J		
Gamma-chlordane <sup>c</sup>	G633SB015	0.047	=	1.8	5
	G633SB016	0.012	J		
	G633SB017	0.031	=		
	G633SB018	0.003	J		
Heptachlor <sup>c</sup>	G633SB015	0.007	=	0.14	11.5
Heptachlor Epoxide <sup>c</sup>	G633SB014	0.002	UJ	0.07	0.35
	G633SB015	0.006	=		
	G633SB016	0.002	J		
p,p'-DDD <sup>c</sup>	G633SB016	0.007	J	2.7	8
	G633SB018	0.006	J		
p,p'-DDE <sup>c</sup>	G633SB014	0.091	J	1.9	27
	G633SB015	0.013	=		
	G633SB016	0.017	J		
	G633SB017	0.006	J		
	G633SB018	0.01	J		
	G633SB019	0.01	J		
p,p'-DDT <sup>c</sup>	G633SB014	0.011	J	1.9	16
	G633SB015	0.007	=		
	G633SB016	0.018	J		
PCB-1016 (Aroclor-1016) <sup>c</sup>	G633SB019	0.089	=	5.5	2.1
PCB-1260 (Aroclor-1260) <sup>c</sup>	G633SB016	0.088	J	0.32	9.9 <sub>site-specific</sub>
	G633SB019	0.27	=		

Concentrations in bold text and outlined within the table represent exceedances of the screening criteria. All values are presented in units of milligrams per kilogram (mg/kg).

**TABLE 4-1**  
 Organic Chemicals Detected in Surface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	EPA Region III Residential RBC <sup>a</sup> (HI=0.1)	Soil to Groundwater SSL <sup>b</sup> (DAF=10)
---------	-----------------	-----------------------	-----------	--	---

<sup>a</sup>U.S. Environmental Protection Agency (EPA) Region III risk-based concentrations (RBCs) with a hazard index (HI) =0.1 for non-carcinogens.

<sup>b</sup>Soil screening levels (SSLs) based on a dilution attenuation factor (DAF)=1 for volatile organic compounds (VOCs), DAF=10 for other compounds.

<sup>c</sup>Compound is listed as a carcinogen.

= Indicates that the analyte was detected at the concentration shown.

J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits or the value was detected below the laboratory's quantification limit.

NA Not applicable/not available

NL Not listed

RE Indicates that the sample was reanalyzed by the laboratory.

UJ Indicates that the analyte was not detected. The concentration shown is an estimated detection limit.

**TABLE 4-2**  
 Inorganic Chemicals Detected in Surface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	EPA Region III Residential RBC <sup>a</sup> (HI=0.1)	Soil to Groundwater SSL <sup>b</sup> (DAF=10)	Zone G Background Range of Concentrations <sup>c</sup>
Aluminum	G633SB013	15,400	=	7,800	NA	2,190 -17,800
	G633SB014	15,200	=			
	G633SB015	8,030	=			
	G633SB016	6,890	=			
	G633SB017	4,140	=			
	G633SB018	7,620	=			
	G633SB019	6,870	=			
	G633SB020	3,750	=			
Antimony	G633SB016	14.4	=	3.1	2.5	0.79 - 5.7
Arsenic	G633SB013	8.7	=	0.43	14.5	0.64 - 18
	G633SB014	10.9	=			
	G633SB015	2.8	=			
	G633SB016	5	=			
	G633SB017	1.2	=			
	G633SB018	4.3	=			
	G633SB019	7.3	=			
	G633SB020	2.9	=			
Barium	G633SB013	21	J	550	800	11 - 129
	G633SB014	30.6	J			
	G633SB015	13.8	=			
	G633SB016	43.9	=			
	G633SB017	6	=			
	G633SB018	27.7	J			
	G633SB019	26.4	J			
	G633SB020	7.1	J			
Beryllium	G633SB013	0.7	=	16	31.5	0.47 - 1.1
	G633SB014	0.84	=			
	G633SB015	0.2	J			
	G633SB016	0.3	J			

**TABLE 4-2**  
 Inorganic Chemicals Detected in Surface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	EPA Region III Residential RBC <sup>a</sup> (HI=0.1)	Soil to Groundwater SSL <sup>b</sup> (DAF=10)	Zone G Background Range of Concentrations <sup>c</sup>
Beryllium	G633SB017	0.07	J	16	31.5	0.47 - 1.1
	G633SB018	0.41	J			
	G633SB019	0.37	J			
	G633SB020	0.22	J			
Cadmium	G633SB013	0.09	J	3.9	4	0.12 - 1.7
	G633SB014	0.44	J			
	G633SB015	0.07	J			
	G633SB016	0.5	J			
	G633SB017	0.04	J			
	G633SB018	0.15	J			
	G633SB019	0.3	J			
	G633SB020	0.13	J			
Calcium	G633SB013	7,030	=	NA	NA	NA
	G633SB014	90,900	=			
	G633SB015	7,590	=			
	G633SB016	83,600	=			
	G633SB017	1,570	=			
	G633SB018	21,500	=			
	G633SB019	16,400	=			
	G633SB020	655	=			
Chromium, Total	G633SB013	26.4	J	23 <sup>d</sup>	19	7 - 39
	G633SB014	38.8	J			
	G633SB015	8.6	=			
	G633SB016	19	=			
	G633SB017	4.9	=			
	G633SB018	45.5	J			
	G633SB019	19.3	J			
	G633SB020	5.4	J			

**TABLE 4-2**  
 Inorganic Chemicals Detected in Surface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	EPA Region III Residential RBC <sup>a</sup> (HI=0.1)	Soil to Groundwater SSL <sup>b</sup> (DAF=10)	Zone G Background Range of Concentrations <sup>c</sup>
Cobalt	G633SB013	3.9	=	470	NA	1.1 - 6.2
	G633SB014	3.1	J			
	G633SB015	0.86	J			
	G633SB016	2	J			
	G633SB017	0.78	J			
	G633SB018	2.3	J			
	G633SB019	2	J			
	G633SB020	1.8	J			
Copper	G633SB013	21	J	310	NA	23 - 431
	G633SB014	23.3	J			
	G633SB015	4.8	J			
	G633SB016	73	=			
	G633SB017	1.8	J			
	G633SB018	23.6	J			
	G633SB019	153	J			
	G633SB020	2.5	J			
Iron	G633SB013	15,800	=	2,300	NA	4,300 - 32,700
	G633SB014	12,900	=			
	G633SB015	4,640	=			
	G633SB016	8,120	=			
	G633SB017	3,140	=			
	G633SB018	7,580	=			
	G633SB019	8,740	=			
	G633SB020	2,670	=			
Lead	G633SB013	25.7	J	400 <sup>o</sup>	400 <sup>o</sup>	3.5 - 275
	G633SB014	39	J			
	G633SB015	17.3	=			
	G633SB016	69	=			
	G633SB017	4.8	=			

**TABLE 4-2**  
 Inorganic Chemicals Detected in Surface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	EPA Region III Residential RBC <sup>a</sup> (HI=0.1)	Soil to Groundwater SSL <sup>b</sup> (DAF=10)	Zone G Background Range of Concentrations <sup>c</sup>
Lead	G633SB018	51.9	J	400 <sup>e</sup>	400 <sup>e</sup>	3.5 - 275
	G633SB019	38	J			
	G633SB020	3.8	J			
Magnesium	G633SB013	2,550	=	NA	NA	NA
	G633SB014	5,350	=			
	G633SB015	525	=			
	G633SB016	1,710	=			
	G633SB017	237	=			
	G633SB018	1,690	=			
	G633SB019	1,160	=			
	G633SB020	292	=			
	Manganese	G633SB013	325	=	160	
G633SB014		179	=			
G633SB015		44.9	=			
G633SB016		114	=			
G633SB017		12.6	=			
G633SB018		67.9	=			
G633SB019		106	=			
G633SB020		11.9	=			
Mercury		G633SB013	0.22	=	NA	1
	G633SB014	0.32	=			
	G633SB015	0.08	=			
	G633SB016	0.24	=			
	G633SB017	0.04	=			
	G633SB018	0.18	=			
	G633SB019	0.29	=			
	G633SB020	0.04	=			
	Nickel	G633SB013	8.4	=	160	65
G633SB014		15.1	=			

**TABLE 4-2**  
 Inorganic Chemicals Detected in Surface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	EPA Region III Residential RBC <sup>a</sup> (HI=0.1)	Soil to Groundwater SSL <sup>b</sup> (DAF=10)	Zone G Background Range of Concentrations <sup>c</sup>	
Nickel	G633SB015	3.5	J	160	65	2 - 27	
	G633SB016	10.8	=				
	G633SB017	2.1	J				
	G633SB018	6.3	=				
	G633SB019	6.4	=				
	G633SB020	1.4	J				
Potassium	G633SB013	1,040	J	NA	NA	NA	
	G633SB014	1,050	J				
	G633SB015	188	J				
	G633SB016	556	=				
	G633SB017	85	J				
	G633SB018	358	J				
	G633SB019	448	J				
	G633SB020	112	J				
Selenium	G633SB014	0.91	=	39.0	2.5	0.45 - 1.4	
	G633SB018	0.38	J				
	G633SB020	0.51	J				
Silver	G633SB016	0.22	J	392	16	ND	
Sodium	G633SB013	1,490	=	NA	NA	NA	
	G633SB014	1,190	=				
	G633SB015	286	J				
	G633SB016	1,250	=				
	G633SB017	216	J				
	G633SB018	613	=				
	G633SB019	537	=				
	G633SB020	240	J				
	Thallium	G633SB013	0.47	J	5.50	18	0.55 - 0.91
	Tin (Sn)	G633SB016	10.7	J	47,000	NA	26 - 26

**TABLE 4-2**  
 Inorganic Chemicals Detected in Surface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	EPA Region III Residential RBC <sup>a</sup> (HI=0.1)	Soil to Groundwater SSL <sup>b</sup> (DAF=10)	Zone G Background Range of Concentrations <sup>c</sup>
Vanadium	G633SB013	32.9	=	55	3,000	7.2 - 57
	G633SB014	35.9	=			
	G633SB015	10.2	=			
	G633SB016	17	=			
	G633SB017	6	=			
	G633SB018	16.2	=			
	G633SB019	17.8	=			
	G633SB020	5.1	=			
Zinc	G633SB013	63.7	J	2,300	6,000	18 - 1,650
	G633SB014	86.9	J			
	G633SB015	20.3	=			
	G633SB016	187	=			
	G633SB017	14.3	=			
	G633SB018	59.5	J			
	G633SB019	87.2	J			
	G633SB020	14	J			

Concentrations in bold and outlined text exceed the appropriate screening criteria.

<sup>a</sup>Generic soil to groundwater soil screening level (SSL) with a dilution attenuation factor (DAF)=10 except for volatile organic compounds (VOCs) which were screened using SSL (DAF=1). SSLs were obtained from Appendix I of the *Charleston Naval Complex Project Team Notebook and Instructions, Revision 1A* (CH2M-Jones, 2001b).

<sup>b</sup>Soil screening levels (SSLs) based on a dilution factor (DAF)=1 for volatile organic compounds (VOCs).

<sup>c</sup>Except as noted by footnote "d", the Zone G Background Ranges of Concentrations were obtained from Appendix J of the *Charleston Naval Complex Project Team Notebook and Instructions, Revision 1A* (CH2M-Jones, 2001b).

<sup>d</sup>The conservative U.S. Environmental Protection Agency (EPA) Region III residential risk-based concentration (RBC) (Hazard Index [HI]=0.1) of 23 milligrams per kilogram (mg/kg) for Chromium VI was used as the screening criteria for Chromium, Total.

<sup>e</sup>A screening level of 400 mg/kg has been set for lead based on the *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities* (EPA, 1994).

= Indicates that the analyte was detected at the concentration shown.

J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits or the value was detected below the laboratory's quantification limit.

mg/kg Milligrams per kilogram

NA Not applicable/not available

ND Not detected

**TABLE 4-3**  
 Organic Chemicals Detected in Subsurface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	Soil to Groundwater SSL <sup>a</sup> (DAF=10)
Alpha-chlordane	G633SB015	0.011	=	5
	G633SB017	0.023	J	
Gamma-chlordane	G633SB020	0.01	=	5
	G633SB015	0.017	=	
	G633SB019	0.002	J	
	G633SB017	0.056	=	
Heptachlor	G633SB017	0.0017	J	11.5
Methoxychlor	G633SB014	0.021	J	80
p,p'-DDD	G633SB017	0.092	=	8
	G633SB015	0.0091	=	
	G633SB020	0.01	J	
p,p'-DDE	G633SB013	0.0074	J	27
	G633SB014	0.006	J	
	G633SB018	0.0092	J	
	G633SB017	0.038	=	
	G633SB015	0.014	J	
	G633SB020	0.0074	J	
p,p'-DDT	G633SB017	0.02	J	16
	G633SB015	0.0096	=	
	G633SB013	0.0052	=	
PCB-1016 (Aroclor-1016)	G633SB020	0.086	J	2.1
PCB-1260 (Aroclor-1260)	G633SB015	0.054	=	9.9 <sub>site-specific</sub> <sup>b</sup>
	G633SB020	0.23	=	
	G633SB018	0.24	J	
	G633SB018RE	0.24	J	

<sup>a</sup>Soil screening levels (SSLs) based on a dilution factor (DAF)=1 for volatile organic compounds (VOCs), DAF=10 for other compounds.

<sup>b</sup>Site-specific SSL used for Aroclor-1260.

= Indicates that the analyte was detected at the concentration shown.

J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits or the value was detected below the laboratory's quantification limit.

mg/kg Milligrams per kilogram

NA Not applicable/not available

**TABLE 4-4**  
 Inorganic Chemicals Detected in Subsurface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	Soil-to-Groundwater SSL <sup>a</sup> (DAF=10)	Zone G Background Range of Concentrations <sup>b</sup>
Aluminum	G633SB015	10,200	=	NA	2,630 - 36,800
	G633SB018	10,700	=		
	G633SB020	8,200	=		
	G633SB017	9,340	=		
	G633SB019	10,400	=		
	G633SB014	20,900	=		
	G633SB013	26,700	=		
Antimony	G633SB020	6.8	J	2.5	ND
	G633SB017	0.97	J		
Arsenic	G633SB013	20	=	14.5	1.4 - 36
	G633SB015	6	=		
	G633SB014	35.3	=		
	G633SB019	7	=		
	G633SB017	7.7	=		
	G633SB020	6.7	=		
	G633SB018	7	=		
Barium	G633SB018	31.9	J	800	7.7 - 63
	G633SB014	75.5	J		
	G633SB020	37.8	J		
	G633SB015	26.8	=		
	G633SB017	20.5	=		
	G633SB013	43.7	J		
	G633SB019	21.8	J		
Beryllium	G633SB015	0.34	J	31.5	0.45 - 2.4
	G633SB017	0.19	J		
	G633SB013	1.3	=		
	G633SB019	0.44	J		
	G633SB020	0.44	J		

**TABLE 4-4**  
 Inorganic Chemicals Detected in Subsurface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	Soil-to-Groundwater SSL <sup>a</sup> (DAF=10)	Zone G Background Range of Concentrations <sup>b</sup>
Beryllium	G633SB018	0.5	J	31.5	0.45 - 2.4
	G633SB014	1.3	=		
Cadmium	G633SB019	0.18	J	4	0.08 - 0.52
	G633SB013	0.35	J		
	G633SB014	0.31	J		
	G633SB020	0.67	J		
	G633SB015	0.16	J		
	G633SB018	0.26	J		
	G633SB017	0.17	J		
Calcium	G633SB020	29,500	=	NA	NA
	G633SB014	54,400	=		
	G633SB019	27,600	=		
	G633SB017	1,890	=		
	G633SB018	28,300	=		
	G633SB013	18,500	=		
	G633SB015	7,150	=		
Chromium, Total	G633SB019	21	J	19	7.4 - 65
	G633SB018	37.9	J		
	G633SB020	26	J		
	G633SB015	15.5	=		
	G633SB017	14.4	=		
	G633SB014	41.2	J		
	G633SB013	47.9	J		
Cobalt	G633SB018	2.4	J	NA	0.9 - 15
	G633SB019	2.6	J		
	G633SB015	1.9	J		
	G633SB020	2.3	J		
	G633SB014	9.2	=		

**TABLE 4-4**  
 Inorganic Chemicals Detected in Subsurface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	Soil-to-Groundwater SSL <sup>a</sup> (DAF=10)	Zone G Background Range of Concentrations <sup>b</sup>
Cobalt	G633SB017	1.3	J	NA	0.9 - 15
	G633SB013	8.3	=		
Copper	G633SB015	28.3	=	5,300	4.5 - 46
	G633SB017	21	=		
	G633SB014	28.5	J		
	G633SB013	41.5	J		
	G633SB018	32	J		
	G633SB019	22.9	J		
	G633SB020	1,080	J		
	Iron	G633SB019	12,300	=	NA
G633SB020		10,300	=		
G633SB014		35,800	=		
G633SB015		10,500	=		
G633SB017		12,000	=		
G633SB013		31,200	=		
G633SB018		11,700	=		
Lead	G633SB018	49.5	J	400 <sup>c</sup>	2.4 - 76
	G633SB020	184	J		
	G633SB014	43.8	J		
	G633SB013	68.3	J		
	G633SB017	21.7	=		
	G633SB019	25.9	J		
	G633SB015	42.5	=		
Magnesium	G633SB020	1,710	=	NA	NA
	G633SB019	1,530	=		
	G633SB018	2,300	=		
	G633SB017	721	=		
	G633SB015	982	=		

**TABLE 4-4**  
 Inorganic Chemicals Detected in Subsurface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	Soil-to-Groundwater SSL <sup>a</sup> (DAF=10)	Zone G Background Range of Concentrations <sup>b</sup>
Magnesium	G633SB013	5,630	=	NA	NA
	G633SB014	5,740	=		
Manganese	G633SB018	91.6	=	NA	20 - 409
	G633SB013	1,200	=		
	G633SB015	125	=		
	G633SB014	2,400	=		
	G633SB017	130	=		
	G633SB019	118	=		
	G633SB020	101	=		
Mercury	G633SB019	0.19	=	1	0.05 - 0.37
	G633SB014	0.65	=		
	G633SB020	0.3	=		
	G633SB018	0.28	=		
	G633SB013	0.52	=		
	G633SB015	0.31	=		
	G633SB017	0.16	=		
Nickel	G633SB014	13.7	=	65	1.9 - 22
	G633SB019	8	=		
	G633SB013	17.1	=		
	G633SB017	4.1	J		
	G633SB020	16.7	=		
	G633SB018	8.8	=		
	G633SB015	5.6	=		
Potassium	G633SB017	329	=	NA	NA
	G633SB020	516	J		
	G633SB013	2,200	J		
	G633SB019	674	J		
	G633SB014	1,850	J		

**TABLE 4-4**  
 Inorganic Chemicals Detected in Subsurface Soil - Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	Soil-to-Groundwater SSL <sup>a</sup> (DAF=10)	Zone G Background Range of Concentrations <sup>b</sup>
Potassium	G633SB018	652	J	NA	NA
	G633SB015	467	=		
Selenium	G633SB017	0.47	J	2.5	0.54 - 1
	G633SB018	0.47	J		
	G633SB020	0.55	J		
	G633SB014	1.1	=		
	G633SB019	0.38	J		
Silver	G633SB020	0.56	J	16	ND
Sodium	G633SB014	2,590	=	NA	NA
	G633SB017	809	=		
	G633SB018	1,130	=		
	G633SB013	2,950	=		
	G633SB015	552	=		
	G633SB019	767	=		
Thallium	G633SB017	0.29	J	0.35	1
	G633SB014	0.72	J		
Tin (Sn)	G633SB020	141	=	NA	1.1 - 2.9
Vanadium	G633SB017	23.4	=	3,000	5.9 - 112
	G633SB018	22.2	=		
	G633SB013	70.8	=		
	G633SB015	21.4	=		
	G633SB014	63.6	=		
	G633SB020	22.2	=		
Zinc	G633SB019	22.5	=		
	G633SB020	279	J	6,000	20 - 198
	G633SB018	93.6	J		
	G633SB014	121	J		

**TABLE 4-4**  
**Inorganic Chemicals Detected in Subsurface Soil - Additional Investigations**  
*RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex*

Analyte	Sample Location	Concentration (mg/kg)	Qualifier	Soil-to-Groundwater SSL <sup>a</sup> (DAF=10)	Zone G Background Range of Concentrations <sup>b</sup>
Zinc	G633SB013	141	J	6,000	20 - 198
	G633SB017	40.7	=		
	G633SB015	65.5	=		
	G633SB019	57.9	J		

Concentrations in bold and outlined text exceed the appropriate screening criteria.

<sup>a</sup>Generic soil-to-groundwater soil screening level (SSL) with a dilution attenuation factor (DAF)=10 except for volatile organic compounds (VOCs) which were screened using SSL (DAF=1). SSLs were obtained from Appendix I of the *Charleston Naval Complex Project Team Notebook and Instructions, Revision 1A* (CH2M-Jones, 2001b).

<sup>b</sup>Except as noted by footnote "c", the Zone G Background Ranges of Concentrations were obtained from Appendix J of the *Charleston Naval Complex Project Team Notebook and Instructions, Revision 1A* (CH2M-Jones, 2001b).

<sup>c</sup>A screening level of 400 mg/kg has been set for lead based on the *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities* (EPA, 1994).

= Indicates that the analyte was detected at the concentration shown.

J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits or the value was detected below the laboratory's quantification limit.

mg/kg Milligrams per kilogram

NA Not applicable/not available

ND Compound was not detected

**TABLE 4-5**  
 Aroclor-1260 Results in Soil at AOC 633; Additional Investigations  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Station ID	Sample ID	Concentration ( $\mu\text{g}/\text{kg}$ )	Qualifier	Date Collected
Aroclor-1260	G633SB011	633CB01101	39	U	07/29/99
		633SB01102	41	U	
	G633SB011	633SB01101	36	U	
	G633SB012	633SB01202	37	U	
	G633SB013	633SB01301	43	U	
		633SB01302	50	U	
	G633SB014	633SB01402	57	U	
		633SB01401	40	U	
	G633SB015	633SB01501	35	U	
		633SB01502	54	=	
	G633SB016	633SB01601	88	J	
	G633SB017	633SB01702	39	U	
		633SB01701	36	U	
	G633SB018	633SB01801	38	U	
		633SB01802	240	J	
	G633SB019	633SB01901	270	=	
		633SB01902	39	U	
	G633SB020	633SB02002	230	=	
		633SB02001	37	U	
	G633SB021	633SB02101	42	U	12/14/99
633SB02102		80	U	01/28/00	

All values are presented in units of micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ).

- = Indicates that the analyte was detected at the concentration shown.
- J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits or the value was detected below the laboratory's quantification limit.
- U Indicates that the analyte was not detected.

**TABLE 4-6**  
 Potentiometric Surface Elevations for AOC 633; October 2002 Sampling  
*RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex*

<b>Monitoring Well ID</b>	<b>Top of Casing Elevation (ft msl)</b>	<b>Measured Depth to Water (ft)</b>	<b>Corrected Depth to Water (ft)</b>	<b>Water Table Elevation (ft msl)</b>	<b>Corrected Water Table Elevation (ft msl)</b>
G633GW001	6.78	3.67*	3.5	3.11	3.28
G633GW002	4.99	2.45		2.54	
G633GW003	5.6	2.58		3.02	
G633GW004	6.43	3.36		3.07	

\* Indicates that the water level depressed by light non-aqueous phase liquid (LNAPL) free product, 0.17-ft thickness.

ft msl Elevation in feet relative to mean sea level (msl).

ft Feet

**TABLE 4-7**  
 Organic Chemicals Detected In Groundwater; October 2002 and January 2003 Sampling  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Station ID	Concentration ( $\mu\text{g/L}$ )	Qualifier	Date Collected	MCL <sup>a</sup>	EPA Region III Tap Water RBC <sup>b</sup> (HI=0.1)
Aroclor-1260	G633GW001	1.8	J	01/24/03	0.5	0.033
1,3-Dichlorobenzene	G663GW001	5.5	=	01/24/03	60	5.5
1,4-Dichlorobenzene	G633GW001	23	=	01/24/03	75	0.47
2,4-Dimethylphenol	G633GW004	106	=	10/02/02	NA	73
2-Methylnaphthalene	G633GW004	401	=	10/02/02	NA	120
3-Methylphenol/4-Methylphenol (mp-Cresol)	G633GW004	16	=	10/02/02	NA	180
Acenaphthene	G633GW004	469	=	10/02/02	NA	37
Anthracene	G633GW004	15.7	=	10/02/02	NA	180
Benzene	G633GW004	23.8	J	10/02/02	5	0.32
Benzo[a]pyrene	G633GW004	0.56	J	10/02/02	0.2	0.0092
Benzo[b]fluoranthene	G633GW004	0.77	J	10/02/02	NA	0.092
bis(2-ethylhexyl)Phthalate	G633GW001	1.6	J	01/24/03	6	48
Carbazole	G633GW004	66.4	=	10/02/02	NA	3.3
Chlorobenzene	G633GW001	1.8	J	01/24/03	100	110
Dibenzofuran	G633GW004	239	J	10/02/02	NA	2.4
Ethylbenzene	G633GW004	16.3	J	10/02/02	700	130
Fluoranthene	G633GW004	25.3	=	10/02/02	NA	150
Fluorene	G633GW004	186	J	10/02/02	NA	24
m+p Xylene	G633GW004	18.1	J	10/02/02	10,000 <sub>total o,m,p</sub> <sup>c</sup>	1,200
Naphthalene	G633GW004	2,510	=	10/02/02	NA	6.5
o-Xylene	G633GW004	12.6	J	10/02/02	10,000 <sub>total o,m,p</sub> <sup>c</sup>	1,200

**TABLE 4-7**

Organic Chemicals Detected In Groundwater; October 2002 and January 2003 Sampling  
*RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex*

Analyte	Station ID	Concentration ( $\mu\text{g/L}$ )	Qualifier	Date Collected	MCL <sup>a</sup>	EPA Region III Tap Water RBC <sup>b</sup> (HI=0.1)
Phenanthrene	G633GW004	206	J	10/02/02	NA	NA
Pyrene	G633GW004	16.4	J	10/02/02	NA	18
Toluene	G633GW001	0.63	J	01/24/03	1,000	75
	G633GW004	17.1	J	10/02/02		
Xylenes, Total	G633GW004	30.6	J	10/02/02	10,000 <sub>total o,m,p</sub> <sup>c</sup>	1,200

All values are presented in units of micrograms per liter ( $\mu\text{g/L}$ ).

Concentrations in bold and outlined text within the table represent exceedances of the screening criteria.

<sup>a</sup>Maximum contaminant level (MCL) is from the U.S. Environmental Protection Agency (EPA) Primary Drinking Water Standards, EPA 816-F-01-007, March 2001.

<sup>b</sup>U.S. EPA Region III risk-based concentrations (RBCs) with a hazard index (HI)=0.1 for non-carcinogens.

<sup>c</sup>Surrogate MCLs are identified with the surrogate compound in subscript adjacent to value.

= Indicates that the analyte was detected at the concentration shown.

J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits or the value was detected below the laboratory's quantification limit.

NA Not applicable/not available

ND Compound was not detected

**TABLE 4-8**  
 Inorganic Chemicals Detected In Groundwater; October 2002 and January 2003 Sampling  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Station ID	Concentration (µg/L)	Qualifier	Date Collected	MCL <sup>a</sup>	EPA Region III Tap Water RBC <sup>b</sup> (HI=0.1)	Zone G Range of Background Concentrations
Aluminum	G633GW003	7,840	=	10/02/02	NA	3,700	136 -1,770
Arsenic	G633GW002	17.9	=	10/02/02	50	0.045	8 - 166
	G633GW003	26	=	10/02/02			
Barium, Dissolved	G633GW001	58	J	01/24/03	2,000	260	14 - 937
Barium	G633GW001	59	J	01/24/03	2,000	260	14 - 937
	G633GW002	102	J	10/02/02			
	G633GW003	100	J	10/02/02			
	G633GW004	94.2	J	10/02/02			
Cadmium, Dissolved	G633GW001	0.67	J	01/24/03	2	1.8	0.3 - 1.5
Cadmium	G633GW001	0.68	J	01/24/03			
Calcium	G633GW002	178,000	=	10/02/02	NA	NA	85,600 - 294,000
	G633GW003	165,000	=	10/02/02			
	G633GW004	185,000	=	10/02/02			
Copper	G633GW002	11	J	10/02/02	1,300	11 <sup>c</sup>	2 - 14
	G633GW003	8.41	J	10/02/02			

**TABLE 4-8**  
 Inorganic Chemicals Detected In Groundwater; October 2002 and January 2003 Sampling  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Station ID	Concentration ( $\mu\text{g/L}$ )	Qualifier	Date Collected	MCL <sup>a</sup>	EPA Region III Tap Water RBC <sup>b</sup> (HI=0.1)	Zone G Range of Background Concentrations
Iron	G633GW002	3,190	=	10/02/02	NA	1,100	2,000 - 35,700
	G633GW003	13,600	=	10/02/02			
	G633GW004	2,020	=	10/02/02			
Magnesium	G633GW002	409,000	=	10/02/02	NA	NA	70,100 - 535,000
	G633GW003	422,000	=	10/02/02			
	G633GW004	334,000	=	10/02/02			
Manganese	G633GW002	794	=	10/02/02	NA	73	149 - 7,980
	G633GW003	1,490	=	10/02/02			
	G633GW004	633	=	10/02/02			
Mercury, Dissolved	G633GW001	0.076	J	01/24/03	2	NA	0.1 - 0.17
Potassium	G633GW002	194,000	J	10/02/02	NA	NA	15,4000 - 180,000
	G633GW003	188,000	J	10/02/02	NA	NA	
	G633GW004	139,000	J	10/02/02			
Sodium	G633GW002	4,810,000	J	10/02/02	NA	NA	NA
	G633GW003	4,700,000	J	10/02/02			
	G633GW004	3,550,000	J	10/02/02			

**TABLE 4-8**  
 Inorganic Chemicals Detected In Groundwater; October 2002 and January 2003 Sampling  
 RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex

Analyte	Station ID	Concentration ( $\mu\text{g/L}$ )	Qualifier	Date Collected	MCL <sup>a</sup>	EPA Region III Tap Water RBC <sup>b</sup> (HI=0.1)	Zone G Range of Background Concentrations
Vanadium	G633GW002	18.8	J	10/02/02	NA	26	3 - 30
	G633GW003	25.1	J	10/02/02			
Zinc	G633GW002	77.2	=	10/02/02	NA	1,100	18 - 124
	G633GW003	52.3	=	10/02/02			

Concentrations in bold and outlined text exceed the appropriate screening criteria.

<sup>a</sup>Maximum contaminant level (MCL) is from the U.S. Environmental Protection Agency (EPA) National Primary Drinking Water Standards, EPA 816-F-01-007, March 2001.

<sup>b</sup>The Zone G Background Ranges of Concentrations were obtained from Appendix J of the *Charleston Naval Complex Project Team Notebook and Instructions, Revision 1A* (CH2M-Jones, 2001b).

<sup>c</sup>The conservative EPA Region III tap water RBC (HI =0.1) of 11 micrograms per liter ( $\mu\text{g/L}$ ) for Chromium VI was used as the screening criteria for Chromium, Total.

- = Indicates that the analyte was detected at the concentration shown.
- J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits or the value was detected below the laboratory's quantification limit.
- NA Not applicable/not available
- ND Compound was not detected

**TABLE 4-9**  
 LNAPL Analytical Results From G633GW001  
*RFI Report Addendum and CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex*

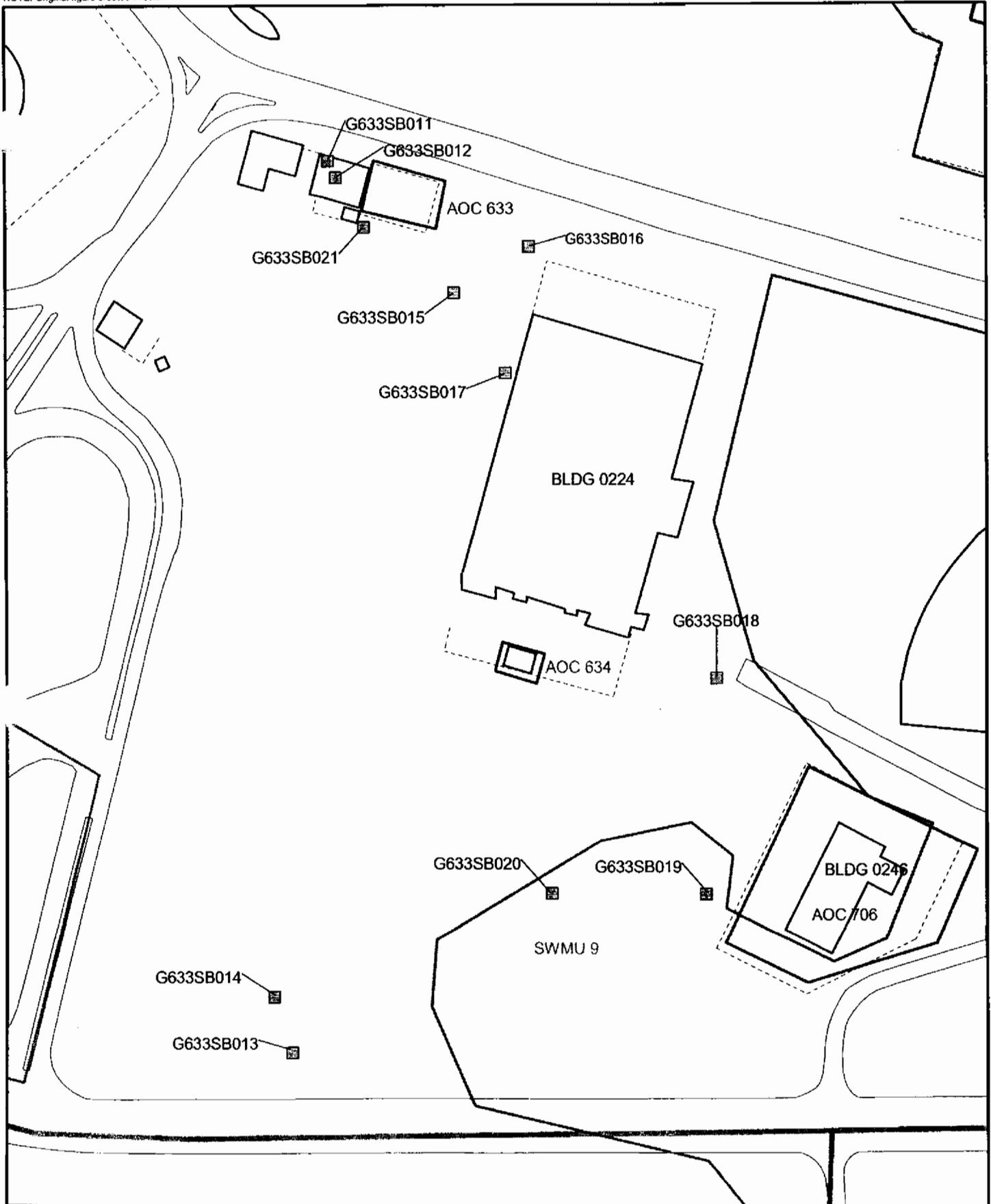
Analyte	Sample Location	Concentration	Qualifier	Units
1,3-Dichlorobenzene	G633GW001	25,000	=	µg/kg
1,4-Dichlorobenzene	G633GW001	100,000	=	µg/kg
Diesel Components	G633GW001	1,000,000	=	mg/kg
bis(2-Ethylhexyl) Phthalate	G633GW001	68,000	J	µg/kg
PCB-1260 (Aroclor-1260)	G633GW001	3,500	=	mg/kg

= Indicates that the analyte was detected at the concentration shown.

J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits or the value was detected below the laboratory's quantification limit.

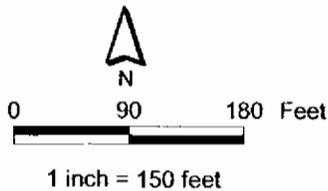
µg/kg Micrograms per kilogram

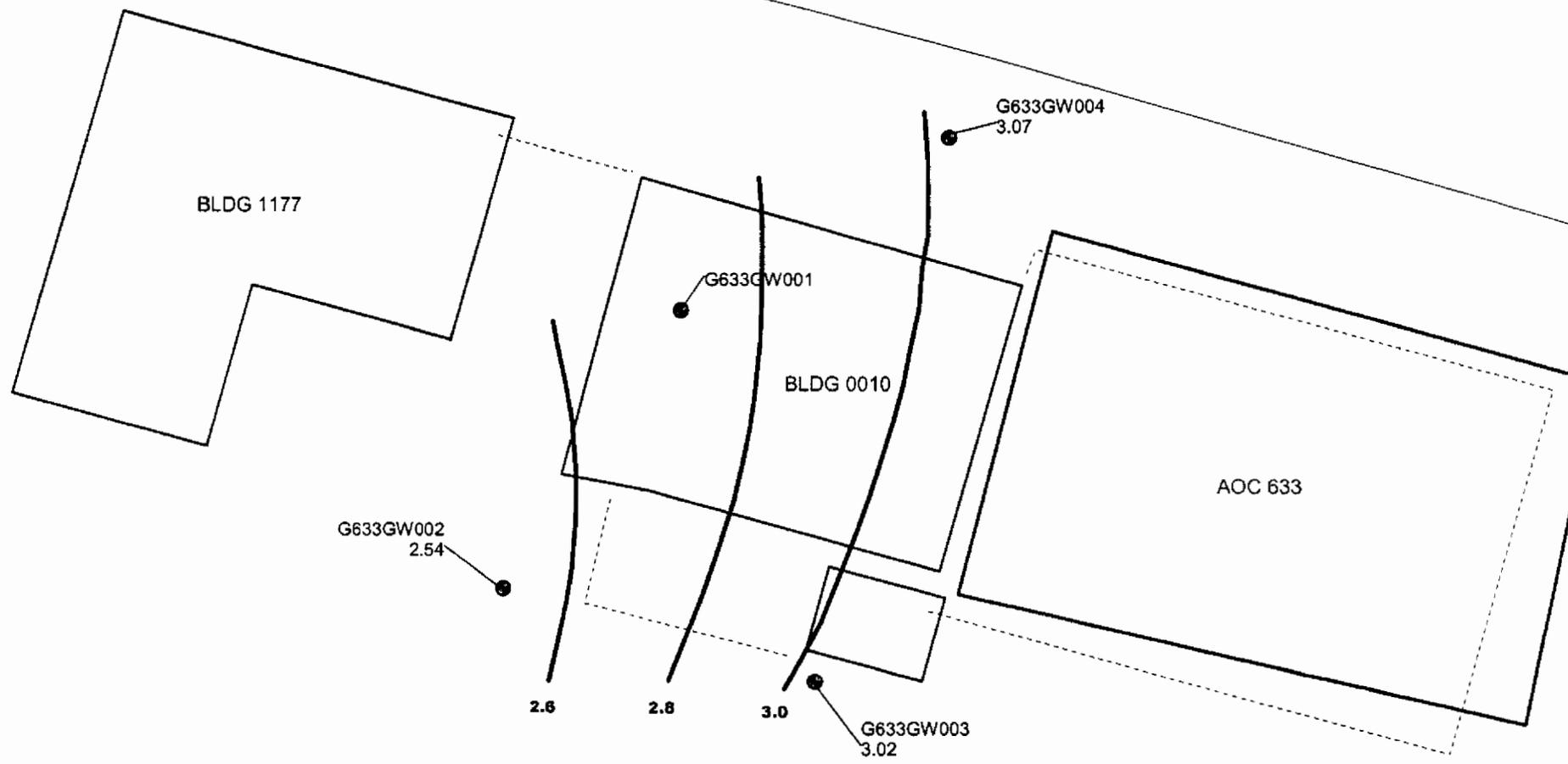
mg/kg Milligrams per kilogram



**Figure 4-1**  
 Additional RFI Sample Locations  
 AOC 633, Zone G  
 Charleston Naval Complex

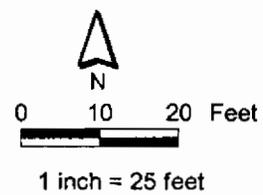
- |                       |                        |
|-----------------------|------------------------|
| Soil Boring           | SWMU Boundary - Active |
| Fence                 | AOC Boundary - NFA     |
| Railroads             | SWMU Boundary - NFA    |
| Roads - Lines         | Buildings              |
| Shoreline             | Surrounding Area       |
| AOC Boundary - Active | Zone Boundary          |





NOTE: Water level values are in feet, relative to mean sea level (msl).

- |                  |                          |                                   |
|------------------|--------------------------|-----------------------------------|
| ● Abandoned Well | □ AOC Boundary - Active  | ▭ Zone Boundary                   |
| ● Active Well    | □ SWMU Boundary - Active | ▭ Potentiometric Surface (ft/msl) |
| ∧ Fence          | □ AOC Boundary - NFA     |                                   |
| ∧ Railroads      | □ SWMU Boundary - NFA    |                                   |
| ∧ Roads - Lines  | □ Buildings              |                                   |
| ∧ Shoreline      | □ Surrounding Area       |                                   |



**Figure 4-2**  
 Potentiometric Surface (without GW001)  
 October 2002  
 AOC 633, Zone G  
 Charleston Naval Complex



## 1 5.0 COPC/COC Refinement

2 The post-IM concentrations of PCBs in subsurface soil were discussed in the IMCR. In this  
 3 report, PCBs were determined to no longer be a subsurface soil COC at AOC 633. Appendix  
 4 E contains a copy of the *Interim Measure Completion Report, AOC 633, Zone G, Revision 0*  
 5 (CH2M-Jones, 2002b). Also, VOCs that were detected in soil at AOC 633 were screened  
 6 against SSLs based on a DAF=1, or site-specific SSLs, in the IMCR. This screening did not  
 7 identify any VOC COCs for AOC 633.

8 This section discusses other COPCs that were identified for AOC 633. Below is a summary  
 9 of the COPCs (other than PCBs) that were identified in site surface and subsurface soil and  
 10 groundwater.

Surface Soil COPCs	Subsurface Soil COPCs	Groundwater COPCs
Antimony	Antimony	Aluminum
Chromium		Aroclor-1260

11

## 12 5.1 Surface Soil COPCs

### 13 5.1.1 Antimony

14 Antimony was detected in one of eight surface soil samples collected at AOC 633. The  
 15 detected concentration (14.4 mg/kg) was above the Zone G range of background  
 16 concentrations (0.79 to 5.7 mg/kg), its SSL (2.5 mg/kg), and its EPA Region III residential  
 17 RBC (3.1 mg/kg, HI=0.1).

18 In order to better assess the potential risk posed by antimony in surface soil, a UCL<sub>95</sub>  
 19 exposure point concentration (EPC) was estimated for antimony. The calculation summary  
 20 is presented in Appendix L. Based on this calculation, the UCL<sub>95</sub> for antimony is 4.6 mg/kg,  
 21 which is above the residential RBC (HI=0.1) of 3.1 mg/kg but below the industrial RBC of  
 22 82 mg/kg (HI=0.1).

23 Based on this EPC, antimony would not be considered a surface soil COC for the industrial  
 24 land use scenario at AOC 633. In addition, the primary target organ for acute oral exposure  
 25 to antimony is the gastrointestinal tract (irritation, diarrhea, vomiting). The targets for long-  
 26 term exposure are the blood (hematological disorders) and liver (mild hepatotoxicity)  
 27 (ATSDR, 1992). Antimony is the only COPC classified with these target organs. Hence,  
 28 because its EPC concentration is below an HI=1.0, and it is the only soil COPC having these

1 target organs, it is not considered a COC for the unrestricted (i.e., residential) land use  
2 scenario.

3 The mean antimony concentration in surface soil was calculated to be 2 mg/kg, which is  
4 below its SSL of 2.5 mg/kg (DAF=10). This calculation can be found in Appendix L. The  
5 calculation was based on the detected concentrations or one-half the detection limit for  
6 samples where the constituent was not detected. Therefore, antimony concentrations are  
7 not expected to be a leaching hazard. Based on these considerations, antimony is not  
8 considered to be a surface soil COC for either the unrestricted or industrial land use  
9 scenarios at AOC 633.

### 10 **5.1.2 Chromium**

11 Chromium was detected in all eight surface soil samples collected at AOC 633. One sample  
12 (633SB01801, 45.5 mg/kg) contained chromium above the Zone G range of background  
13 concentrations (7 to 39 mg/kg), its residential RBC (23 mg/kg, HI=0.1), and its SSL (19  
14 mg/kg, DAF=10). The residential RBC for chromium is based on the more toxic, and less  
15 common, hexavalent form of chromium. No evidence exists at AOC 633 that suggests the  
16 presence of hexavalent chromium at the site.

17 In order to better assess the potential risk posed by chromium in surface soil, a  $UCL_{95}$  EPC  
18 was estimated for chromium. The calculation summary is presented in Appendix L. Based  
19 on this calculation, the  $UCL_{95}$  for chromium is 45.5 mg/kg, which is above the residential  
20 RBC (HI=0.1) of 23 mg/kg but below the industrial RBC (HI=0.1) of 610 mg/kg.

21 Based on this EPC, chromium would not be considered a surface soil COC for the industrial  
22 land use scenario. In addition, the primary target organ for acute exposure to chromium are  
23 the lungs. Chromium is the only COPC with this target organ. Hence, because its EPC  
24 concentration is below an HI=1.0 and is the only soil COPC having this target organ, it is  
25 not considered a COC for the unrestricted land use scenario.

26 The mean chromium concentration was calculated to be 21 mg/kg, which is marginally  
27 above the SSL of 19 mg/kg (DAF=10) based on hexavalent chromium. This calculation can  
28 be found in Appendix L. The mean chromium concentration is within the range of  
29 background concentrations. This information suggests that detected concentrations of  
30 chromium do not represent a significant threat to groundwater above background levels.  
31 Chromium was not detected in any groundwater samples above its MCL of 100  $\mu\text{g}/\text{L}$ , nor  
32 was it detected in subsurface soil above background levels. Based on these observations,  
33 leaching of chromium is not occurring, and it is not considered a surface soil COC at AOC  
34 633.

## 1 **5.2 Subsurface Soil COPCs**

### 2 **5.2.1 Antimony**

3 Antimony was detected above its SSL (2.5 mg/kg) in a single subsurface sample  
4 (633SB02002, 6.8 mg/kg). Antimony was not detected in the grid-based (background)  
5 samples. Therefore, there were no Zone G background concentrations available for  
6 comparison.

7 The mean concentration for antimony in subsurface soil was calculated at 1.3 mg/kg. The  
8 mean concentration was based on the detected concentrations or one-half the detection limit  
9 for samples where the constituent was not detected. This value is less than antimony's SSL  
10 of 2.5 mg/kg (DAF=10). Therefore, antimony concentrations are not expected to be a  
11 leaching hazard, and antimony is not considered a subsurface soil COC at AOC 633.

## 12 **5.3 Sediment COPCs**

13 As part of the Zone G RFI, sediment samples were collected to evaluate the risk to  
14 ecological receptors. Ecological risk will be addressed in the Zone J RFI. Therefore, further  
15 discussion of the sediment samples collected within the AEC will be deferred to the Zone J  
16 RFI Report.

## 17 **5.4 Groundwater COPCs**

### 18 **5.4.1 Aluminum**

19 Aluminum was detected in only a single well, at a concentration of 7,840  $\mu\text{g/L}$ , which is  
20 above its tap water RBC (HI=0.1) of 3,700  $\mu\text{g/L}$ . Aluminum is a commonly occurring  
21 natural mineral. It has been detected in grid well samples across the CNC at concentrations  
22 of up to 16,100  $\mu\text{g/L}$ . Because aluminum can be a significant component of clays, it would  
23 be expected to be present in groundwater samples that have been impacted by entrained  
24 turbidity. There were no elevated concentrations of aluminum in the site soil samples and  
25 no indications that aluminum has been released at this site as a contaminant. Based on these  
26 considerations, aluminum is not considered a groundwater COC at AOC 633.

### 27 **5.4.2 Aroclor-1260**

28 Aroclor-1260 was detected in a single well (G633GW001) after removal of LNAPL. Its  
29 concentration in the groundwater was above its MCL. Accordingly, Aroclor-1260 is  
30 considered a COC for groundwater. The occurrence of Aroclor-1260 in groundwater is most  
31 likely related to the presence of the small amounts of weathered diesel LNAPL that contains

1 Aroclor-1260, and that slowly accumulates in this well. The absence of detections of  
2 Aroclor-1260 and other PCBs in other groundwater samples suggests that a significant  
3 dissolved plume of this chemical is not widely present at the site.

#### 4 **5.4.3 Fuel Hydrocarbons**

5 Although not considered COCs for AOC 633, several fuel-related hydrocarbons detected in  
6 well G633GW004 exceeded their MCLs or RBCs. These hydrocarbons do not appear to be  
7 related to the weathered diesel LNAPL found at AOC 633, but are more likely related to a  
8 past release from a hydrocarbon source such as the FDS. An old FDS line runs adjacent to  
9 AOC 633 and well G633GW004, along Hobson Avenue. The fuel hydrocarbons detected in  
10 this well should be addressed under the SCDHEC petroleum program.

#### 11 **5.4.4 Chlorobenzenes**

12 Although not specifically identified as COCs because their concentrations did not exceed  
13 their respective MCLs or RBCs, several chlorobenzenes (1,3-DCB, 1,4-DCB and  
14 chlorobenzene) were detected in the groundwater sample collected from well G633GW001.  
15 The dichlorobenzenes were detected in the LNAPL sample collected from this well and  
16 have the potential to leach into the groundwater. Therefore, these chemicals should  
17 continue to be monitored in this well. If their concentrations in groundwater are found to  
18 exceed the MCLs, they would be considered COCs.

### 19 **5.5 Summary of COCs**

20 No COCs were identified for soil at AOC 633. The small amount of LNAPL that  
21 accumulates in well G633MW001 is considered to be of concern at the site, and Aroclor-1260  
22 is also considered to be a groundwater COC. A CMS to address the LNAPL and Aroclor-  
23 1260 is recommended. Section 8.0 presents a focused CMSWP for LNAPL and groundwater  
24 at AOC 633.

## 6.0 Summary of Information Related to Site Closeout Issues

---

### 6.1 RFI Status

The *Zone G RFI Report, Revision 0* (EnSafe, 1998a) addressed SWMUs/AOCs within the Naval Complex, including AOC 633. Additional samples were collected subsequent to submittal of the report. In addition, the *Zone G RFI Report Work Plan Addendum* (EnSafe, 2000) recommended the collection of one additional sample at AOC 633. Comments on the *Zone G RFI Report* recommended collecting additional samples at AOC 633 (see Appendix F for a copy of the responses to these comments). The additional samples have been collected and further investigation is not warranted.

### 6.2 Presence of Inorganics in Groundwater

For the purpose of site closeout documentation, the inorganics in groundwater issue refers to the occasional or intermittent detection of several metals (primarily arsenic, thallium, and antimony) in groundwater at concentrations above the applicable MCL, preceded or followed by detections of these same metals below the MCL or below the practicable quantitation limit.

Based on the sampling results presented herein, the presence of arsenic, thallium, and antimony in AOC 633 groundwater does not appear to be an issue. Arsenic was detected in all wells at levels below its MCL; thallium and antimony were not detected. Therefore, additional discussion of inorganics in site groundwater is not warranted.

### 6.3 Potential Linkage to SWMU 37, Investigated Sanitary Sewers at the CNC

AOC 633 is an electrical substation. There is no evidence to suggest that wastewater or sanitary wastewater was generated at this facility, and no apparent access to a sewer system

1 was found (Davis and Floyd, 1998). Therefore, there is no linkage between AOC 633 and the  
2 investigated sanitary sewers, and further evaluation of this issue is not warranted.

### 3 **6.4 Potential Linkage to AOC 699, Investigated Storm Sewers** 4 **at the CNC**

5 Investigated segments of the storm sewer were identified in the *Zone L RFI Report, Revision 0*  
6 (EnSafe, 1998b). The nearest investigated storm sewers to AOC 633 are approximately 800  
7 feet to the North in Zone E, and approximately 700 feet to the Northwest on Lamar Avenue,  
8 associated with the dike for AST 3900-E. Therefore, there is no known linkage between  
9 AOC 633 and the investigated sanitary sewers of AOC 699, and further evaluation of this  
10 issue is not warranted.

### 11 **6.5 Potential Linkage to AOC 504, Investigated Railroad Lines** 12 **at the CNC**

13 The potential linkage of a SWMU or AOC to a railroad potentially applies only to SWMUs  
14 or AOCs at which an investigated portion of the railroad system, identified as AOC 504 in  
15 the *Zone L RFI Work Plan* (EnSafe, 1995), passes through or is directly adjacent to the AOC or  
16 SWMU.

17 The nearest investigated railroad line to AOC 633 is approximately 250 feet to the north.  
18 There is no known linkage between AOC 633 and the investigated railroad lines of AOC  
19 504, and further evaluation of this issue is not warranted.

### 20 **6.6 Potential Migration Pathways to Surface Water Bodies at** 21 **the CNC**

22 Following the IM soil removal activities at AOC 633, COCs have been remediated from  
23 surface and subsurface soil at the site. Therefore, any potential for contaminant migration  
24 via stormwater runoff has been mitigated, and further investigation of this issue is not  
25 warranted at this site.

### 26 **6.7 Potential Contamination in Oil/Water Separators (OWSs)**

27 The issue of potential contamination of OWSs refers to the possible presence of an OWS that  
28 has not yet been investigated at a SWMU or AOC as part of the RCRA or UST process.

1 Neither the RFA nor the RFI reports refer to the presence or possible presence of an OWS at  
2 AOC 633. In addition, there is no reference made in the basewide OWS report prepared by  
3 the Navy in Y2000 to an OWS at this facility. Therefore, further evaluation of this issue is  
4 not warranted.

## 5 **6.8 Land Use Controls (LUCs)**

6 AOC 633 is planned for future industrial land use. The evaluation presented in this report  
7 concludes that site soils are sufficiently remediated to allow this use, but site groundwater  
8 will be addressed with a CMS. Therefore, AOC 633 will have LUCs applied as part of the  
9 CMS. At a minimum, the LUCs are expected to include restrictions against unrestricted (i.e.,  
10 residential) land use, installation of wells, and use of the shallow groundwater.

## 1 **7.0 Recommendations**

---

2 The information presented in this RFIRA/CMSWP supports the conclusions that further  
3 investigation is not warranted at AOC 633 and that further action is not warranted for AOC  
4 633 soils. The site groundwater was evaluated by installing four new monitoring wells;  
5 three of these wells were sampled in October 2002, and one was sampled during January  
6 2003 (G633MW001). The results indicate that with the exception of aluminum, inorganic  
7 analytes do not exceed the criteria for unrestricted (i.e., residential) land use.

8 Benzene, benzo[a]pyrene, benzo[b]fluoranthene, carbazole, dibenzofuran, fluorene,  
9 naphthalene, and phenanthrene were each detected at concentrations that exceeded their  
10 MCLs (or RBCs in the absence of an MCL) in one well, and are considered to most likely be  
11 related to a release from the FDS pipeline that runs along Hobson Avenue. No COCs were  
12 identified for soil at AOC 633. The small amount of LNAPL that accumulates in well  
13 G633MW001 and Aroclor-1260 are considered to be of concern for groundwater at the site,  
14 and therefore a CMS is recommended. Section 8.0 presents a focused CMSWP for LNAPL  
15 and groundwater at AOC 633.

## 1 **8.0 CMS Work Plan for AOC 633 Groundwater**

---

2 The purpose of this CMSWP is to identify and evaluate potential remedial alternatives for  
3 preventing unacceptable exposure to organic chemicals in the shallow groundwater at AOC  
4 633. A focused CMS will be performed to evaluate two principle actions for shallow  
5 groundwater: 1) long-term groundwater monitoring with LUCs, and 2) groundwater  
6 remediation.

### 7 **8.1 Remedial Action Objectives**

8 Remedial action objectives (RAOs) are medium-specific goals that the remedial actions will  
9 be designed to accomplish in order to protect human health and the environment by  
10 preventing or reducing exposures under current and future land use conditions. The RAOs  
11 identified for shallow groundwater at AOC 633 are to prevent ingestion and direct/dermal  
12 contact with groundwater having unacceptable carcinogenic risk and noncarcinogenic  
13 hazards, and to restore the shallow aquifer to beneficial use conditions.

### 14 **8.2 Remedial Goal Options and Proposed Media Cleanup** 15 **Standards**

16 Typically after RAOs have been established and the risk assessment is complete, RGOs are  
17 developed for each RAO. The RGOs are based on assumptions about a particular land use  
18 scenario and include different residual risk levels for comparison. For example, to  
19 remediate surface soils to protect an onsite maintenance worker, RGOs might include  
20 remediating to anthropogenic background levels or to one of a variety of specific risk levels  
21 (such as 1E-06 or 1E-04). For each RGO, a specific MCS is determined for specific chemicals.  
22 These MCSs are expressed in conventional concentration units, such as mg/kg or mg/L, for  
23 specific chemicals. Remediating the site to those specific MCSs would be suitable to  
24 demonstrate that the RAO has been achieved.

25 The exposure medium of concern for AOC 633 is shallow groundwater. Because AOC 633 is  
26 located within a highly developed area of the CNC and there are no surface water bodies in  
27 the immediate vicinity of the site, ecological exposures were not considered necessary for  
28 evaluation.

1 Potential MCSs for achieving RGOs protective of potentially exposed human receptors (e.g.,  
2 site workers involved in monitoring and maintenance) under the anticipated future land  
3 use scenario (industrial) will be presented in the CMS. Remedial alternatives for achieving  
4 these potential MCSs will be evaluated and described in the CMS.

5 LNAPL and Aroclor-1260 are the COCs at AOC 633 for which a specific RGO and MCS is  
6 required. There is no standard for the removal of LNAPL to a measurable thickness in  
7 SCDHEC regulations or guidance. However, technical standards and corrective action  
8 requirements for owners and operators of USTs as outlined in Chapter 61-92, Part 280 under  
9 the SCDHEC Bureau of Land and Waste Management, UST Program, addresses the  
10 removal of free product (Code of Regulation 61-92, Section 280.64). The regulation states  
11 that "At sites where investigations under Section 280.62(a)(6) indicate the presence of free product,  
12 owners and operators must remove free product to the maximum extent practicable as determined by  
13 the Department...."

14 Through telephone correspondence with the technical section of the UST program, LNAPL  
15 removal at UST sites is to 0.01 feet (i.e., 1/8 -inch), as required by SCDHEC during the  
16 corrective action phase. This standard is documented in the site-specific corrective action  
17 plan prepared and submitted to the UST program. As a result, the proposed MCS for  
18 LNAPL removal at AOC 633 is to a measurable thickness of less than or equal to 0.01 feet.  
19 For Aroclor-1260, the proposed MCS is the MCL for PCBs of 0.5  $\mu\text{g}/\text{L}$ .

### 20 **8.3 Corrective Measure Technology Focused Evaluation**

21 This focused CMS will evaluate the options for preventing direct contact by future site  
22 workers or residents, including LUCs, and groundwater remediation to RBCs or MCLs.  
23 Technologies associated with LUCs will be evaluated, including deed restrictions against  
24 residential use, and long-term monitoring and maintenance. Technologies associated with  
25 groundwater include long term sampling and analysis of monitoring wells, and  
26 groundwater remediation.

### 27 **8.4 Focused CMS Approach**

28 This focused CMS will consist of the following three tasks. These tasks will be performed in  
29 the order presented below:

- 30 1. The corrective measure alternatives described above will be screened using several  
31 criteria and decision factors. Other corrective measure alternatives may also be  
32 evaluated in the CMS.

- 1 2. A preferred corrective measure alternative will be selected for each medium.
- 2 3. The CMS and preferred corrective measure alternatives will be documented in the CMS
- 3 report.

## 4 **8.5 Approach to Evaluating Corrective Measure Alternatives**

5 According to the RCRA permit issued by SCDHEC (SCDHEC, 1998), the alternatives will be  
6 evaluated using the following five standards:

- 7 1. Protect human health and the environment.
- 8 2. Attain MCSs (RGOs).
- 9 3. Control the source of releases to minimize future releases that may pose a threat to
- 10 human health and the environment.
- 11 4. Comply with applicable standards for the management of wastes generated by remedial
- 12 activities.
- 13 5. Other factors include (a) long-term reliability and effectiveness; (b) reduction in toxicity,
- 14 mobility, or volume of wastes; (c) short-term effectiveness; (d) implementability; and (e)
- 15 cost.

16 Each of the five criteria is defined in more detail below:

### 17 **8.5.1 Protect Human Health and the Environment**

18 The alternatives will be evaluated on the basis of their ability to protect human health and  
19 the environment. The ability of an alternative to achieve this standard may or may not be  
20 independent of its ability to achieve the other standards. For example, an alternative may be  
21 protective of human health, but may not be able to attain the MCSs, if the MCSs are not  
22 directly tied to protecting human health.

### 23 **8.5.2 Attain MCSs (RGOs)**

24 The alternatives will be evaluated on the basis of their ability to achieve the RGOs defined  
25 in this CMSWP. Another aspect of this is the time frame to achieve the RGOs. Estimates of  
26 the time frame for the alternatives to achieve RGOs will be provided.

### 8.5.3 Control the Source of Releases

This deals with the control of releases of contamination from the source (the area in which the contamination originated). For example, blast media may be considered a source under the unrestricted land use exposure scenario, but be within RGOs under industrial land use.

### 8.5.4 Comply with Applicable Standards for the Management of Wastes

This deals with the management of wastes derived from implementing the alternatives (e.g., treatment or disposal of excavated material). The removal alternative will be designed to comply with all standards for management of wastes. Consequently, this will not be explicitly included in the detailed evaluation presented in the CMS.

### 8.5.5 Other Factors

Five other factors must be considered if an alternative is found to meet the four criteria described above. These other factors are as follows:

#### a. Long-term reliability and effectiveness

These two alternatives will be evaluated on the basis of their reliability and the potential impact should the alternative fail. In other words, a qualitative assessment will be made as to the chance of the alternative's failing and the consequences of that failure.

#### b. Reduction in the toxicity, mobility, or volume of wastes

Alternatives with technologies that reduce the toxicity, mobility, or volume of the contamination will be generally favored over those that do not. Consequently, a qualitative assessment of this factor will be performed for each alternative.

#### c. Short-term effectiveness

Alternatives will be evaluated on the basis of the risk they create during the implementation of the remedy. Factors that may be considered include fire, explosion, and exposure of workers to hazardous substances.

#### d. Implementability

The alternatives will be evaluated for their implementability by considering any difficulties associated with conducting the alternatives (such as the construction disturbances they may create), operation of the alternatives, and the availability of equipment and resources to implement the technologies comprising the alternatives.

1 e. Cost

2 A net present value of each alternative will be developed. These cost estimates will  
3 be used for the relative evaluation of the alternatives, not to bid or budget the work.  
4 The estimates will be based on information available at the time of the CMS and on a  
5 conceptual design of the alternative. They will be "order of magnitude" estimates  
6 with a generally expected accuracy of -50 percent to +50 percent for the scope of  
7 action described for each alternative. The estimates will be categorized into capital  
8 costs and operations and maintenance costs for each alternative.

9 In addition to the criteria described above, the alternatives will be evaluated for the ability  
10 to achieve all contractual obligations of CH2M-Jones and the Navy.

## 11 **8.6 Focused CMS Report**

12 The focused CMS Report will present the identification, development, and evaluation of  
13 potential corrective measures for AOC 633 groundwater. A proposed outline of the report,  
14 as shown in Table 8-1, provides an example of the report format and content organization.

**TABLE 8-1**  
 Outline of Focused CMS Report for AOC 633  
*RFI Report Addendum/IM Completion Report/CMS Work Plan, AOC 633, Zone G, Charleston Naval Complex*

<b>Section No.</b>	<b>Section Title</b>
<b>1.0</b>	<b>Introduction</b>
1.1	Corrective Measures Study Purpose and Scope
1.2	Report Organization
1.3	Background Information
1.3.1	Facility Description
1.3.2	Site History and Background
1.3.2.1	Nature and Extent of Contamination
1.3.2.2	Summary of Risk Assessment
<b>2.0</b>	<b>Remedial Goal Options</b>
<b>3.0</b>	<b>Detailed Analysis of Focused Alternatives</b>
3.1	Approach
3.2	Evaluation Criteria
3.3	Description of Groundwater Alternatives <sup>a</sup>
3.3.1	Alternative 1: Long Term Monitoring With Land Use Controls
3.3.2	Alternative 2: Groundwater Remediation
3.4	Comparative Analysis of Groundwater Alternatives
<b>4.0</b>	<b>Recommended Remedial Alternatives</b>
<b>5.0</b>	<b>References</b>
<b>Appendix A</b>	<b>Corrective Measure Alternative Cost Estimates<sup>b</sup></b>
	List of Tables
	List of Figures

<sup>a</sup> Additional alternatives will be analyzed, if necessary.

<sup>b</sup> Additional appendices will be added, if necessary.

**Section 9.0**

## 1 9.0 References

---

- 2 Agency for Toxic Substances and Disease Registry (ATSDR). *Toxicological Profile for*  
3 *Antimony*. Agency for Toxic Substances and Disease Registry U.S. Department of Health and  
4 *Human Services, A Public Health Service*. Atlanta, Georgia. December 1992.
- 5 CH2M-Jones. *Phase I Interim Measure Work Plan. Subsurface Soil Removal, AOC 633, Zone G.*  
6 *Revision 0*. September 2001a.
- 7 CH2M-Jones. *Project Team Notebook and Instructions: Charleston Naval Complex, Environmental*  
8 *Restoration Project. Revision 1A*. December 2001b.
- 9 CH2M-Jones. *Phase II Interim Measure Work Plan, LNAPL and LNAPL-Impacted Soil Removal,*  
10 *AOC 633, Zone G. Revision 0*. May 2002a.
- 11 CH2M-Jones. *Interim Measure Completion Report, AOC 633, Zone G. Revision 0*. September  
12 2002b.
- 13 Davis and Floyd. *Evaluation of Wastewater System Serving Charleston Naval Complex,*  
14 *Charleston Naval Complex Redevelopment Authority*. June 1998.
- 15 Davis and Floyd. *Evaluation of Drainage System Serving Charleston Naval Complex, Charleston*  
16 *Naval Complex Redevelopment Authority*. September 1998.
- 17 EnSafe/Allen & Hoshall. *Final RCRA Facility Assessment Naval Base Charleston Volume II.*  
18 June 6, 1995.
- 19 EnSafe Inc. *Zone L RCRA Facility Investigation Work Plan. Revision 0*. October 18, 1995.
- 20 EnSafe Inc. *Zone G RFI Report, NAVBASE Charleston. Revision 0*. February 20, 1998a.
- 21 EnSafe Inc. *Draft Zone L RCRA Facility Investigation Report, Charleston Naval Complex.*  
22 December 18, 1998b.
- 23 EnSafe Inc. *Zone G RFI Report Work Plan Addendum, NAVBASE Charleston*. January 17, 2000.
- 24 U.S. Environmental Protection Agency. *Revised Interim Soil Lead Guidance for CERCLA sites*  
25 *and RCRA Corrective Action Facilities*. 1994.
- 26 U.S. Environmental Protection Agency. *Soil Screening Guidance: Technical Background*  
27 *Document*. Office of Solid Waste and Emergency Response. May 1996.
- 28 U.S. Environmental Protection Agency, Region III. *Risk Based Concentration Table*. October 6,  
29 2000.

Table 10.2.1  
 Zone G  
 AOC 633  
 Soil Samples and Analyses

Boring Location	Sample Identifier	Sample Interval	Date Collected	Analyses	Remarks
633SB001	633SB00101	Upper	10/02/96	See note	
	633SB00202	Lower			
633SB002	633SB00201	Upper	10/02/96	See note	
	633SB00202	Lower			
633SB003	633SB00301	Upper	10/02/96	See note	
	633SB00302	Lower			
633SB004	633SB00401	Upper	10/02/96	See note	
	633SB00402	Lower			
633SB005	633SB00501	Upper	10/02/96	See note	Lower interval not sampled
633SB006	633SB00601	Upper	10/02/96	See note	Lower interval not sampled
633SB007	633SB00701	Upper	10/02/96	See note	
	633SB00702	Lower			
633SB008	633SB00801	Upper	1/07/97	See note	Second-round sample
	633SB00802	Lower			
633SB009	633SB00901	Upper	1/07/97	See note	Second-round sample
	633SB00902	Lower			
633SB010	634SB01001	Upper	1/07/97	See note	Second-round sample
	634SB01002	Lower			

*Note:*  
 SW-846 (Pesticides/PCBs) at DQO Level III.

Table 10.2.2  
 Zone G  
 AOC 633  
 Organic Compound Analytical Results for Soil

Parameters	Sample Interval	Frequency of Detection	Range of Detections ( $\mu\text{g}/\text{kg}$ )	Mean of Detections ( $\mu\text{g}/\text{kg}$ )	Reference Conc. ( $\mu\text{g}/\text{kg}$ )	Number of Samples Exceeding Reference
<b>Pesticides and PCBs (Upper Interval - 10 Samples/Lower Interval - 8 Samples) (<math>\mu\text{g}/\text{kg}</math>)</b>						
alpha-Chlordane	Upper	1/10	450	450	1800	0
	Lower	2/8	2.90 - 8.70	5.80	10000	0
gamma-Chlordane	Upper	1/10	420	420	1800	0
	Lower	2/8	3.10 - 9.30	6.20	10000	0
4,4'-DDD	Upper	1/10	68.0	68.0	2700	0
	Lower	1/8	6.70	6.70	16000	0
4,4'-DDE	Upper	1/10	58.0	58.0	1900	0
	Lower	1/8	53.0	53.0	54000	0
4,4'-DDT	Upper	4/10	3.40 - 30.0	14.6	1900	0
	Lower	1/8	740	740	32000	0
Heptachlor epoxide	Upper	1/10	19.0	19.0	70.0	0
	Lower	0/8	ND	ND	700	0
Aroclor-1260	Upper	3/10	41.0 - 480	207	320	1
	Lower	2/8	310 - 25000	12700	1000	1

**Notes:**

- \* = Residential RBCs (THQ=0.1) were used as a reference concentration for upper interval samples. Generic soil to groundwater SSLs (DAF=20) from the *Soil Screening Guidance: Technical Background Document* (USEPA, 1996b) were used as a reference concentration for lower interval samples.
- ND = Not detected.
- $\mu\text{g}/\text{kg}$  = Micrograms per kilogram.

Table 10.2.3  
 Zone G  
 AOC 633  
 Analytes Detected in Surface and Subsurface Soil

Parameters	Location	Surface Conc.	Residential RBC* (THQ=0.1)	Surface Background	Subsurface Conc.	Soil to Groundwater SSL* (DAF=20)	Subsurface Background
<b>Pesticides/PCBs (µg/kg)</b>							
alpha-Chlordane	633SB009	ND	1800	NA	2.9	10000	NA
	633SB010	450			8.7		
gamma-Chlordane	633SB009	ND	1800	NA	3.1	10000	NA
	633SB010	420			9.3		
4,4'-DDD	633SB010	68	2700	NA	6.7	16000	NA
4,4'-DDE	633SB007	ND	1900.0	NA	53	54000	NA
	633SB010	58			ND		
4,4'-DDT	633SB001	30	1900	NA	ND	32000	NA
	633SB002	3.4			ND		
	633SB007	ND			740		
	633SB009	4			ND		
	633SB010	21			ND		
Heptachlor epoxide	633SB010	19	70	NA	ND	700	NA
Aroclor-1260	633SB001	480	320	NA	ND	1000	NA
	633SB002	41			ND		
	633SB004	ND			310		
	633SB007	ND			2500		
	633SB008	100			ND		

*Notes:*

\* = Residential RBCs (THQ=0.1) were used as a reference concentration for upper interval samples. Generic soil to groundwater SSLs (DAF=20) from the *Soil Screening Guidance: Technical Background Document* (USEPA, 1996b) were used as a reference concentration for lower interval samples.

ND = Not detected.

NT = Not taken.

NA = Not applicable.

**Bolded concentrations exceed both the reference concentration (RBC or SSL) and the zone background.**

**All background values for Zone G are based on twice the means of the grid sample concentrations.**

**10.2.4 Sediment Sampling and Analysis**

The approved final RFI work plan proposed collecting six sediment samples to identify contaminants introduced to AEC IV-1 from AOC 633 and also from two other nearby AOCs (AOCs 634 and 706). Six sediment samples were collected during the investigation. In accordance with the approved final RFI work plan, sediment samples were analyzed for pesticides/PCBs at DQO Level III. In addition, sediment samples were analyzed for metals, SVOCs, and VOCs at DQO Level III. Table 10.2.4 summarizes the AOC 633 sediment samples and analyses.

**Table 10.2.4**  
**Zone G**  
**AOC 633**  
**Sediment Samples and Analyses**

Sample Location	Sample Identifier	Date Collected	Analyses	Remarks
633M0001	633M000101	9/26/96	See note	
633M0002	633M000201	9/26/96	See note	
633M0003	633M000301	9/26/96	See note	
633M0004	633M000401	9/26/96	See note	
633M0005	633M000501	9/26/96	See note	
633M0006	633M000601	9/26/96	See note	

*Note:*  
 SW-846 (metals, pesticides/PCBs, SVOCs, VOCs) at DQO Level III.

**10.2.4.1 Nature of Contamination in Sediment**

Organic compound analytical results for sediment are summarized in Table 10.2.5. Inorganic analytical results for sediment are summarized in Table 10.2.6. Table 10.2.7 summarizes all analytes detected in sediment at AOC 633. Appendix D contains a complete analytical data report for all Zone G samples. Section 8 discusses the ecological risk from these detections.

Zone G RCRA Facility Investigation Report  
 NAVBASE Charleston  
 Section 10 — Site Specific Evaluations  
 Revision: 0

Table 10.2.5  
 Zone G  
 AOC 633  
 Organic Analytical Results for Sediment

Parameters	Frequency of Detection	Range of Detections (µg/kg)	Mean of Detections (µg/kg)	SSVs (µg/kg)	Number of Samples Exceeding SSVs
<b>Volatile Organic Compounds (6 Samples) (µg/kg)</b>					
2-Butanone (MEK)	1/6	20.0	20.0	NL	NA
Carbon disulfide	1/6	11.0	11.0	NL	NA
<b>Semivolatile Organic Compounds (6 Samples) (µg/kg)</b>					
BEQs <sup>1</sup>	3/6	14.7 - 178	79.4	NL	NA
Benzo(a)anthracene	3/6	60 - 180	137	330	0
Benzo(b)fluoranthene	3/6	78 - 310	213	NL	NA
Benzo(k)fluoranthene	2/6	77 - 200	139	NL	NA
Benzo(a)pyrene	1/6	130	130	330	0
Chrysene	3/6	91 - 260	200	330	0
Anthracene	1/6	60.0	60.0	330	0
Benzoic acid	1/6	79.0	79.0	NL	NA
Butylbenzylphthalate	1/6	63.0	63.0	NL	NA
bis(2-Ethylhexyl)phthalate	1/6	3400	3400	182	1
Fluoranthene	3/6	100 - 410	280	330	2
2-Methylnaphthalene	1/6	92.0	92.0	330	NA
Phenanthrene	2/6	100 - 270	185	330	0
Pyrene	3/6	120 - 650	390	330	2
<b>Pesticides and PCBs (6 Samples) (µg/kg)</b>					
alpha-Chlordane	2/6	5.10 - 86.0	45.6	1.7	2
gamma-Chlordane	2/6	9.10 - 130	69.6	1.7	2
4,4'-DDD	3/6	12.0 - 18.0	14.7	3.3	3
4,4'-DDE	4/6	8.10 - 34.0	21.0	3.3	4
4,4'-DDT	1/6	16.0	16.0	3.3	1
Aroclor-1260	1/6	270	270	33	1

*Zone G RCRA Facility Investigation Report*  
*NAVBASE Charleston*  
*Section 10 — Site Specific Evaluations*  
*Revision: 0*

---

**Notes:**

1 = Calculated from methods described in USEPA Interim *Supplemental Guidance to RAGS: Human Health Risk Assessment*, Bulletin 2 (USEPA, 1995c).

µg/kg = Micrograms per kilogram.

NL = Not listed.

NA = Not available.

SSV = Sediment Screening Value.

SSVs from *Supplemental Guidance to RAGS: Region IV Bulletins, Ecological Risk Assessment, Bulletin 2* (USEPA, 1995a).

Table 10.2.6  
 Zone G  
 AOC 633  
 Inorganics Analytical Results for Sediment

Parameters	Frequency of Detection	Range of Detections (mg/kg)	Mean of Detections (mg/kg)	SSVs (mg/kg)	Number of Samples Exceeding SSVs
<b>Inorganics (6 Samples)</b>					
Aluminum (Al)	6/6	8850 - 34500	21400	NL	0
Antimony (Sb)	2/6	0.95 - 23.5	12.2	12	1
Arsenic (As)	6/6	4.90 - 25.3	15.8	7.24	5
Barium (Ba)	6/6	19.3 - 317	96.5	NL	NA
Beryllium (Be)	5/6	0.53 - 1.60	1.16	NL	NA
Cadmium (Cd)	4/6	0.39 - 4.90	1.92	1.0	3
Calcium (Ca)	6/6	2120 - 43700	22700	NL	NA
Chromium (Cr)	6/6	13.0 - 61.7	42.2	52.3	3
Cobalt (Co)	6/6	0.77 - 9.10	5.53	NL	NA
Copper (Cu)	5/6	34.4 - 1220	320	18.7	5
Iron (Fe)	6/6	8300 - 39100	25400	NL	NA
Lead (Pb)	6/6	6.90 - 393	153	30.2	5
Magnesium (Mg)	6/6	394 - 6440	3770	NL	NA
Manganese (Mn)	6/6	16.0 - 710	333	NL	NA
Mercury (Hg)	5/6	0.27 - 1.000	0.51	0.13	5
Nickel (Ni)	5/6	17.1 - 47.6	24.8	15.9	5
Potassium (K)	6/6	300 - 2810	1590	NL	NA
Selenium (Se)	6/6	0.47 - 1.50	1.09	NL	NA
Silver (Ag)	2/6	0.73 - 0.95	0.84	2.0	0
Sodium (Na)	3/6	1990 - 4030	2820	NL	NA
Tin (Sn)	1/6	52.8	52.8	NL	NA
Vanadium (V)	6/6	21.5 - 77.0	52.8	NL	NA
Zinc (Zn)	5/6	140 - 3260	832	124	5

*Notes:*

mg/kg = Milligrams per kilogram.

NL = Not listed.

NA = Not available.

SSV = Sediment Screening Value.

SSVs from *Supplemental Guidance to RAGs: Region IV Bulletins, Ecological Risk Assessment, Bulletin 2* (USEPA, 1995a).

Table 10.2.7  
 Zone G  
 AOC 633  
 Analytes Detected in Sediment Samples

Parameters	Location	Concentration	SSVs
<b>Volatile Organic Compounds (<math>\mu\text{g}/\text{kg}</math>)</b>			
Carbon disulfide	633M0003	11	NL
2-Butanone	633M0004	20	NL
<b>Semivolatile Organic Compounds (<math>\mu\text{g}/\text{kg}</math>)</b>			
BEQs <sup>1</sup>	633M0002	128.26	NL
	633M0003	45.25	
	633M0006	14.66	
Benzo(a)anthracene	633M0002	170	330
	633M0003	180	
	633M0006	60	
Benzo(b)fluoranthene	633M0002	310	NL
	633M0003	250	
	633M0006	78	
Benzo(k)fluoranthene	633M0003	200	NL
	633M0006	77	
Benzo(a)pyrene	633M0002	130	330
Chrysene	633M0002	260	330
	633M0003	250	
	633M0006	91	
Anthracene	633M0002	60	330
Benzoic acid	633M0002	79	NL
Butylbenzylphthalate	633M0002	63	NL
bis(2-ethylhexyl)phthalate	633M0003	3400	182
Fluoranthene	633M0002	410	330
	633M0003	330	
	633M0006	100	
2-Methylnaphthalene	633M0006	92	330
Phenanthrene	633M0002	270	330
	633M0006	100	
Pyrene	633M0002	400	330
	633M0003	650	
	633M0006	120	
<b>Pesticides (<math>\mu\text{g}/\text{kg}</math>)</b>			
alpha-Chlordane	633M0002	86	1.7
	633M0006	5.1	

Table 10.2.7  
 Zone G  
 AOC 633  
 Analytes Detected in Sediment Samples

Parameters	Location	Concentration	SSVs
gamma-Chlordane	633M0002	130	1.7
	633M0006	9.1	
4,4'-DDD	633M0002	18	3.3
	633M0005	12	
	633M0006	14	
4,4'-DDE	633M0002	29	3.3
	633M0003	13	
	633M0005	8.1	
	633M0006	34	
4,4'-DDT	633M0005	16	3.3
Aroclor-1260	633M0005	270	33
<b>Inorganics (mg/kg)</b>			
Aluminum (Al)	633M0001	9010	NL
	633M0002	24300	
	633M0003	26100	
	633M0004	34500	
	633M0005	25900	
	633M0006	8850	
Antimony (Sb)	633M0002	0.95	12
	633M0005	23.5	
Arsenic (As)	633M0001	4.9	7.24
	633M0002	13.3	
	633M0003	22.7	
	633M0004	25.3	
	633M0005	19.2	
	633M0006	9.2	
Barium (Ba)	633M0001	19.3	NL
	633M0002	59.8	
	633M0003	91.2	
	633M0004	54.3	
	633M0005	317	
	633M0006	37.1	
Beryllium (Be)	633M0002	0.89	NL
	633M0003	1.4	
	633M0004	1.6	
	633M0005	1.4	
	633M0006	0.53	
Cadmium (Cd)	633M0002	1.1	1.0
	633M0003	1.3	
	633M0005	4.9	
	633M0006	0.39	

**Table 10.2.7**  
**Zone G**  
**AOC 633**  
**Analytes Detected in Sediment Samples**

Parameters	Location	Concentration	SSVs
Calcium (Ca)	633M0001	2120	NL
	633M0002	25900	
	633M0003	36900	
	633M0004	15000	
	633M0005	12700	
	633M0006	43700	
Chromium (Cr)	633M0001	13	52.3
	633M0002	47.6	
	633M0003	57.2	
	633M0004	54.1	
	633M0005	61.7	
	633M0006	19.8	
Cobalt (Co)	633M0001	0.77	NL
	633M0002	4.8	
	633M0003	8.0	
	633M0004	7.8	
	633M0005	9.1	
	633M0006	2.7	
Copper (Cu)	633M0002	120	18.7
	633M0003	80.7	
	633M0004	34.4	
	633M0005	1220	
	633M0006	143	
Iron (Fe)	633M0001	10100	NL
	633M0002	25100	
	633M0003	31500	
	633M0004	38400	
	633M0005	39100	
	633M0006	8300	
Lead (Pb)	633M0001	6.9	30.2
	633M0002	182	
	633M0003	203	
	633M0004	57.7	
	633M0005	393	
	633M0006	75.6	
Magnesium (Mg)	633M0001	394	NL
	633M0002	3320	
	633M0003	5990	
	633M0004	6440	
	633M0005	4930	
	633M0006	1530	

Table 10.2.7  
 Zone G  
 AOC 633  
 Analytes Detected in Sediment Samples

Parameters	Location	Concentration	SSVs
Manganese (Mn)	633M0001	16	NL
	633M0002	170	
	633M0003	432	
	633M0004	492	
	633M0005	710	
	633M0006	178	
Mercury (Hg)	633M0002	0.57	0.13
	633M0003	0.37	
	633M0004	0.27	
	633M0005	1.0	
	633M0006	0.34	
Nickel (Ni)	633M0002	17.1	15.9
	633M0003	21.5	
	633M0004	20.4	
	633M0005	47.6	
	633M0006	17.2	
Potassium (K)	633M0001	300	NL
	633M0002	1480	
	633M0003	2450	
	633M0004	2810	
	633M0005	1960	
	633M0006	547	
Selenium (Se)	633M0001	0.47	NL
	633M0002	1.4	
	633M0003	1.4	
	633M0004	1.5	
	633M0005	1.3	
	633M0006	0.48	
Silver (Ag)	633M0002	0.73	2.0
	633M0005	0.95	
Sodium (Na)	633M0002	1990	NL
	633M0003	4030	
	633M0004	2450	
Tin (Sn)	633M0005	52.8	NL
Vanadium (V)	633M0001	21.5	NL
	633M0002	64.5	
	633M0003	69.2	
	633M0004	77.0	
	633M0005	62.8	
	633M0006	21.8	

Table 10.2.7  
 Zone G  
 AOC 633  
 Analytes Detected in Sediment Samples

Parameters	Location	Concentration	SSVs
Zinc (Zn)	633M0002	312	124
	633M0003	279	
	633M0004	140	
	633M0005	3260	
	633M0006	167	

**Notes:**

- 1 = Calculated from methods described in USEPA Interim Supplemental Guidance to RAGS: Human Health Risk Assessment, Bulletin 2 (USEPA, 1995c).
- μg/kg = Micrograms per kilogram.
- SSV = Sediment Screening Value.
- Bolded concentrations exceed the SSV.
- SSVs from Supplemental Guidance to RAGS: Region IV Bulletins, Ecological Risk Assessment, Bulletin 2 (USEPA, 1995a).

**Volatile Organic Compounds in Sediment**

Two VOCs, 2-butanone, and carbon disulfide, were detected in AOC 633 sediment samples. No VOCs in sediment exceeded their respective sediment screening values (SSVs).

**Semivolatile Organic Compounds in Sediment**

Thirteen SVOCs were detected in AOC 633 sediment samples. Bis(2-ethylhexyl)phthalate, fluoranthene and pyrene exceeded their respective SSVs in sediment samples at this AOC. Figure 10.2-4 presents bis(2-ethylhexyl)phthalate concentrations detected in sediment at AOC 633. Figure 10.2-5 presents fluoranthene concentrations detected in sediment at this AOC. Figure 10.2-6 presents pyrene concentrations detected in sediment at this AOC.

**Pesticides and PCBs in Sediment**

Five pesticides were detected in AOC 633 sediment samples. All pesticides detected exceeded their respective SSV. Figures 10.2-7 through 10.2-11 present alpha-chlordane, gamma-chlordane, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT concentrations in AOC 633 sediment samples, respectively.

Table 10.2.8  
 Chemicals Detected in Surface Soil, Subsurface Soil, and Shallow Groundwater  
 Comparison to SSLs, Tap Water RBCs, Saltwater Surface Water Chronic Screening Levels, and Background Concentrations  
 NAVBASE Charleston, Zone G: AOC 633  
 Charleston, South Carolina

Parameter	Max. Concentration		Max. Concentration		Screening Concentration *			Soil Units	Water Units	Leaching Potential	Ground-Water Migration Concern	Surface Water Migration Concern
	Surface Soil	Subsurface Soil	Shallow GW	Deep GW	Soil to GW SSL	Tap Water RBC	Saltwater Surf. Wtr. Chronic					
<b>Pesticides/PCB Compounds</b>												
Aroclor-1260	480	25000	NA	NA	1000	0.034	0.03	UG/KG	UG/L	YES	NO	NO
alpha-Chlordane	450	8.7	NA	NA	10000	0.19	0.004	UG/KG	UG/L	NO	NO	NO
gamma-Chlordane	420	9.3	NA	NA	10000	0.19	0.004	UG/KG	UG/L	NO	NO	NO
4,4'-DDD	68	6.7	NA	NA	16000	0.28	0.025	UG/KG	UG/L	NO	NO	NO
4,4'-DDE	58	53	NA	NA	54000	0.2	0.14	UG/KG	UG/L	NO	NO	NO
4,4'-DDT	30	740	NA	NA	32000	0.2	0.001	UG/KG	UG/L	NO	NO	NO
Heptachlor epoxide	19	ND	NA	NA	700	0.0012	0.0036	UG/KG	UG/L	NO	NO	NO

\* Screening Concentrations:

Soil to GW - Generic SSLs based on DAF = 20, from 1996 Soil Screening Guidance or calculated using values from Table 6.4

Tap Water RBC - From EPA Region III Risk-Based Concentration Table, October 22, 1997

Salt Water Surface Water Chronic - From EPA Supplemental Guidance to RAGS: Region IV Bulletins, Ecological Risk Assessment, November, 1995; Table 2  
 For inorganics, the value shown is the greater of the relevant screening value or the corresponding background value.

NA - Not available/Not applicable

ND - Not detected

RBC - Risk based concentration

SSL - Soil screening level

MG/KG - Milligrams per kilogram

NG/KG - Nanograms per kilogram

PG/L - Picograms per liter

UG/KG - Micrograms per kilogram

UG/L - Micrograms per liter



# **SAMPLING REPORT**

**SITE DELINEATION FOR PCB's AT  
AREA OF CONCERN (AOC) 633  
CHARLESTON NAVAL COMPLEX  
CHARLESTON, SC**



Prepared for:

**DEPARTMENT OF THE NAVY  
SOUTHERN DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
CHARLESTON SC**

Prepared by:

**SOUTH CAROLINA RESEARCH AUTHORITY  
Environmental Enterprise Group  
1899 North Hobson Avenue, Bldg. 30  
North Charleston, SC 29405-2106**



Submitted by:

**Delphinus Engineering  
93 Monte Sano Drive  
Hanahan, SC 29406**

February 26, 2000



## **Introduction**

The South Carolina Research Authority's (SCRA) Environmental Enterprise Group (EEG) was tasked to perform an Interim Measure (IM) at Area of Concern (AOC) 633. During the initial phase of the IM EEG discovered the extent of contamination exceeded the Scope of Work (SOW) as described below under "Work Plan Implementation/Site Delineation".

AOC 633 is currently an active South Carolina Electric & Gas (SCE&G) electrical switch station. The only electrical load the station supplied as of January 2000 is navigational lighting for pier Zulu located on the Charleston Naval Complex. SCE&G reports that eventually this service will be transferred and the station will be obsolete.

## **Background**

AOC 633 is located near Building 451C, an electrical substation constructed in 1943. This facility functions as a switch station currently; however, it was previously a fully functional electrical substation with several high voltage switches, breakers and transformers. EEG's research of site plans dating back to the 1950s show the site has undergone several physical changes. This includes building, wall, and concrete slab installations and removals to support operational needs at the time. Several Polychlorinated Biphenyl (PCB) releases were also documented at the site during past operations. Investigative sampling performed during the Zone G Resource Conservation Recovery Act (RCRA) Facility Investigation (RFI) Report Vol. II, dated 1998, identified PCB contamination (Aroclor-1260) at 25 ppm in one subsurface (3'-5') soil sample (633SB007). EEG was tasked with removing the PCB contamination with a previously approved Work Plan and submitting a post remediation Completion Report.

## **Work Plan Implementation/Site Delineation**

The approved Work Plan recognized removing an area surrounding sample location 633SB007 measuring 10' x 10' at a depth of 5' and collecting confirmation samples. Prior to implementing the Work Plan, EEG determined it was necessary to perform delineation/confirmation sampling prior to excavating the contamination for two reasons:

- 1) Minimize the impact on SCE&G by verifying the area to be excavated would meet the cleanup objective of <1ppm PCBs.
- 2) Disposal was based on one sample and good engineering practices dictated additional data was required.

EEG performed an initial round of subsurface sampling on 12 January 2000 to verify the contamination was within the 10' x 10' area. Samples were collected at sample location



633SB007 as a center point and extended out at 10' intervals to 20' in four directions. These samples locations and contaminant concentrations are shown on Figure 1 in red. The results indicated that the extent of PCB contamination was greater than originally thought and portions of the excavation contained PCB levels exceeding 50 ppm requiring stricter disposal requirements. EEG notified the Southern Division (SDIV) Naval Facilities Engineering Command Technical Representative of these results. SDIV authorized EEG to perform additional sampling to delineate the extent of contamination.

EEG performed a second round of sampling on 1 February 2000 to further define the extent of contamination. These sample locations are depicted in green on Figure 1. These results were presented to SDIV on 22 February 2000. SDIV determined the data was sufficient to define the extent of contamination for removal.

Table 1, found on page 3, lists the sample points, results, and sample analysis I.D. numbers. Laboratory analytical sheets and chain of custody sheets are also included in this report following figure 1.

### **Observations**

Personnel performing the sampling at AOC 633 with hand augers encountered numerous interferences and obstacles at approximately two feet below ground surface. Based on the media retrieved with the sampling devices, it appears that the original surface gravel and possibly obstructions/debris were left from the demolition of walls and concrete pads prior to bringing in the existing fill and surface gravel. Field technicians observed that following removal of the surface gravel the first one to two feet of soil consisted of what appeared to be clean backfill. This is consistent with conversations between EEG and SCE&G personnel who reported a large amount of fill was brought in to raise the ground elevation and covered with gravel. This would also explain why the RFI sampling performed at AOC 633 did not detect PCB contamination in the 1<sup>st</sup> interval at sample location 633SB007. After auguring through this backfill, samplers encountered large railroad bed size gravel and occasionally solid objects that prevented further auguring. When this occurred, samples locations were moved until a subsurface sample could be collected. After penetrating the subsurface layer of gravel, the soil below was consistent (organic silty clay) with subsurface soils found at Charleston Naval Complex. Groundwater intrusion was observed at depths of 4 to 5 feet.



**TABLE 1**  
**SAMPLE ANALYSIS**

Sample Point	Sample I.D.	Sample Result in ppm (mg/kg)
1	00EEG009-1	7
2	00EEG009-2	2.9
3	00EEG009-3	3.1
4	00EEG009-4	4.8
5	00EEG009-5	6.8
6	00EEG0010-1	0.52
7	00EEG0010-2	60.0
8	00EEG0010-3	9.9
9	00EEG0010-4	0.2
10	00EEG0017-1	33.0
11	00EEG0017-2	61.0
12	00EEG0017-3	1.4
13	00EEG0017-4	ND
14	00EEG0017-5	80.0
15	00EEG0017-6	17.0
16	00EEG0017-7	0.3
17	00EEG0017-8	1.3

ND – Non- Detect

Sample points 1-9 are first round samples identified in red on Figure 1

Sample points 10-17 are second round samples identified in green of Figure 1

All PCB detections were Aroclor-1260

Cleanup Objective is <1 ppm

Environmental Conservation Laboratories, Inc.  
1207 General Drive  
Florida 32824-8529  
3-5314  
/ 850-6945  
www.encolabs.com



DHRS Certification No. E83182

CLIENT : SCRA-Environmental  
ADDRESS: Enterprise Group  
1899 N. Hobson Ave. Bldg.30  
N. Charleston, SC 29405-2106

REPORT # : OR9444  
DATE SUBMITTED: January 15, 2000  
DATE REPORTED : January 24, 2000

PAGE 1 OF 5

ATTENTION: Rusty Cope

**SAMPLE IDENTIFICATION**

Samples submitted and  
identified by client as:

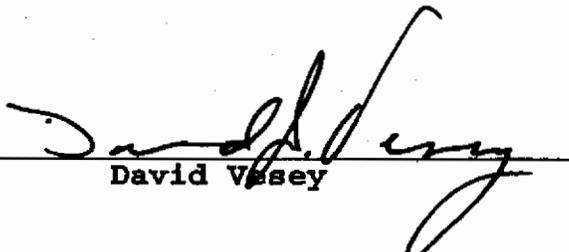
PROJECT #: AOC633

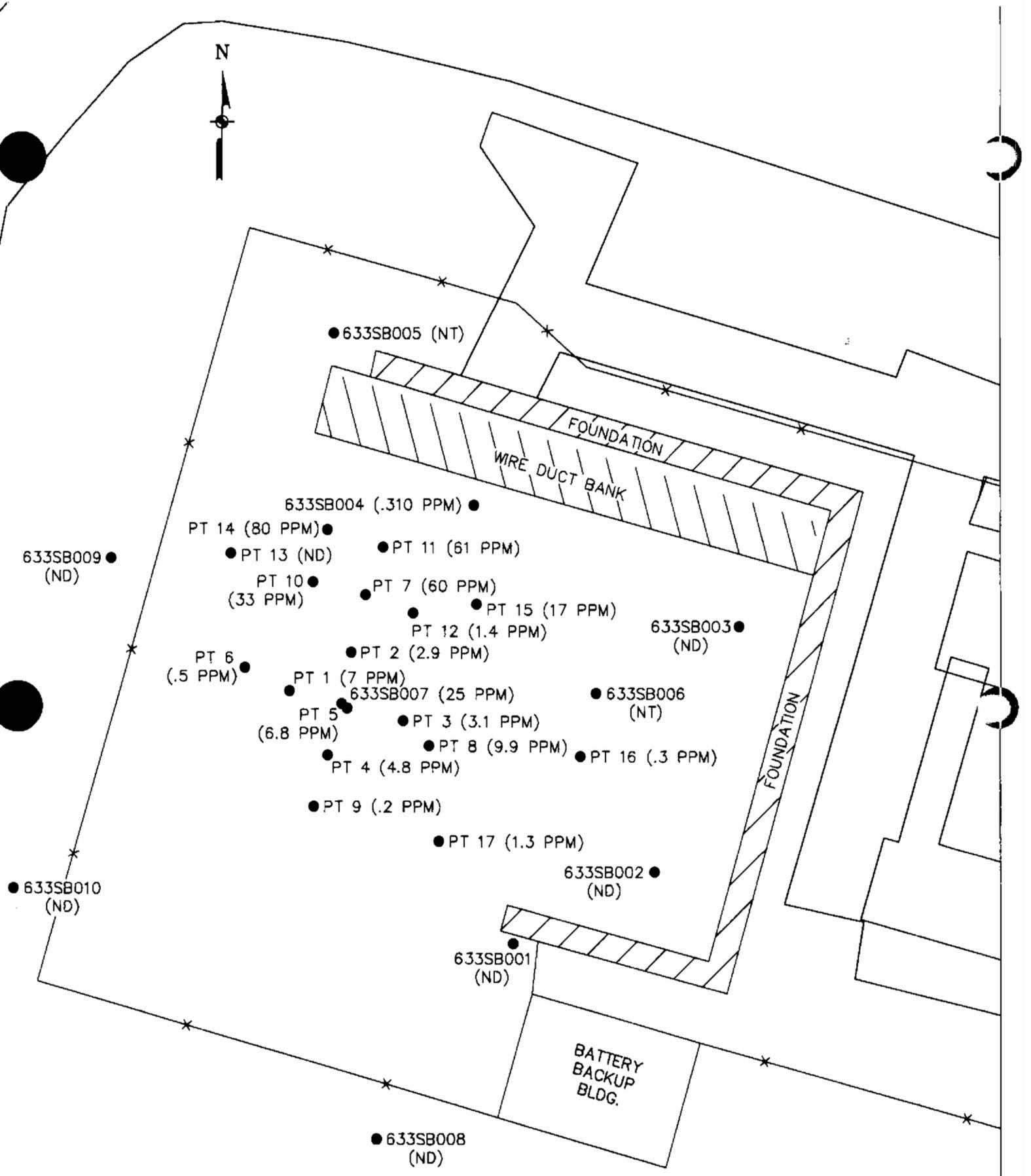
Charleston Naval Complex

01/12/00

#1 - 00EEG0009-1 @ 15:00  
#2 - 00EEG0009-2 @ 09:20  
#3 - 00EEG0009-3 @ 09:45  
#4 - 00EEG0009-4 @ 10:15  
#5 - 00EEG0009-5 @ 15:30

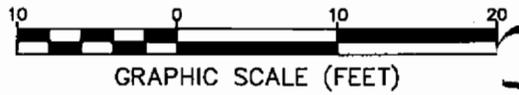
PROJECT MANAGER

  
David Vesey



**LEGEND**

- ND NON DETECT
- NT NOT TAKEN
- RFI SAMPLE LOCATION
- FIRST ROUND SAMPLE LOCATION
- SECOND ROUND SAMPLE LOCATION



NOTE 1. ITEMS SHOWN IN MAGENTA REPRESENT SITE CONFIGURATION AND BOUNDARIES AS DETERMINED BY RECENT GPS SURVEY.

**AOC 633 (451-C)**  
**FIGURE 1**

ENCO LABORATORIES

REPORT # : OR9444  
 DATE REPORTED: January 24, 2000  
 REFERENCE : AOC633  
 PROJECT NAME : Charleston  
 Naval Complex

PAGE 2 OF 5

RESULTS OF ANALYSIS

**A METHOD 8082 -  
 Colors**

	<u>00EEG0009-1</u>	<u>00EEG0009-2</u>	<u>Units</u>
B-1016/1242	400 U D1	200 U D2	µg/Kg
B-1221	400 U D1	200 U D2	µg/Kg
B-1232	400 U D1	200 U D2	µg/Kg
B-1248	400 U D1	200 U D2	µg/Kg
B-1254	400 U D1	200 U D2	µg/Kg
B-1260	7000 D1	2900 D2	µg/Kg

**Surrogate:**

	<u>% RECOV</u>	<u>% RECOV</u>	<u>LIMITS</u>
4,5,6-TCMX	98	104	30-150
MC	122	128	37-128
ate Extracted	01/18/00	01/18/00	
alyzed	01/22/00	01/22/00	

**MISCELLANEOUS**

	<u>METHOD</u>	<u>00EEG0009-1</u>	<u>00EEG0009-2</u>	<u>Units</u>
Percent Solids	SM2540G	84	82	%
ate Analyzed		01/18/00	01/18/00	

NOTE: Analyte values are reported on a dry weight basis.

= Compound was analyzed for but not detected to the level shown.

o Analyte value determined from a 1:10 dilution.

o Analyte value determined from a 1:5 dilution.

ENCO LABORATORIES

REPORT # : OR9444  
 DATE REPORTED: January 24, 2000  
 REFERENCE : AOC633  
 PROJECT NAME : Charleston  
 Naval Complex

PAGE 3 OF 5

RESULTS OF ANALYSIS

A METHOD 8082 -  
Colors

	<u>00EEG0009-3</u>	<u>00EEG0009-4</u>	<u>Units</u>
B-1016/1242	190 U D2	390 U D1	µg/Kg
B-1221	190 U D2	390 U D1	µg/Kg
B-1232	190 U D2	390 U D1	µg/Kg
B-1248	190 U D2	390 U D1	µg/Kg
B-1254	190 U D2	390 U D1	µg/Kg
B-1260	3100 D2	4800 D1	µg/Kg

<u>Prorogate:</u>	<u>% RECOV</u>	<u>% RECOV</u>	<u>LIMITS</u>
4,5,6-TCMX	118	116	30-150
C	128	130	37-128
te Extracted	01/18/00	01/18/00	
Analyzed	01/22/00	01/22/00	

<u>MISCELLANEOUS</u>	<u>METHOD</u>	<u>00EEG0009-3</u>	<u>00EEG0009-4</u>	<u>Units</u>
Percent Solids	SM2540G	86	85	%
te Analyzed		01/18/00	01/18/00	

NOTE: Analyte values are reported on a dry weight basis.

= Compound was analyzed for but not detected to the level shown.  
 Analyte value determined from a 1:10 dilution.  
 Analyte value determined from a 1:5 dilution.

ENCO LABORATORIES

REPORT # : OR9444  
 DATE REPORTED: January 24, 2000  
 REFERENCE : AOC633  
 PROJECT NAME : Charleston  
 Naval Complex

PAGE 4 OF 5

RESULTS OF ANALYSIS

A METHOD 8082 -  
Colors

	<u>00EEG0009-5</u>	<u>LAB BLANK</u>	<u>Units</u>
3-1016/1242	580 U D1	330 U D1	µg/Kg
3-1221	580 U D1	330 U D1	µg/Kg
3-1232	580 U D1	330 U D1	µg/Kg
3-1248	580 U D1	330 U D1	µg/Kg
3-1254	580 U D1	330 U D1	µg/Kg
3-1260	6800 D1	330 U D1	µg/Kg

Proximate:

	<u>% RECOV</u>	<u>% RECOV</u>	<u>LIMITS</u>
4,5,6-TCMX	118	100	30-150
3	140	120	37-128
Sample Extracted	01/18/00	01/18/00	
Sample Analyzed	01/22/00	01/21/00	

SCCELLANEOUS

	<u>METHOD</u>	<u>00EEG0009-5</u>	<u>LAB BLANK</u>	<u>Units</u>
Percent Solids	SM2540G	57	NA	%
Sample Analyzed		01/18/00		

NOTE: Analyte values are reported on a dry weight basis.

U = Not applicable

D = Compound was analyzed for but not detected to the level shown.  
 B = Analyte value determined from a 1:10 dilution.

ENCO LABORATORIES

REPORT # : OR9444  
DATE REPORTED: January 24, 2000  
REFERENCE : AOC633  
PROJECT NAME : Charleston  
Naval Complex

PAGE 5 OF 5

QUALITY CONTROL DATA

<u>Parameter</u>	<u>% RECOVERY</u> <u>MS/MSD/LCS</u>	<u>ACCEPT</u> <u>LIMITS</u>	<u>% RPD</u> <u>MS/MSD</u>	<u>ACCEPT</u> <u>LIMITS</u>
<u>Method 8082</u> 3-1260	91/ 92/ 88	57-167	1	13

Environmental Conservation Laboratories Comprehensive QA Plan #960038

- = Less Than
- = Matrix Spike
- D = Matrix Spike Duplicate
- S = Laboratory Control Standard
- D = Relative Percent Difference

This report shall not be reproduced except in full, without the written approval of the laboratory. Results for these procedures apply only to samples as submitted.



ENVIRONMENTAL CONSERVATION LABORATORIES

QSARF #10117

4810 Executive Park Court, Suite 211  
 Jacksonville, Florida 32216-6069  
 Ph. (904) 296-3007 • Fax (904) 296-6210

10207 General Drive  
 Orlando, Florida 32824-8529  
 Ph. (407) 826-5314 • Fax (407) 850-6945

1015 Passport Way  
 Cary, North Carolina 27513  
 Ph. (919) 677-1669 • Fax (919) 677-9846

ENCO CompQAP No.: 960038G/0

CHAIN OF CUSTODY RECORD

PROJECT REFERENCE <i>Charleston Naval Complex</i>		PROJECT NO. <i>AOC 633</i>	P.O. NUMBER
PROJECT LOC. (State) <i>SC</i>	SAMPLER(S) NAME <i>Rusty Cope</i>	PHONE <i>843-202-8032</i>	FAX <i>843-202-8011</i>
CLIENT NAME <i>Environmental Enterprise Group</i>		CLIENT PROJECT MANAGER <i>R. Cope</i>	
CLIENT ADDRESS (CITY, STATE, ZIP) <i>1899 N. Hobson Ave CHAS., S.C. 29405-2106</i>			

STATION	SAMPLE			SAMPLE IDENTIFICATION	MATRIX TYPE							PRESERVATIVE	NUMBER OF CONTAINERS SUBMITTED	REMARKS
	DATE	TIME	GRAB		COMPL	SURFACE WATER	GROUND WATER	WASTEWATER	DRINKING WATER	SOIL/SOLID SEDIMENT	NONAQUEOUS LIQUID (oil, solvent, etc.)			
1	1/12/00	1500	X	00EEG0009-1				X					1	Sample JAR 1 I.D. ↓ 2 ↓ 3 ↓ 4 ↓ 5 ↓
2	1/13/00	0920	X	00EEG0009-2				X					1	
3	1/13/00	0945	X	00EEG0009-3				X					1	
4	1/13/00	1015	X	00EEG0009-4				X					1	
5	1/12/00	1530	X	00EEG0009-5				X					1	

SAMPLE KIT PREPARED BY: JACKSONVILLE	DATE	TIME	RELINQUISHED BY: (SIGNATURE) <i>K. Armstrong</i>	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
				1/11/00	2:30			
RELINQUISHED BY: (SIGNATURE) <i>RWCopes</i>	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
	1/14/00	1300						
RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

RECEIVED FOR LAB BY: (SIGNATURE) <i>K. Armstrong</i>	DATE	TIME	CUSTODY INTACT	ENCO LOG NO. <i>OR94</i>	REMARKS
	1-15-00	10:00			

Environmental Conservation Laboratories, Inc.  
107 General Drive  
Tampa, Florida 32824-8529  
813-5314  
813-850-6945  
www.encolabs.com



DHRS Certification No. E83182

CLIENT : SCRA-Environmental  
ADDRESS: Enterprise Group  
1899 N. Hobson Ave. Bldg.30  
N. Charleston, SC 29405-2106

REPORT # : OR9443  
DATE SUBMITTED: January 15, 2000  
DATE REPORTED : January 24, 2000

PAGE 1 OF 5

ATTENTION: Rusty Cope

**SAMPLE IDENTIFICATION**

Samples submitted and  
identified by client as:

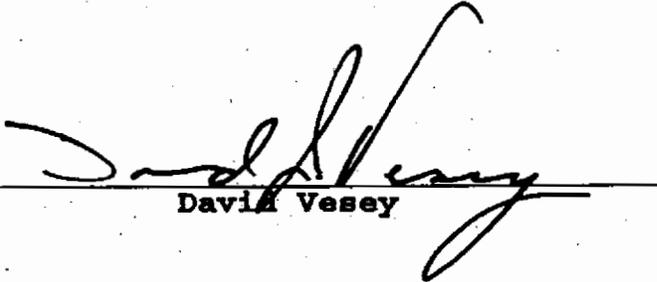
PROJECT #: AOC633

Charleston Naval Complex

01/13/00

- #1 - 00EEG0010-1 @ 10:30
- #2 - 00EEG0010-2 @ 10:48
- #3 - 00EEG0010-3 @ 11:15
- #4 - 00EEG0010-4 @ 11:30

PROJECT MANAGER

  
David Vesey

ENCO LABORATORIES

REPORT # : OR9443  
 DATE REPORTED: January 24, 2000  
 REFERENCE : AOC633  
 PROJECT NAME : Charleston  
 Naval Complex

PAGE 2 OF 5

RESULTS OF ANALYSIS

<u>METHOD 8082 -</u> <u>clors</u>	<u>00EEG0010-1</u>	<u>00EEG0010-2</u>	<u>Units</u>
-1016/1242	56 U	2000 U D1	µg/Kg
-1221	56 U	2000 U D1	µg/Kg
-1232	56 U	2000 U D1	µg/Kg
-1248	56 U	2000 U D1	µg/Kg
-1254	56 U	2000 U D1	µg/Kg
-1260	520	60000 D1	µg/Kg
<u>rogate:</u>	<u>% RECOV</u>	<u>% RECOV</u>	<u>LIMITS</u>
,5,6-TCMX	84	102	30-150
	132	*	37-128
Extracted	01/18/00	01/18/00	
alyzed	01/21/00	01/22/00	

<u>MISCELLANEOUS</u>	<u>METHOD</u>	<u>00EEG0010-1</u>	<u>00EEG0010-2</u>	<u>Units</u>
Percent Solids	SM2540G	60	81	%
Sample Analyzed		01/18/00	01/18/00	

NOTE: Analyte values are reported on a dry weight basis.

- Matrix interference; unable to obtain surrogate recovery.  
 Compound was analyzed for but not detected to the level shown.  
 Analyte value determined from a 1:50 dilution.

ENCO LABORATORIES

REPORT # : OR9443  
 DATE REPORTED: January 24, 2000  
 REFERENCE : AOC633  
 PROJECT NAME : Charleston  
 Naval Complex

PAGE 3 OF 5

RESULTS OF ANALYSIS

METHOD 8082 -  
Polars

	<u>00EEG0010-3</u>	<u>00EEG0010-4</u>	<u>Units</u>
-1016/1242	430 U D2	38 U	µg/Kg
-1221	430 U D2	38 U	µg/Kg
-1232	430 U D2	38 U	µg/Kg
-1248	430 U D2	38 U	µg/Kg
-1254	430 U D2	38 U	µg/Kg
-1260	9900 D2	200	µg/Kg

<u>rogate:</u>	<u>% RECOV</u>	<u>% RECOV</u>	<u>LIMITS</u>
5,6-TCMX	98	82	30-150
	118	76	37-128
Extracted	01/18/00	01/18/00	
Analyzed	01/22/00	01/21/00	

<u>CELLANEOUS</u>	<u>METHOD</u>	<u>00EEG0010-3</u>	<u>00EEG0010-4</u>	<u>Units</u>
cent Solids	SM2540G	77	88	%
e Analyzed		01/18/00	01/18/00	

E: Analyte values are reported on a dry weight basis.

Compound was analyzed for but not detected to the level shown.  
 Analyte value determined from a 1:10 dilution.

ENCO LABORATORIES

REPORT # : OR9443  
DATE REPORTED: January 24, 2000  
REFERENCE : AOC633  
PROJECT NAME : Charleston  
Naval Complex

PAGE 4 OF 5

RESULTS OF ANALYSIS

METHOD 8082 -  
lors

1016/1242  
1221  
1232  
1248  
1254  
1260

LAB BLANK

330 U D2  
330 U D2

Units

µg/Kg  
µg/Kg  
µg/Kg  
µg/Kg  
µg/Kg  
µg/Kg

rogate:  
5,6-TCMX

% RECOV

100  
120  
01/18/00  
01/21/00

LIMITS

30-150  
37-128

Extracted  
Analyzed

Compound was analyzed for but not detected to the level shown.  
Analyte value determined from a 1:10 dilution.

ENCO LABORATORIES

REPORT # : OR9443  
DATE REPORTED: January 24, 2000  
REFERENCE : AOC633  
PROJECT NAME : Charleston  
Naval Complex

PAGE 5 OF 5

QUALITY CONTROL DATA

<u>meter</u>	<u>% RECOVERY</u> <u>MS/MSD/LCS</u>	<u>ACCEPT</u> <u>LIMITS</u>	<u>% RPD</u> <u>MS/MSD</u>	<u>ACCEPT</u> <u>LIMITS</u>
Method 8082 1260	91/ 92/ 88	57-167	1	13

Environmental Conservation Laboratories Comprehensive QA Plan #960038

- = Less Than
- = Matrix Spike
- = Matrix Spike Duplicate
- = Laboratory Control Standard
- = Relative Percent Difference

This report shall not be reproduced except in full, without the written approval of the laboratory. Results for these procedures apply only to samples as submitted.



# ENVIRONMENTAL CONSERVATION LABORATORIES

QSARF # \_\_\_\_\_

4810 Executive Park Court, Suite 211 Jacksonville, Florida 32216-6069  
 10207 General Drive Orlando, Florida 32824  
 Ph. (904) 296-3007 • Fax (904) 296-6210 Ph. (407) 826-5314 • Fax (407) 850-6945

ENCO CompQAP No.: 960038G/0

## CHAIN OF CUSTODY RECORD

OBJECT REFERENCE <b>Charleston Naval Complex</b>		PROJECT NO. <b>AOC 633</b>	P.O. NUMBER	MATRIX TYPE	REQUIRED ANALYSIS	PAGE <b>1</b> OF <b>1</b>
OBJECT LOC. (Site) <b>SC Rusty Cope</b>	SAMPLER(s) NAME	PHONE <b>843-202-8032</b>	FAX <b>843-202-8011</b>	<b>PCB 8062</b>	PRESERVATIVE	<input checked="" type="checkbox"/> STANDARD REPORT DELIVERY <input type="checkbox"/> EXPEDITED REPORT DELIVERY (surcharge) Date Due: <b>1-20-00</b>
CLIENT NAME <b>Environmental Enterprise Group</b>	CLIENT PROJECT MANAGER <b>R Cope</b>					
CLIENT ADDRESS (CITY, STATE, ZIP) <b>899 N. Hobson Ave N. CHAS. SC. 29405-2106</b>						

SAMPLE					SURFACE WATER	GROUND WATER	WASTEWATER	DRINKING WATER	SOIL/SOLID/SEDIMENT	NONAQUEOUS LIQUID (not including oil)	AIR	SLUDGE	OTHER	PRESERVATIVE	ID	REMARKS
STATION	DATE	TIME	GRAB	COMP												
	1/13/00	1030	X		00EEG0010-1			X							Sample JAR # 6	
	1/13/00	1048	X		00EEG0010-2			X							" "	7
	1/13/00	1115	X		00EEG0010-3			X							" "	8
	1/13/00	1130	X		00EEG0010-4			X							" "	9
															④ 4oz jar labeled	

SAMPLE KIT PREPARED BY: JACKSONVILLE      ORLANDO		DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
RELINQUISHED BY: (SIGNATURE) <i>RW Cope</i>		DATE 1/14/00	TIME 1300	RECEIVED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
RECEIVED BY: (SIGNATURE)		DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME
RECEIVED FOR LAB	BY: (SIGNATURE)	DATE	TIME	CUSTODY INTACT	ENCO LOG NO.	REMARKS			

Environmental Conservation Laboratories, Inc.  
Executive Park Court, Suite 211  
Orlando, Florida 32216-6069  
3007  
404/298-6210  
www.encolabs.com



DHHS Certification No. E82277

NT : SCRA-Environmental  
ESS: Enterprise Group  
1899 N. Hobson Ave. Bldg.3C  
N. Charleston, SC 29405-2106

REPORT # : JR1524  
DATE SUBMITTED: February 4, 2000  
DATE REPORTED : February 11, 2000

PAGE 1 OF 7

ATTENTION: Mr. Rusty Cope

**SAMPLE IDENTIFICATION**

Samples submitted and  
identified by client as:

PROJECT #: AOC 633

Charleston Naval Complex

02/01/00

- #1 - 00EEG0017-1 @ 11:15
- #2 - 00EEG0017-2 @ 15:23
- #3 - 00EEG0017-3 @ 10:15
- #4 - 00EEG0017-4 @ 12:08
- #5 - 00EEG0017-5 @ 14:20
- #6 - 00EEG0017-6 @ 11:40
- #7 - 00EEG0017-7 @ 11:20
- #8 - 00EEGC017-8 @ 15:08

MANAGER

*Scott D. Martin*  
\_\_\_\_\_  
Scott D. Martin

**ENCO LABORATORIES**  
**REPORT #** : JR1524  
**DATE REPORTED:** February 11, 2000  
**REFERENCE** : AOC 633  
**PROJECT NAME** : Charleston Naval  
 Complex

PAGE 2 OF 7

**RESULTS OF ANALYSIS**

<u>METHOD 8082 -</u> <u>Loclors</u>	<u>00EEG0017-1</u>	<u>00EEG0017-2</u>	<u>Units</u>
116/1242	4100 U D1	8000 U D2	µg/Kg
121	4100 U D1	8000 U D2	µg/Kg
132	4100 U D1	8000 U D2	µg/Kg
148	4100 U D1	8000 U D2	µg/Kg
154	4100 U D1	8000 U D2	µg/Kg
160	33000 D1	61000 D2	µg/Kg
<u>Rate:</u>	<u>% RECOV</u>	<u>% RECOV</u>	<u>LIMITS</u>
6-TCMX	*	*	55-152
ected alyzed	02/09/00	02/09/00	55-152
	02/09/00	02/10/00	

<u>PLANEOUS</u>	<u>METHOD</u>	<u>00EEG0017-1</u>	<u>00EEG0017-2</u>	<u>Units</u>
at Solids alyzed	SM2540G	81 02/06/00	82 02/06/00	†

arrogate recovery unavailable due to matrix interference.  
 ompound was analyzed for but not detected to the level shown.  
 nalysis is reported on a "dry weight" basis.  
 yte value determined from a 1:100 dilution.  
 te value determined from a 1:200 dilution.

ENCO LABORATORIES  
 REPORT # : JR1524  
 DATE REPORTED: February 11, 2000  
 REFERENCE : AOC 633  
 PROJECT NAME : Charleston Naval  
 Complex

PAGE 3 OF 7

RESULTS OF ANALYSIS

METHOD 8082 -  
 Troclors

	<u>00EEG0017-3</u>	<u>00EEG0017-4</u>	<u>Units</u>
016/1242	210 U D3	61 U	µg/Kg
221	210 U D3	61 U	µg/Kg
232	210 U D3	61 U	µg/Kg
248	210 U D3	61 U	µg/Kg
254	210 U D3	61 U	µg/Kg
260	1400 D3	61 U	µg/Kg
<u>Matrix:</u>	<u>% RECOV</u>	<u>% RECOV</u>	<u>LIMITS</u>
6-TCMX	*	34#	55-152
Extracted	02/09/00	31#	55-152
Analyzed	02/10/00	02/09/00	
		02/10/00	

<u>COLLEAGUES</u>	<u>METHOD</u>	<u>00EEG0017-3</u>	<u>00EEG0017-4</u>	<u>Units</u>
at Solids	SM2540G	80	54	t
Analyzed		02/06/00	02/06/00	

Surrogate recovery unavailable due to matrix interference.  
 Surrogate recovery outside of laboratory established limits.  
 Compound was analyzed for but not detected to the level shown.  
 Analysis is reported on a "dry weight" basis.  
 Analyte value determined from a 1:5 dilution.

## ENCO LABORATORIES

REPORT # : JR1524  
 DATE REPORTED: February 11, 2000  
 REFERENCE : AOC 633  
 PROJECT NAME : Charleston Naval  
 Complex

PAGE 4 OF 7

## RESULTS OF ANALYSIS

ETHOD 8082 -  
roclors

	<u>00EEG0017-5</u>	<u>00EEG0017-6</u>	<u>Units</u>
016/1242	8000 U D2	5500 U D1	µg/Kg
221	8000 U D2	5500 U D1	µg/Kg
232	8000 U D2	5500 U D1	µg/Kg
248	8000 U D2	5500 U D1	µg/Kg
254	8000 U D2	5500 U D1	µg/Kg
260	80000 D2	17000 D1	µg/Kg

<u>gate:</u>	<u>% RECOV</u>	<u>% RECOV</u>	<u>LIMITS</u>
6-TCMX	*	*	55-152
Extracted	02/09/00	02/09/00	55-152
Analyzed	02/10/00	02/09/00	

<u>LLANEIOUS</u>	<u>METHOD</u>	<u>00EEG0017-5</u>	<u>00EEG0017-6</u>	<u>Units</u>
nt Solids	SM2540G	82	60	%
Analyzed		02/06/00	02/06/00	

Surrogate recovery unavailable due to matrix interference.  
 Compound was analyzed for but not detected to the level shown.  
 Analysis is reported on a "dry weight" basis.  
 µg/Kg value determined from a 1:100 dilution.  
 µg/Kg value determined from a 1:200 dilution.

ENCO LABORATORIES

REPORT # : JR1524  
 DATE REPORTED: February 11, 2000  
 REFERENCE : AOC 633  
 PROJECT NAME : Charleston Naval Complex

PAGE 5 OF 7

RESULTS OF ANALYSIS

METHOD 8082 -  
 Trochloro

	<u>00EEG0017-7</u>	<u>00EEG0017-8</u>	<u>Units</u>
.016/1242	39 U	200 U D3	µg/Kg
.221	39 U	200 U D3	µg/Kg
.232	39 U	200 U D3	µg/Kg
.248	39 U	200 U D3	µg/Kg
.254	39 U	200 U D3	µg/Kg
.260	300	1300 D3	µg/Kg
<u>Spigate:</u>	<u>% RECOV</u>	<u>% RECOV</u>	<u>LIMITS</u>
6-TCMX	65	*	55-152
Extracted	131	*	55-152
Analyzed	02/09/00	02/09/00	
	02/10/00	02/10/00	

<u>ILLANEOUS</u>	<u>METHOD</u>	<u>00EEG0017-7</u>	<u>00EEG0017-8</u>	<u>Units</u>
ent Solids Analyzed	SM2540G	84 02/06/00	83 02/06/00	%

Surrogate recovery unavailable due to matrix interference.  
 Compound was analyzed for but not detected to the level shown.  
 Analysis is reported on a "dry weight" basis.  
 Analyte value determined from a 1:5 dilution.

## ENCO LABORATORIES

REPORT # : JR1524  
 DATE REPORTED: February 11, 2000  
 REFERENCE : AOC 633  
 PROJECT NAME : Charleston Naval  
 Complex

PAGE 6 OF 7

## RESULTS OF ANALYSIS

METHOD 8082 -  
roclors

.016/1242  
 .221  
 .232  
 .248  
 .254  
 .260

LAB BLANK

33 U  
 33 U  
 33 U  
 33 U  
 33 U  
 33 U

Units

µg/Kg  
 µg/Kg  
 µg/Kg  
 µg/Kg  
 µg/Kg  
 µg/Kg

gate:

6-TCMX

acted  
 Analyzed

% RECOV

101  
 95  
 02/09/00  
 02/09/00

LIMITS

55-152  
 55-152

Compound was analyzed for but not detected to the level shown.

## ENCO LABORATORIES

REPORT # : JR1524  
 DATE REPORTED: February 11, 2000  
 REFERENCE : AOC 633  
 PROJECT NAME : Charleston Naval  
 Complex

PAGE 7 OF 7

## QUALITY CONTROL DATA

<u>meter</u>	<u>% RECOVERY</u> <u>MS/MSD/LCS</u>	<u>ACCEPT</u> <u>LIMITS</u>	<u>% RPD</u> <u>MS/MSD</u>	<u>ACCEPT</u> <u>LIMITS</u>
<u>proclors</u> 221	90/ 94/107	8-127	4	49

Environmental Conservation Laboratories Comprehensive QA Plan #910190

- Less Than
- Matrix Spike
- Matrix Spike Duplicate
- Laboratory Control Standard
- Relative Percent Difference

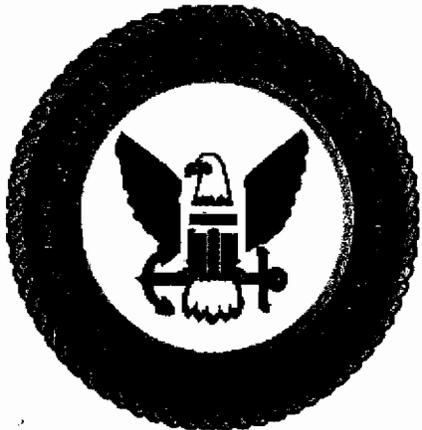
report shall not be reproduced except in full, without the written  
 of the laboratory. Results for these procedures apply only to  
 samples as submitted.





## **INTERIM STABILIZATION MEASURE**

**AREA OF CONCERN (AOC) 633  
CHARLESTON NAVAL COMPLEX  
CHARLESTON, SC**



Prepared for:

**DEPARTMENT OF THE NAVY  
SOUTHERN DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
CHARLESTON SC**

Prepared by:

**SOUTH CAROLINA RESEARCH AUTHORITY  
Environmental Enterprise Group  
1899 North Hobson Avenue, Bldg. 30  
North Charleston, SC 29405-2106**



Submitted by:

**Delphinus Engineering  
93 Monte Sano Drive  
Hanahan, SC 29406**

September 15, 2000

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

**TABLE OF CONTENTS**

<b><u>SECTION</u></b>	<b><u>PAGE</u></b>
COVER PAGE	
TABLE OF CONTENTS	i
ACRONYM LIST	ii
1.0 INTRODUCTION	1
2.0 WORK PLAN OBJECTIVE	1
3.0 WORK PLAN GUIDANCE	2
4.0 WORK PLAN IMPLEMENTATION	2
4.1 PHASE I:    PRE EXCAVATION WORK	2
4.2 PHASE II:   EXCAVATION AND DISPOSAL OF SOIL	3
4.3 PHASE III:  CONFIRMATION SAMPLING	3
4.4 PHASE IV:  WASTE MANAGEMENT AND DEMOBILIZATION	3
5.0 SUBMITTALS	4

**APPENDICES**

A. SITE HISTORY	A-1
B. SITE SPECIFIC HEALTH AND SAFETY PLAN (SSHSP)	B-1
C. SCHEDULE	C-1
D. SITE MAPS	D-1

---

Prepared by: Todd M. Dailey CHMM #9930

Approved by: Wayne Hardwick CSP #14,298  
EEG Safety and Health Director

Approved by: J. M. Starnell  
EEG Engineering Director

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

**ACRONYM LIST**

AOC	Area of Concern
BGS	Below Ground Surface
CFR	Code of Federal Regulations
CSAP	Comprehensive Sampling and Analysis Plan
CHASP	Comprehensive Health and Safety Plan
GI	Gastrointestinal
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	High Efficiency Particulate Air Filter
IM	Interim Measure
MSDS	Material Safety Data Sheet
NAVBASE	Naval Base
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyl
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PPE	Personnel Protective Equipment
ppm	Parts per million
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
ROC	Run of Crush
SCDHEC	South Carolina Department of Health and Environmental Control
SCE & G	South Carolina Electric & Gas
SCRA-EEG	South Carolina Research Authority-Environmental Enterprise Group
SHSO	Site Health and Safety Officer
SOP	Standard Operating Procedure
SDIV	Southern Division Naval Facilities Engineering Command
SSHSP	Site-Specific Health and Safety Plan
SUPSHIP	Supervisor of Shipbuilding, Conversion and Repair
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage and Disposal Facility
USN	United States Navy
µg/kg	Micrograms per kilogram

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

## **1.0 INTRODUCTION**

The Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report Zone G, dated 20 Feb 1998, for Naval Base Charleston (NAVBASE) has identified the area outlined in Figure 1 Appendix D as Area of Concern (AOC) 633. AOC 633 is the fenced area surrounding the electrical substation at Building 451C. It is located in Zone G at the Charleston Naval Complex and currently covered with 8-10" of run of crush (ROC). Building 451C is a two-room block structure with a concrete roof and floor, built in 1943. An energized electrical power station is mounted on concrete slabs south of the contaminated area. The original structure was demolished in the early 1970s leaving the foundation intact. Several high voltage switches, breakers and transformers were formerly located in the structure. In 1981 a large leak of 10C oil was reported at the site. In 1984 transformer 7105360 was removed and the 2280 gallons of 10C oil was disposed of appropriately. In 1989 an electrical transformer was destroyed by Hurricane Hugo and subsequently removed. No additional records of response actions have been found, however, information gathered from Naval Base Charleston fire department officials and site point of contact reported several incidences of possible Polychlorinated Biphenyl (PCB) releases. Currently one room of Building 451C holds two active banks of batteries that are supported by a cooling mechanism to prevent overheating. The environmental concern is PCB as Aroclor 1260 as stated in sections 7 and 10 of the Zone G Site Specific Evaluations Revision 0, dated 20 Feb 1998.

## **2.0 WORK PLAN OBJECTIVE**

The objective of this Interim Measure (IM) is to remove soils contaminated with PCBs at AOC 633 sample location 633SB007. The cleanup level for PCB contaminated soil will be < 1 part per million (ppm) which is the clean soil definition as specified by 40 Code of Federal Regulations (CFR) 761.125. This IM may not necessarily be the final remedial action taken at this site. Additional actions may be required as determined by the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) process. This IM is consistent with the ultimate cleanup of the site and is not intended to circumvent the public participation process inherent within environmental cleanup under RCRA.

Appendix A contains a description of the site including information on current conditions and past investigations. Appendix B provides the Site Specific Health and Safety Plan (SSHSP).

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

**3.0 WORK PLAN GUIDANCE**

This work plan will utilize and follow the guidance specified in the RFI Comprehensive Work Plan dated 30 August 1994. Work performed under this work plan is covered by the South Carolina Research Authority Environmental Enterprise Group (SCRA-EEG) Comprehensive Health and Safety Plan (CHASP). The CHASP is required to be on site as part of the official work plan prior to work commencing. The Project Safety and Health Officer has amended this work plan with "Site Specific" Health and Safety requirements (SSHSP Appendix B).

**4.0 WORK PLAN IMPLEMENTATION**

**4.1 PHASE I: Pre-Excavation Work**

**Secure Electrical Service** - Prior to excavation, the Palmetto Utility (NO CUTS) will be utilized to mark any existing underground utilities. SCE&G personnel will de-energize the substation and will remain on-site during all excavation work. Electrical power for affected tenants will be rerouted to other substations. Once the site is placed in a safe working condition, all safety precautions outlined in Appendix B shall be followed.

**Site Delineation** – In an effort to minimize the impact on SCE&G customers and waste disposal costs, SCRA-EEG determined it was necessary to perform delineation/confirmation sampling prior to excavation. EEG performed an initial round of subsurface sampling on 12 January 2000 to verify the contamination surrounding sample location 633SB007. Samples were collected using sample location 633SB007 as a center point and extended out at 10' intervals to 20' in four directions. The results indicated that the extent of PCB contamination was greater than originally thought and portions of the excavation contained PCB levels exceeding 50 ppm, requiring stricter disposal requirements. EEG performed a second round of sampling on 1 February 2000 to further define the extent of contamination. EEG notified the Southern Division (SDIV) Naval Facilities Engineering Command Technical Representative of these results in their Site Delineation Report For Charleston Naval Complex Area of Concern 633 Report dated 26 Feb 2000. SDIV determined the data was sufficient to define the extent of contamination for removal. The sample locations and PCB concentrations are shown in Figure 2 of Appendix D.

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

**4.2 PHASE II: Excavation and Disposal of Soil**

ROC will be removed from the designated excavation area and stockpiled for reinstallation after satisfactory confirmation sample results are received.

SCRA-EEG trained personnel will excavate the area defined in Figure 2 of Appendix C utilizing earth-moving equipment. This excavation area consists of approximately 60 tons of soil containing > 50 ppm PCB and 180 tons of soil containing > 1 ppm but < 50 ppm PCB. Excavation will continue to a depth of 5 feet (approximate depth to groundwater) or until the cleanup objective of < 1 ppm PCB in soil has been met. The excavated soil will be directly loaded for transport to the approved Treatment, Storage and Disposal Facility (TSDF) facility for disposal

Any groundwater that requires removal will be placed in 55 gallon drums and sampled for RCRA IX Metals, BTEX, naphthalene, PCB, pH, and Oil & Grease.

**4.3 PHASE III: Confirmation Sampling**

Confirmation samples will be analyzed to confirm PCB removal to the levels specified in paragraph 2 of this IM. The discrete grab samples collected previously collected for delineation as well as 3 additional second interval sidewall samples will be used as the horizontal perimeter confirmation samples. Five discrete grab samples taken from the bottom of the excavation will be used as the vertical confirmation samples. All sampling will be performed in accordance with the Comprehensive Sampling and Analysis Plan (CSAP). Sample locations are shown in Figure 2 of Appendix D.

**4.4 PHASE IV: Waste Management and Demobilization**

The excavated soils will be characterized in accordance with South Carolina Hazardous Waste Management Regulations (Section SCDHEC R.61-79.261) and disposed of in accordance with all applicable regulations and permits. Soil that is characterized as non-hazardous <sup>( < 1 ppm )</sup> will be sent to a Subtitle D landfill or approval for recycling will be obtained from the Waste Assessment Division of South Carolina Department of Health and Environmental Control (SCDHEC). Soil that is characterized as hazardous <sup>( > 1 ppm )</sup> will be sent to a permitted Treatment, Storage and Disposal Facility (TSDF) for proper disposal. PCB contaminated waste will be disposed of at a Toxic Substances Control Act (TSCA) facility in accordance with 40 CFR 761.60 and 761.70.

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

Demobilization will include removing from the job site all construction equipment, materials, tools, and supplies used to accomplish this IM. Decontamination of tools and equipment will be conducted in a designated area using the guidelines specified in the CHSAP.

All excavations will be back filled and graded with clean fill and ROC. The area will be left in a clean condition upon completion of all operations.

## **5.0 SUBMITTALS**

A final report will be submitted within 90 days after Southern Division Facilities Engineering Command agrees the IM at the site is completed (review of Data and Walk-through is performed). This report will summarize actions taken and report the following:

- excavated volumes
- nature of waste generated
- waste disposal
- sampling evolutions and sample results
- site photographs
- site condition following completion of work
- plan modification and any other data requested by agencies involved
- problems encountered and any other information that could be helpful in the remediation, closure or reuse of the site.

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

**APPENDIX A  
SITE HISTORY**

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

**1.0 SITE HISTORY**

Past sampling investigation documented that a PCB release occurred at the site. Records indicate that during the Zone G Resource Conservation Recovery Act (RCRA) Facility Investigation (RFI) the Environmental Clean Contractor, "EnSafe," performed soil sampling that identified PCBs, in the form of Aroclor-1260, as the contaminant of concern. The contaminant Aroclor-1260 was detected at surface soil location 633SB001 (480 µg/kg) and subsurface soil location 633SB007 (25,000 µg/kg). Sample location 633SB007 exceeds the soil screening level of 1,000 µg/kg. The RFI report does not identify any other contaminants of concern. The current use of the location supplies electrical power to tenants south of the location. This creates a potential worker electrical hazard during removal actions. Abandoned electrical cables exist underground within concrete duct bank enclosures. Some ROC shifting has occurred during past disturbance activities.

**1.1 Site Geology/Hydrogeology**

The detailed stratigraphy at AOC 633 could not be determined since no monitoring well borings were completed within this area. Geologic data for monitoring well boring FDS07B (installed during the investigation of the Fuel Distribution System), approximately 315 feet east of AOC 633, is presented. The stratigraphy at this location consists of silty, gravelly, medium to coarse sand overlying organic silty clay. The silty clay was encountered near the total depth of the boring, occurring below 10 ft bgs. Based on the hydrologic data gathered from FDS07B, the ground water elevation at AOC 633 is approximately 4.5 feet msl. Shallow groundwater flows generally to the north in the direction of the Cooper River.

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

**APPENDIX B**

**SITE SPECIFIC HEALTH AND SAFETY PLAN (SSHSP)**

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

**SITE SPECIFIC HEALTH AND SAFETY PLAN**

*SEE AMENDMENT 1 AT THE END OF THIS APPENDIX*

*T.M. Daily, EEG PROGRAM MANAGER 9/20/2000*

**1. PURPOSE:**

This plan provides supplemental site-specific information, and is to be used in conjunction with the Project Operations Plan For Site Investigations and Remedial Investigations dated August 1997, and the Detachment Comprehensive Health and Safety Plan (CHASP).

**2. SITE DESCRIPTION, HAZARDS, and BACKGROUND:**

AOC 633, an energized substation situated east of Building 451C. The topography of the area is level and open air.

**3. WORK SCOPE BRIEF (REFER TO THE WORK DOCUMENT FOR FULL BRIEF:**

The subsurface contaminated areas will be excavated to a depth of 5 feet. Excavated soils will be placed directly into trucks for transportation to a TSDf for disposal at a subtitle D landfill. Disposal trucks will be staged on 6-mil plastic to protect the area against soil spills. Spills of contaminated material will be cleaned up immediately.

**4. HAZARDS:**

The primary health hazard is exposure to PCB contaminated soils generated by dirt removal actions. Removal of the soil may create a contact and/or respiratory hazard.

**Aroclor 1260** is a polychlorinated biphenyl (PCB). PCBs are toxic chemicals belonging to the chlorinated hydrocarbon group and are of concern due to their persistence in the environment and the tendency to accumulate in the food chain. They range in form from oily liquids to hard solids and transparent resins. The health effect for workers who have a long history of prolonged skin contact is chloracne, a skin eruption disorder. Studies have shown the potential for problems in the liver and pancreas. PCBs are fat-soluble and accumulate in fat cells. In normal temperatures, PCBs do not evaporate into the air. A major route of entry is ingestion by improper hand to mouth work practices. Another concern is the need to prevent the spread of PCBs outside the area of contamination.

**Safety hazards include:**

- Heat stress
- Traffic
- Personal injury risks during operation of excavation equipment
- The dangers of possible above ground or underground electrical wiring
- Excavation and trenching hazards
- Electrocution hazards from power distribution equipment

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

The risk for chronic exposure is very low due to the open-air area, and the relatively short work duration at the site. Risk of acute exposure is also minimal due to the low contaminant levels and the fact that PCBs are not readily volatile. The primary health hazard is ingestion of PCBs from incorrect work habits, or from ingestion of soil which contains PCBs.

**5. PERSONAL PROTECTIVE EQUIPMENT:**

The minimum PPE required for general work is hard hat, safety shoes/boots, hearing protection, and safety glasses. These choices are based on a personal protective equipment assessment of the hazards normally present at construction sites such as impact, compression/crushing, material handling, flying objects, use of heavy equipment, and noise. Wear nitrile gloves, protective coveralls (either tyvek or cloth) and shoe covers, steel-toe boots, and booties when exposed to soil being excavated. If splashing is possible, wear a face shield or a full-face respirator. Industrial hygiene monitoring will be performed. Avoid contact with ground water.

Use of a minimum of a half-mask respirator with an organic vapor and P100 filter is required. Respiratory protection is required for:

- working with or near the soil excavation if PID readings in the breathing zone in excess of 5 ppm PID units are obtained for greater than 10 minutes (and can not be eliminated by use of ventilation)
- if dust is present (and can not be eliminated by working upwind or misting with water)

Change the organic vapor respirator cartridge after every day of use. IF PID units over 500 ppm continuous are measured, evacuate immediately and assess the situation.

Additional care in work practices, area access controls and equipment decontamination should be exercised due to the need to avoid any spread of PCBs. If protective clothing and equipment are not removed at the worksite for cleaning or disposal, provide a changing area with separate lockers for protective clothing/equipment and for street clothing to prevent cross contamination.

Employees may not wear or carry home PPE used during the work shift. Employees must wash their hands and face at the end of each work shift.

Hearing protection is required when operating noise hazardous equipment.

**6. SPECIAL PERSONNEL TRAINING QUALIFICATIONS:**

Hazwoper training (40 hour initial with 8 hour annual refresher), and depending on the planned work, respiratory protection training with fit test, fall protection, excavation standard, forklift operation, lockout/tagout, and heavy metals worker training. Crane and heavy equipment operators must be licensed for the equipment being operated.

These requirements are applicable to visitors also. Visitors must certify by their signature in the work logbook that they meet the required training.

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

**7. OCCUPATIONAL SAFETY AND HEALTH PRECAUTIONS:**

Prior to the start of work, the area must be checked for the presence of above or below ground electrical, sewage, telephone or water utilities if they will be endangered by the planned work. They must be marked and secured by lockout/tagout if they will be endangered by work operations. Inspect the area for the presence of overhead power lines, or poles that may be undermined by digging. Comply with the EDC SOP for lockout/tagout of electrical services if they endanger the work, and inspection of power poles and prohibition of digging near power poles. The substation will be de-energized prior to the start of excavations by qualified SCE & G personnel.

Excavation sites may become a trip/fall hazard (especially at night), and may also be an attractive nuisance for children. For both reasons sites should be secured (e.g. by barrier fencing) at night or when not being worked, and when work is completed, filled or the excavation edges are graded.

The excavations created will become confined spaces if they exceed four feet in depth. They will not be entered in this work and will require gas testing and an entry permit if entry is needed. Excavation depths of 5 feet or greater must comply with the requirements of OSHA 29 CFR 1926.650 and 651 for trenching and excavation.

For excavations where personnel entry is required, a "Competent Person" for excavation oversight must be designated, in writing (e.g. by making a log entry). This person will have been trained in the requirements of 29 CFR 1926.650/651/652 (The Construction Excavation Standard). This duty may be rotated among trained personnel, but only one person at a time is designated the competent person. Duties include:

- Identifying existing and predictable employee excavation hazards, and being authorized to take prompt corrective measures to eliminate those hazards
- Ensuring compliance with the excavation standard Detachment policy that all soils are to be classified as Type "C", and sloping/shoring/trench boxes will be used where needed
- Daily inspections prior to work or entry, and after rainstorms
- Being present at the site whenever employees enter an excavation over 5 feet deep
- Answering questions by regulators about compliance with the excavation standard during regulator inspections
- Informing EDC Project Team if excavation exceeds 5 feet in depth

During excavation, be alert to the discovery of containers or drums, utility lines especially power or sewer, and changes in the color or smell of the soil which could indicate past spills. Stop work, monitor with the PID, and evaluate if unknown conditions are encountered.

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

If excavation work encounters ground water avoid contact with the ground water.

Strict entrance and exit controls should be maintained for each worksite to avoid spread of PCBs. Protection from traffic should be provided e.g. by blocking vehicle access or by use of warning cones. Truck drivers should exit trucks during loading.

If desirable to ventilate, use an exhaust blower to ventilate the excavation after reaching a depth of about three feet. Exhaust downwind and away from personnel and occupied buildings. Ensure generators and other engine equipment used to power the blower should not discharge exhaust gas into the excavation. A good work practice is to stay upwind of dust produced. If dust is evident during work, use a light water mist to eliminate the dust or move the equipment upwind.

If protective clothing and equipment (PPE) are not removed at the worksite for cleaning or disposal, provide a changing area with separate lockers for protective clothing/equipment and for street clothing to prevent cross contamination. Ensure facilities for washing face and hands are available to employees. Employees must wash their hands and face prior to eating or smoking and at the end of the work shift before going home. PPE worn during the work shift may not be worn home. Use of bug repellent and sun tan oil is suggested.

Monitoring will be performed for organic vapors using a PE Photovac PID Model 2020, or equivalent with a 10.6 eV tube. Combustible gas indicators, indicator tubes and passive dosimetry badges may also be used.

Use the emergency numbers and routes of Attachment A. Notify Detachment supervision of all injuries, including symptoms of health effects.

**8. Material Safety Data Sheet:**

MSDS for PCB will be in the official work plan folder.

**9. MEDICAL SURVEILLANCE:**

Hazardous waste worker (B27), Hearing Conservation (C2), and for Respirator (A10).

**10. TRAINING AND MEDICAL RECORDS:**

Training and medical documentation for on sit workers will be placed in the job folder.

**11. EMERGENCY PROCEDURES:**

**Notification-**

If any situation or unplanned occurrence requires outside emergency assistance, immediately call the following:

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

Fire Department	Phone 911
Police Department	Phone 911
Ambulance	Phone 911

As soon as practical, the following personnel should be appraised of the situation:

Project Manager  
Project Leader  
EDC Occupational Health and Safety Specialist and Health and Safety Officer

### **Site Resources-**

The Project Supervisor will have a two-way radio and cellular phone on site for routine and emergency communication/coordination with EDC personnel. First aid, eyewash, hand/face washing equipment and toilet facilities will be available at the work site.

### **Pre-Emergency Planning**

During the site briefing, all employees will be reminded of provisions of the emergency response plan, communication systems, and evacuation routes.

### **Emergency Procedures**

In case of an emergency, which necessitates the evacuation of the site, the following procedures shall be followed:

- a) Activate alarms as designated by the Site Specific Health and Safety Plan (SSHSP).
- b) Immediately proceed to a pre-determined assembly area (relocated if necessary) and remain there until instructed to do otherwise.
- c) Use planned escape routes. Escape routes will be planned for each site.
- d) In the event that an individual experiences effects or symptoms of exposure while on site, personnel will immediately halt work and act according to the instructions provided by the Project Supervisor or, in his/her absence, the Site Health and Safety Officer (SHSO).
- e) For applicable site activities wind indicators will be used to continuously indicate upwind, preferred escape routes, from downwind routes.
- f) Investigate conditions(s) suggesting site conditions may be more hazardous than anticipated. The condition observed and the decisions made shall be recorded in the SSHSP. If there are any doubts about how to proceed, suspend work and back away from the work area until the SHSO has evaluated the situation and provided the appropriate instructions.
- g) If an individual suffers personal injury, if the situation indicates, the SHSO will call the N. Charleston Fire Department or ambulance at (911). Next, alert appropriate emergency response agencies as the situation dictates.

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

- h) If an individual suffers chemical exposure, the affected areas should be flushed immediately with copious amounts of clean water and, if the situation dictates, the SHSO should alert appropriate emergency response agencies, or personally ensure the exposed individual is transported to the nearest medical treatment facility for prompt treatment. (A-8 Map of Emergency Medical Facility Route)
- i) If available, additional information on appropriate chemical exposure treatment methods will be provided through the MSDS and should be provided to medical assistance authorities.

**Nearest Medical Assistance**

For non-emergency medical services, utilize Roper North Hospital located on 2750 Speissegger Drive, N. Charleston, SC. The phone number at the facility is (843) 744-2110. The Emergency Room number is (843) 745-2787. A map showing the site and the route to the medical facility is included in this appendix.

**EMERGENCY TELEPHONE NUMBERS**

Environmental Detachment Charleston, (Bobby Dearhart Manager)	843-743-2821 (ext. 131)
USEPA Environmental Response Team	1-800-642-9999
Fire/Police/Ambulance (Dispatcher)	911
Poison Control Center	1-800-292-6678
Caretaker Safety Officer	1-800-430-6930

**HOSPITAL INFORMATION**

**FOR ALL LIFE THREATENING MEDICAL EMERGENCIES:**

**CALL COUNTY EMS**

**911**

**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

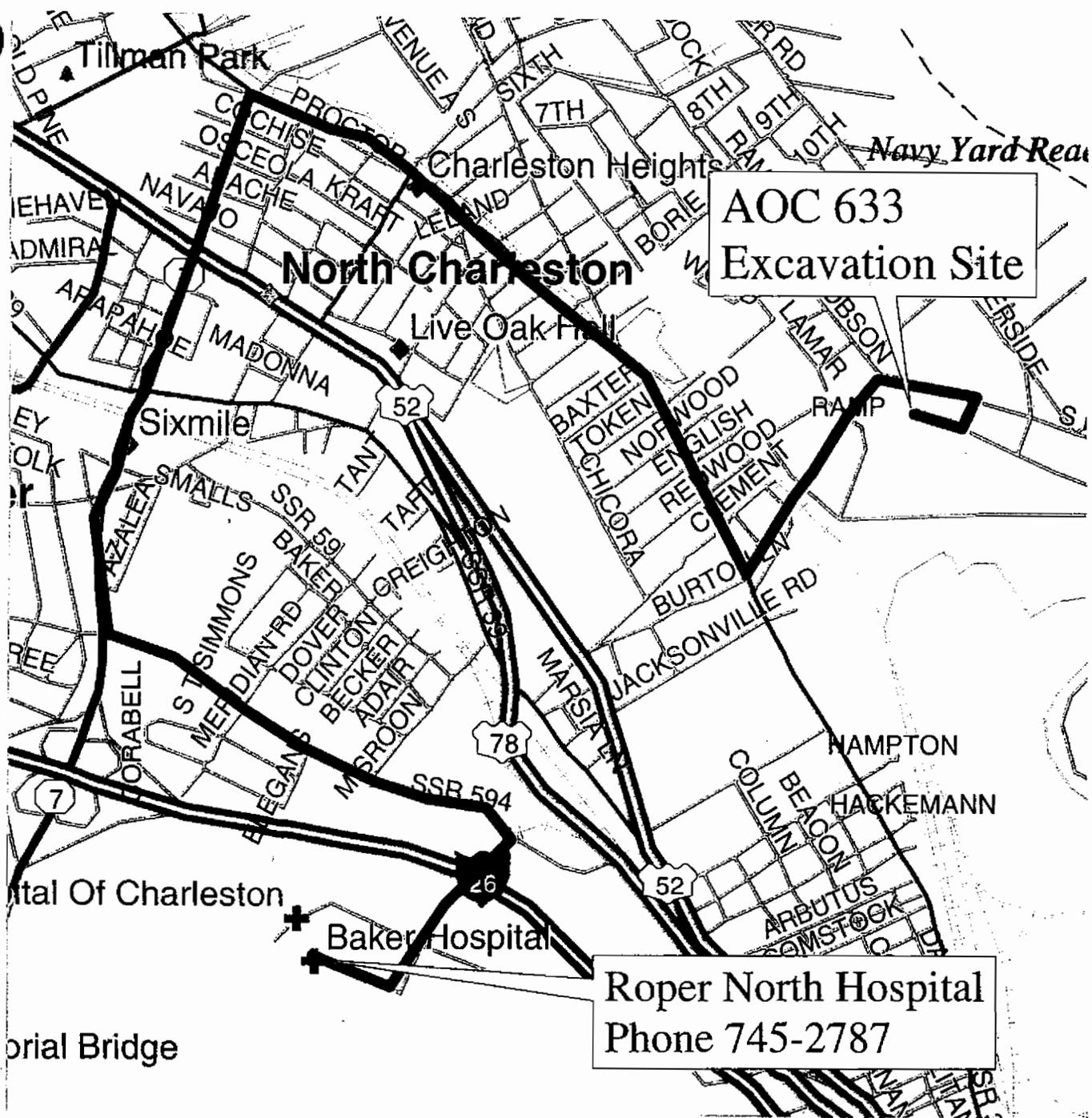
---

**NEAREST HOSPITAL IS:**

**ROPER NORTH HOSPITAL  
2750 SPEISSEGGER DRIVE  
NORTH CHARLESTON, SOUTH CAROLINA**

**Emergency Room Telephone Number: (843) 745-2787  
General Information Number: (843) 744-2110  
Ambulance: 911**

INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL



Directions to Roper North

1. Take South Hobson to the Via Duct Gate Rd. – Turn left onto Via Duct Rd.
2. Via Duct Gate to Spruill Ave. – Turn right onto Spruill
3. Spruill Ave. to Cosgrove Ave. (Hwy 7) – Turn left on to Cosgrove Ave.
4. Cosgrove to Azalea Ave. (SSR SSR 594 ) – Turn left onto Azalea Ave.
5. Azalea Ave. to Baker Hospital Rd. – Turn right onto Baker Hospital Rd.
6. Baker Hospital Rd. turns into Speissegger Dr. – Roper North on left.

The following is an amendment to the SSHP for the SCRA-EEG Work Plan-Interim Measure for AOC 633 dated June 22, 1999. The following amendments are applicable:

**1. Correction for Section 5 (PPE):**

In paragraph 3, the 500-PPM number given should be 50 PPM. The PID readings are to monitor for any possible unexpected Volatile Organic Compounds.

**2. New Additional Paragraphs Applicable to Section 7:**

**7A- Confined Space Entry:**

Confined Space entry will not be performed during this work. This prohibits personnel entry into any excavation over four feet deep. Sampling will be done by use of the equipment bucket.

**7B- Contact with Groundwater-**

If groundwater is found in the excavations, "bottom" samples will be taken just above the groundwater.

**7C - Decontamination:**

Decontaminate equipment (as needed) before exiting the work zones. Decontamination will be performed by wiping, sweeping, and/or scrubbing with water if needed to remove oil, or oily dirt, sand and mud from coveralls, gloves, boots and tools and equipment. Minimize the use of water. Water used for decontamination will be captured and properly marked and disposed of.

All employees leaving a contaminated area shall be appropriately decontaminated; all contaminated clothing and equipment leaving a contaminated area shall be appropriately disposed of or decontaminated.

Decontamination procedures shall be monitored by the Site Safety and Health Officer to ensure compliance with this procedure, and to take corrective actions if necessary.

**7D - Spill Containment Procedure**

**General**

Waste at this site consists of PCB contaminated soil and rinsate from cleaning plastic sheeting and PPE.

### **Contaminated Soil**

Excavations will be planned, on site, by the Project Manager. Movement of trucks and excavating equipment will eliminate or minimize loading or movement over clean ground. All equipment will be decontaminated prior to leaving the work site. Decontamination will be on plastic drop cloths. Drop cloths will be properly disposed of as waste.

All waste containers will be inspected and properly marked prior to use. There will be no unmarked waste containers on this site. They will be marked with the proper identifying/shipping labels or marked "empty".

The Project Manager will determine, prior to pumping/cleaning, the estimated quantity of waste, and the most suitable location for waste containers. The waste containers will be placed in an area that will minimize the possibility of damage or overturning by mechanized equipment. The location will be covered with plastic drop cloths capable of containing the entire quantity of waste. A suitable quantity of sorbent materials will be on site to aid containment and cleanup if necessary.

### **7E- Electrical Safety**

In lieu of securing the switching station power as outlined in paragraph 2 of Section 7, the electrically energized side of the station may be isolated from the excavation side by erecting a temporary fence. The location of the fence will be as directed by the Power Company. During fence work, do not enter the energized station side of the fence. During fence post installation, or any other excavation, if grid-grounding wires are found, stop work and notify the Power Company for resolution.

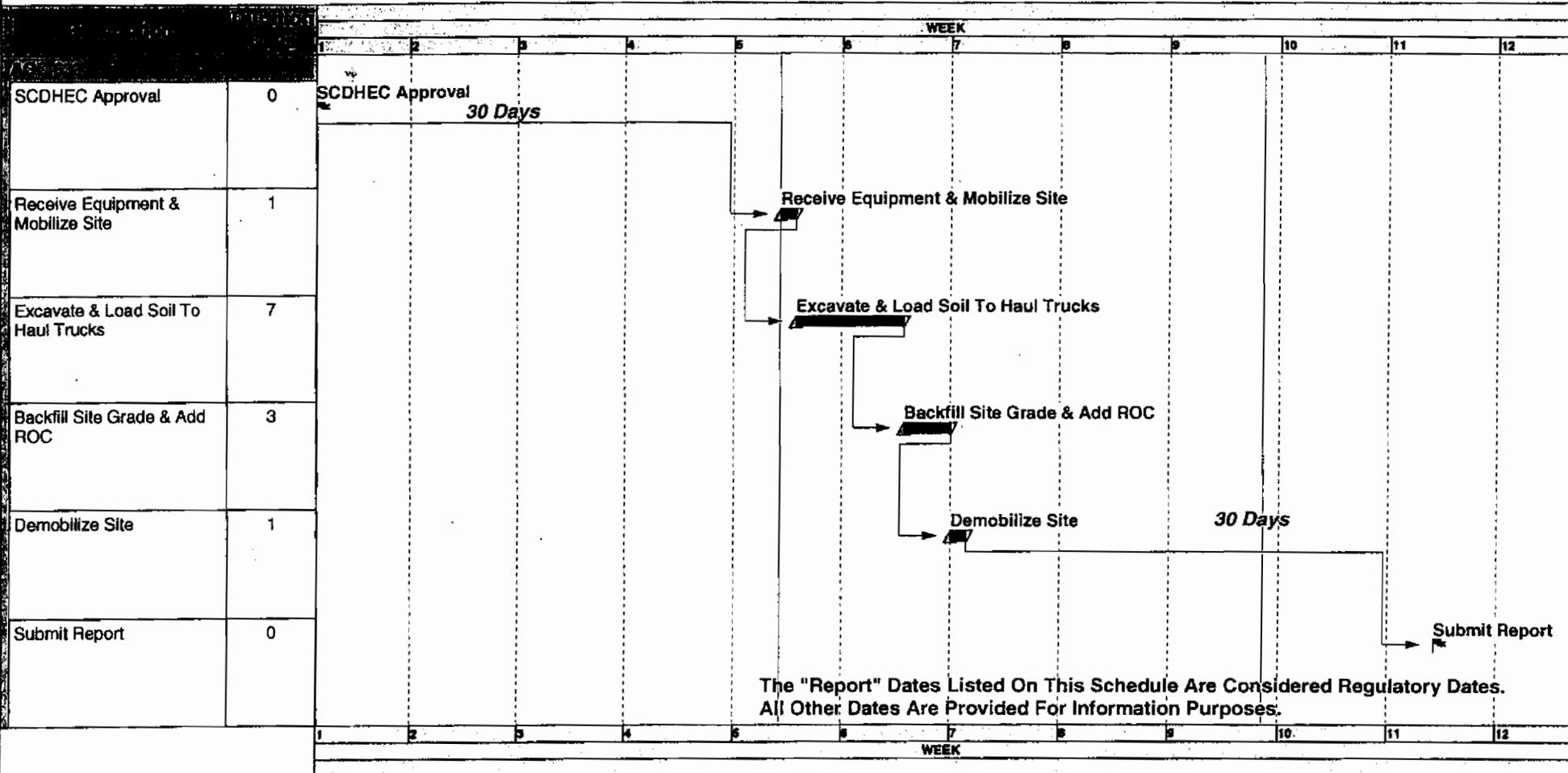
**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

**APPENDIX C**

**SCHEDULE**

**ENVIRONMENTAL DETACHMENT  
CHARLESTON SC**



Data date	01JUN99
Run date	21JUN99
Page number	1A
© Primavera Systems, inc.	

**AOC 633  
PCB CONTAMINATED SOIL REMOVAL  
Appendix ( C-1 )**

- Early bar
- ▲ Early start point
- ▼ Early finish point
- ▬ Progress bar
- ▬ Critical bar
- Summary bar
- Start milestone point
- Finish milestone point

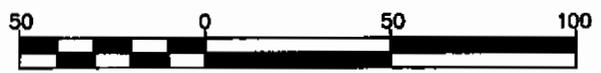
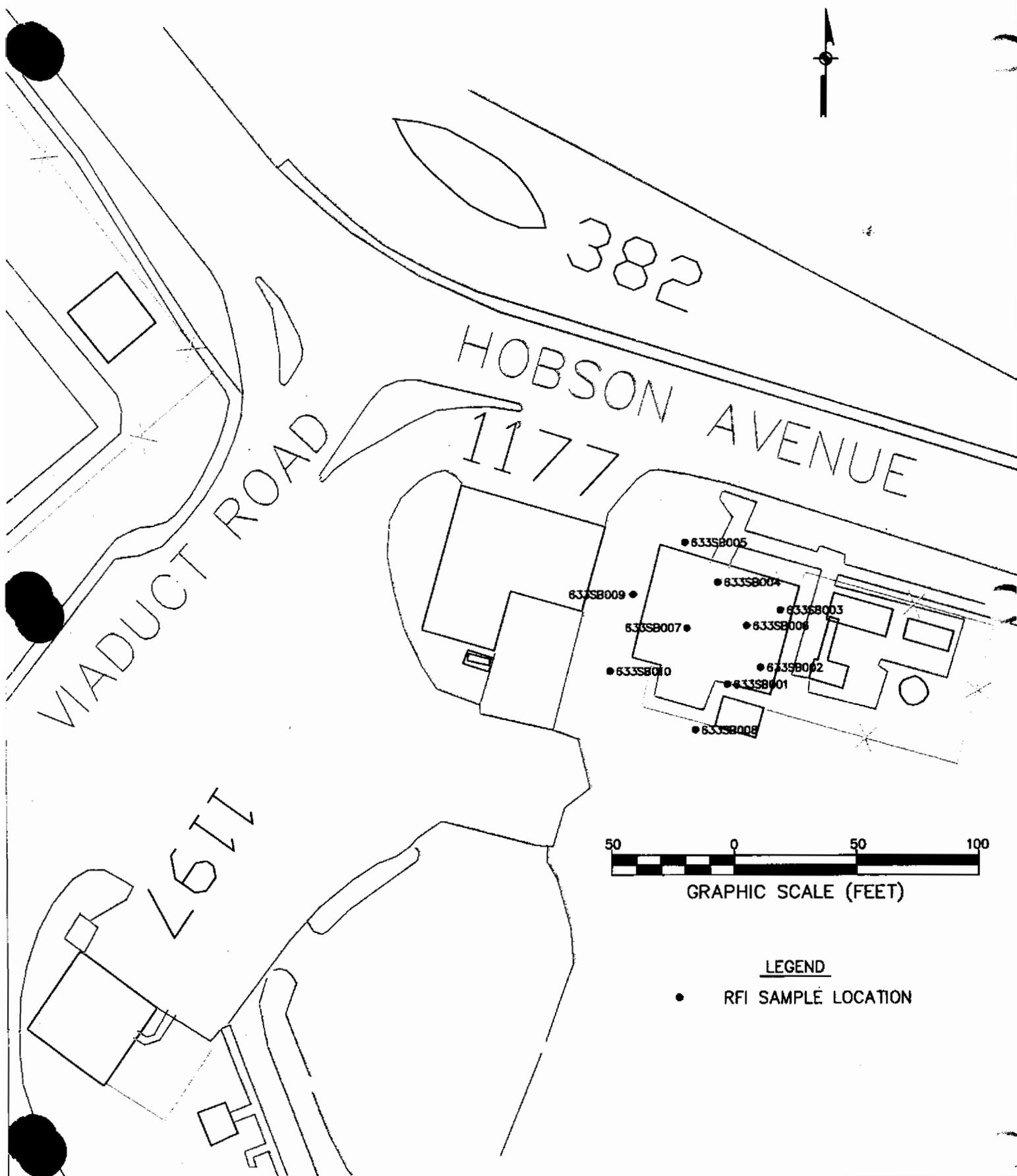


**INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL**

---

**APPENDIX D**

**SITE MAP**



GRAPHIC SCALE (FEET)

LEGEND

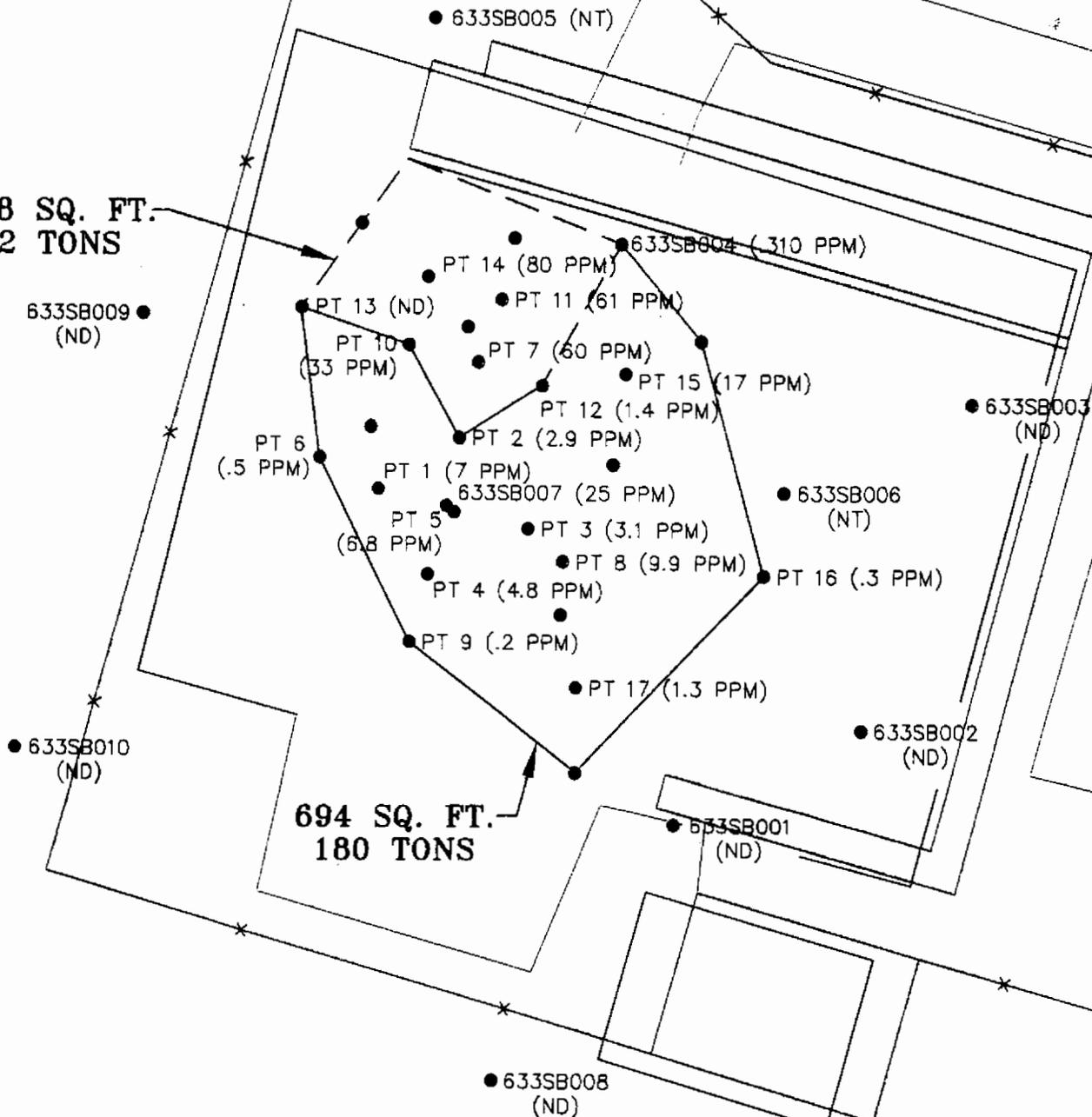
- RFI SAMPLE LOCATION

**AOC 633 (451-C)**



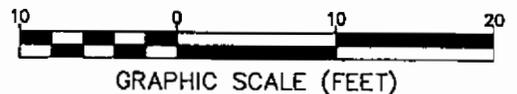
238 SQ. FT.  
62 TONS

694 SQ. FT.  
180 TONS



**LEGEND**

- SAMPLES PERFORMED FOR PCB DELINEATION
- RFI SAMPLE LOCATION
- DELINEATION AND CONFIRMATION SAMPLES AFTER EXCAVATION



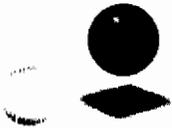
**AOC 633 (451-C)**

INTERIM STABILIZATION MEASURE  
AOC 633  
ZONE G PCB CONTAMINATED SOIL REMOVAL

---

**ADDENDUM**

For purposes of clarity, the Environmental Detachment Charleston (DET) working under Supervisor of Shipbuilding, Conversion and Repair, USN, Portsmouth VA, Command has transitioned and is now South Carolina Research Authority, Environmental Enterprise Group (EEG). The personnel, work plans, standing directives, training, and comprehensive sampling and safety plans remain intact, therefore no changes to the approved work plan for this interim measure have been made.



**CH2MHILL**

**CH2M HILL**

3011 S.W. Williston Road

Gainesville, FL

32608-3928

Mailing address:

P.O. Box 147009

Gainesville, FL

32614-7009

Tel 352.335.7991

Fax 352.335.2959

September 24, 2001

Mr. David Scaturro  
Division of Hazardous and Infectious Wastes  
South Carolina Department of Health and  
Environmental Control  
Bureau of Land and Waste Management  
2600 Bull Street  
Columbia, SC 29201

Re: Interim Measure Work Plan (Revision 0) – AOC 633, Zone G

Dear Mr. Scaturro:

Enclosed please find four copies of the Interim Measure Work Plan (Revision 0) for AOC 633 in Zone G of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

The principal author of this document is Bill Elliott. Please contact him at 352/335-5877, extension 2477, if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

cc: Rob Harrell/Navy, w/att  
Gary Foster/CH2M HILL, w/att

# INTERIM MEASURE WORK PLAN

## Subsurface Soil Removal AOC 633, Zone G



***Charleston Naval Complex  
North Charleston, South Carolina***

SUBMITTED TO  
***U.S. Navy Southern Division  
Naval Facilities Engineering Command***

PREPARED BY  
***CH2M-Jones***

*September 2001*

*Revision 0  
Contract N62467-99-C-0960  
158814.ZG.PR.03*

# 1 Contents

---

2	<b>Acronyms and Abbreviations</b> .....	v
3	<b>1.0 Introduction</b> .....	1-1
4	1.1 Purpose of the IM Work Plan.....	1-1
5	1.2 Site Background and Setting .....	1-1
6	1.3 Organization of the IM Work Plan .....	1-2
7	Figure 1-1 Aerial Photo of AOC 633, Zone G .....	1-3
8	<b>2.0 Previous Investigations</b> .....	2-1
9	2.1 Description of Previous Investigations.....	2-1
10	2.2 Development of Media Cleanup Standard for Subsurface Soil .....	2-2
11	2.3 Summary .....	2-2
12	Table 2-1 Surface Soil PCB Detections .....	2-3
13	Table 2-2 Subsurface Soil PCB Detections.....	2-4
14	Table 2-3 SSL Calculation .....	2-5
15	Figure 2-1 Soil Sample Locations .....	2-6
16	<b>3.0 Technical Approach</b> .....	3-1
17	3.1 Delineation/Confirmation Sample Collection .....	3-1
18	3.2 Soil Sample Analysis .....	3-2
19	3.3 Soil Removal .....	3-2
20	3.4 Site Restoration.....	3-3
21	3.5 Reporting.....	3-3
22	Table 3-1 Aroclor-1260 Analytical Results for Subsurface Soil Samples .....	3-4
23	Figure 3-1 Excavation Area .....	3-6
24	Figure 3-2 Proposed Delineation Sample Locations .....	3-7
25	<b>4.0 Investigation-Derived Waste</b> .....	4-1
26	<b>5.0 References</b> .....	5-1

# 1 **Acronyms and Abbreviations**

---

2	AOC	area of concern
3	BRAC	Base Realignment and Closure Act
4	CA	corrective action
5	CNC	Charleston Naval Complex
6	COC	chemical of concern
7	COPC	chemical of potential concern
8	CSAP	Comprehensive Sampling and Analysis Plan
9	DET	Environmental Detachment Charleston
10	DMP	Data Management Plan
11	DQO	Data Quality Objective
12	EEG	Environmental Enterprise Group
13	EnSafe	EnSafe Inc.
14	EPA	U.S. Environmental Protection Agency
15	ft <sup>3</sup>	cubic feet
16	ft bls	feet below land surface
17	IDW	investigation-derived waste
18	IM	interim measure
19	mg/kg	milligram per kilogram
20	NAVBASE	Naval Base
21	NFA	no further action
22	PCB	polychlorinated biphenyl
23	QAP	Quality Assurance Plan
24	RCRA	Resource Conservation and Recovery Act
25	RFI	RCRA Facility Investigation
26	SCDHEC	South Carolina Department of Health and Environmental Control
27	SSL	soil screening level

**Section 1.0**

---

# 1 1.0 Introduction

---

2 In 1993, Naval Base (NAVBASE) Charleston was added to the list of bases scheduled for  
3 closure as part of the Defense Base Realignment and Closure Act (BRAC), which regulates  
4 closure and transition of property to the community. The Charleston Naval Complex (CNC)  
5 was formed as a result of the dis-establishment of the Charleston Naval Shipyard and  
6 NAVBASE on April 1, 1996.

7 CNC Corrective Action (CA) activities are being conducted under the Resource Conservation and  
8 Recovery Act (RCRA); the South Carolina Department of Health and Environmental Control  
9 (SCDHEC) is the lead agency for CA activities at the site. All RCRA CA activities are performed  
10 in accordance with the Final Permit (Permit No. SC0 170 022 560).

11 In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation  
12 and remediation services at the CNC. This submittal has been prepared by CH2M-Jones to  
13 document the basis for an Interim Measure (IM) Work Plan at Area of Concern (AOC) 633  
14 in Zone G of the CNC.

## 15 1.1 Purpose of the IM Work Plan

16 This IM Work Plan presents a technical approach for the removal of soils containing  
17 polychlorinated biphenyls (PCBs) from an electrical substation known as AOC 633, located  
18 in Zone G of the CNC. The limited removal of the subsurface soils exceeding the site-  
19 specific soil screening level (SSL) of 15.4 milligrams per kilogram (mg/kg) will eliminate  
20 the potential for migration of contaminants from this site. This excavation work will be  
21 performed, documented, and reported in a manner consistent with the investigative and  
22 corrective action goals and requirements of the existing RCRA permit for the facility.

## 23 1.2 Site Background and Setting

24 AOC 633 is located near Building 451C, an electrical substation built in 1943. Figure 1-1  
25 provides an aerial view of the site. Building 451C is a block structure with a concrete roof  
26 and floor. Several high voltage switches, breakers, and transformers are located in the two-  
27 room block structure. The site contains several steel enclosures on concrete slabs and  
28 foundations from earlier buildings. In 1989, an electrical transformer at this substation was  
29 destroyed by Hurricane Hugo. Several historical PCB releases have been reported for this  
30 site, including a large leak of 10C oil in 1981. No remedial activities were known to have

1 occurred at this site prior to commencement of the Zone G RCRA Facility Investigation  
2 (RFI) performed in 1997.

### 3 **1.3 Organization of the IM Work Plan**

4 This IM Work Plan consists of the following sections, including this introductory section:

5 **1.0 Introduction** — Presents the purpose of the IM Work Plan and background information  
6 regarding the site.

7 **2.0 Previous Investigations** – Provides a brief description of previous investigations at  
8 AOC 633.

9 **3.0 Technical Approach** — Provides a brief description of the technical approach for  
10 completing the soil removal and soil disposal.

11 **4.0 Investigation-Derived Waste** — Describes the procedures to be implemented for  
12 management of investigation-derived waste (IDW).

13 **5.0 References** — Lists the references used in this document.

14 All tables and figures are at the end of their respective sections.

NOTE: Aerial Photo Date is 1997  
NOTE: Original figure created in color



-  AOC Boundary
-  Buildings
-  Roads
-  Fence
-  Pavement



0 50 100 Feet

**Figure 1-1**  
Aerial Photo  
AOC 633, Zone G  
Charleston Naval Complex

**CH2MHILL**



## 2.0 Previous Investigations

---

### 2.1 Description of Previous Investigations

Several soil investigations were conducted at AOC 633. These investigations resulted in numerous soil samples being collected at the site. The locations of the samples collected at AOC 633 are presented in Figure 2-1. Summaries of the surface and subsurface analytical results for PCBs are provided in Tables 2-1 and 2-2, respectively.

An RFI was conducted in 1997 and 1998 to investigate the nature and extent of any environmental contamination at the site, and recommend whether additional site activities such as corrective actions would be required to eliminate or minimize unacceptable risks to human health or the environment. Results of the RFI identified Aroclor-1260 as the only chemical of potential concern (COPC) driving risk, and did not identify any chemicals of concern (COCs), or unacceptable risk. The site was recommended for No Further Action (NFA).

The *Zone G RFI Work Plan Addendum* (EnSafe Inc. [EnSafe], 2000) recommended one additional soil boring (G633SB021) to delineate the extent of Aroclor-1260 in surface and subsurface soil to the south of G633SB001. Aroclor-1260 was not detected in either sample.

Additional delineation samples were collected by Environmental Enterprise Group (EEG) (formerly know as Environmental Detachment Charleston [DET]) in cooperation with EnSafe, and analyzed for PCBs at Data Quality Objective (DQO) Level III. These samples were collected to delineate the extent of Aroclor-1260 found at soil boring G633SB007. The analytical results of EEG's sampling were presented in the *Sampling Report, Site Delineation for PCBs at AOC 633, Charleston Naval Complex, Charleston, SC* (EEG, 2000a). The analytical results indicated that the extent of PCB-impacted soil was greater than previously known.

A soil excavation IM was then planned for AOC 633. The proposed IM involved the removal of PCB-contaminated subsurface (3 to 5 feet below land surface [ft bls]) soil around G633SB007 and was to be conducted by EEG. The initial sampling phase of the IM was conducted by EEG, and a target area of excavation was identified by EEG as a result of two additional sampling events (EEG, 2000a).

EEG then prepared and submitted an IM Work Plan (EEG, 2000b) proposing to excavate all soils containing greater than 1 mg/kg of Aroclor-1260. EEG did not perform the excavation or disposal of site-contaminated soils, as a result of some uncertainties that arose

1 concerning cleanup levels and waste disposal requirements (the Navy has re-assigned the  
2 site IM to CH2M-Jones). The 1-mg/kg cleanup level was based on remediation for  
3 unrestricted land use. This area is zoned for continued marine industrial use (M-1);  
4 therefore, PCB-impacted soil does not need to be excavated to residential cleanup levels.

5 The existing data were evaluated during the preparation of this IM Work Plan. Surface soil  
6 analytical results indicate that PCB-impacted surface soil is not present above the  
7 residential cleanup standard of 1 mg/kg, as presented in Title 40 *Code of Federal Regulations*  
8 (CFR) Part 761.61 (40 CFR 761.61), *PCB Remediation Waste* (2000).

## 9 **2.2 Development of Media Cleanup Standard for Subsurface** 10 **Soil**

11 The PCB-impacted subsurface soil at AOC 633 does not present a direct exposure pathway,  
12 as approximately 2 ft of non-impacted soil is present above the PCB-impacted soil.

13 However, the subsurface soil may present a potential threat to shallow groundwater at  
14 AOC 633. To develop a target subsurface soil media cleanup standard (MCS), a site-specific  
15 SSL for Aroclor-1260 was calculated; a generic SSL was not available for Aroclor-1260. The  
16 SSL calculation is consistent with the U.S. Environmental Protection Agency (EPA)'s *Soil*  
17 *Screening Guidance: User's Guide* (EPA, 1996a) and the *Soil Screening Guidance: Technical*  
18 *Background Document* (EPA, 1996b). Table 2-3 presents the SSL calculation and input  
19 parameters. The SSL for Aroclor-1260 was determined to be 15.4 mg/kg. Subsurface soil  
20 remains on site containing PCBs (specifically Aroclor-1260) in excess of the site-specific SSL  
21 (15.4 mg/kg), which could represent a threat to site groundwater.

## 22 **2.3 Summary**

23 Aroclor-1260 was detected in subsurface soil at concentrations that exceed the cleanup  
24 standards presented in Title 40 Code of Federal Regulations Part 761.61 (40 CFR 761.61),  
25 *PCB Remediation Waste*. Because these soils do not present a direct exposure pathway, a site-  
26 specific SSL value was calculated to determine a cleanup criterion for subsurface soil that is  
27 protective of human health and the environment. The SSL was calculated to be 15.4 mg/kg.

28 Surface soil samples, collected as part of the AOC 633 investigation, did not indicate that  
29 surface soil concentrations of Aroclor-1260 were above 1 mg/kg. Based on this information,  
30 surface soil does not require remediation at AOC 633.

31 CH2M-Jones is proposing a focused soil excavation IM to remove the PCB-impacted  
32 subsurface soil.

**TABLE 2-1**  
 Surface Soil PCB Detections  
*IM Work Plan, AOC 633, Zone G, Charleston Naval Complex*

<b>Parameter</b>	<b>Station ID</b>	<b>Sample ID</b>	<b>Date Collected</b>	<b>Results (mg/kg)</b>	<b>Qualifier</b>
Aroclor-1016	G633SB019	633SB01901	07/27/99	0.089	=
Aroclor-1260	G633SB001	633SB00101	10/02/96	0.48	=
	G633SB002	633SB00201	10/02/96	0.041	J
	G633SB008	633SB00801	01/07/97	0.1	J
	G633SB016	633SB01601	07/28/99	0.088	J
	G633SB019	633SB01901	07/27/99	0.27	=

= Analyte was detected, the reported concentration is the actual analytical concentration.

J Analyte was detected, the reported concentration is an estimated concentration.

mg/kg milligram per kilogram

**TABLE 2-2**  
 Subsurface Soil PCB Detections  
 IM Work Plan, AOC 633, Zone G, Charleston Naval Complex

Parameter	Station ID	Date Collected	Results (mg/kg)	Qualifier
Aroclor-1016	G633SB020	07/27/1999	0.086	J
Aroclor-1260	G633SB004	10/02/1996	0.310	=
	G633SB007	10/02/1996	25.0	=
	G633SB015	07/28/1999	0.054	=
	G633SB018	07/27/1999	0.240	J
	G633SB020	07/27/1999	0.230	=
	00EEG0009-1	01/12/2000	7.0	=
	00EEG0009-2	01/12/2000	2.9	=
	00EEG0009-3	01/12/2000	3.1	=
	00EEG0009-4	01/12/2000	4.8	=
	00EEG0009-5	01/12/2000	6.8	=
	00EEG00010-1	10/13/1996	0.52	=
	00EEG00010-2	10/13/1996	60.0	=
	00EEG00010-3	10/13/1996	9.9	=
	00EEG00010-4	10/13/1996	0.20	=
	00EEG00017-1	02/01/2000	33.0	=
	00EEG00017-2	02/01/2000	61.0	=
	00EEG00017-3	02/01/2000	1.4	=
	00EEG00017-5	02/01/2000	80.0	=
	00EEG00017-6	02/01/2000	17.0	=
	00EEG00017-7	02/01/2000	0.30	=
00EEG00017-8	02/01/2000	1.3	=	

= Analyte was detected, the reported concentration is the actual analytical concentration.

J Analyte was detected, the reported concentration is an estimated concentration.

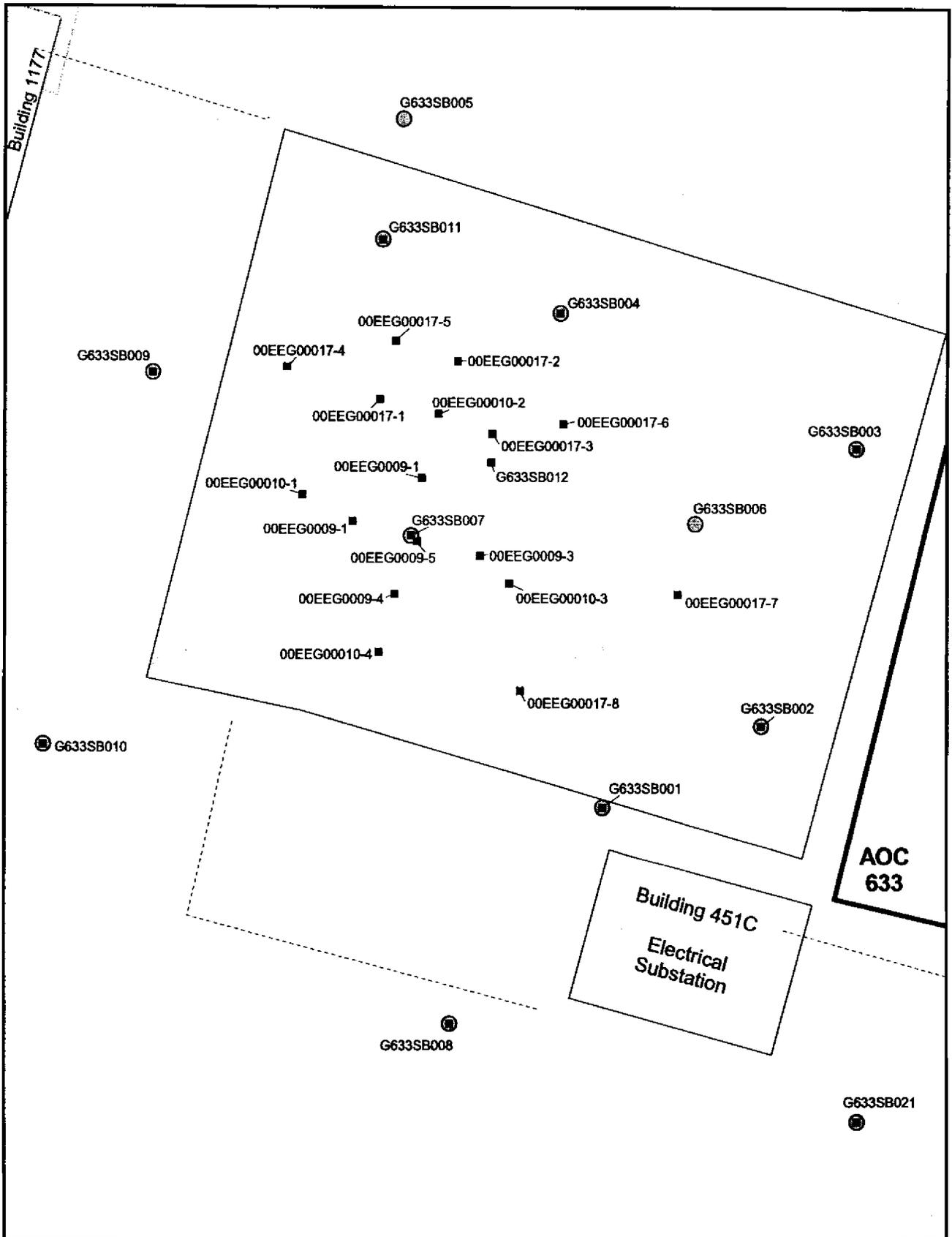
mg/kg milligram per kilogram

**Table 2-3**

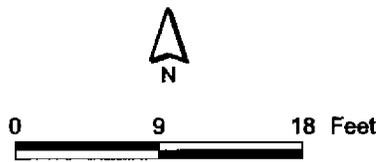
SSL Calculation  
 IM Work Plan, AOC 633, Zone G, Charleston Naval Complex

		Parameter	Aroclor-1260
<b>Chemical Specific Input Parameters</b>			
Cw =	Target groundwater concentration MCL (mg/L)		5.00E-04
H =	Henry's Law Constant, dimensionless		1.89E-01
ks =	Soil-water sorption coefficient (cm <sup>3</sup> water / g soil = L/kg) = Koc x foc where		8.84E+03
	koc = organic carbon-water sorption coefficient, (cm <sup>3</sup> (ml) water) / (g soluble organic carbon)		8.50E+05
	foc = Fraction of organic content, dimensionless	0.0104	
<b>Site Specific Input Parameters</b>			
Sw =	Width of Source Parallel to Groundwater Flt (impacted soil zone)	3.7 m	12 ft
da =	Aquifer Thickness	1.8 m	6 ft
d =	Groundwater Mixing Zone thickness	0.62 m	2.0 ft
i =	Groundwater Gradient		1.0E-03 (unitless)
Ks =	Saturated Hydraulic Conductivity	445.0 m/yr	1460.0 ft/yr
θw =	Volumetric Water Content of Soil Pore Space	0.3 cm <sup>3</sup> vapor/cm <sup>3</sup> soil	0.3 in <sup>3</sup> vapor/in <sup>3</sup> soil
θv =	Volumetric Vapor Content of Soil Pore Space	0.11 cm <sup>3</sup> vapor/cm <sup>3</sup> soil	0.11 in <sup>3</sup> vapor/in <sup>3</sup> soil
ρs =	Soil Bulk Density	1.5 g/cm <sup>3</sup>	93.64 lb <sub>m</sub> /ft <sup>3</sup>
qi =	Water Infiltration Rate	0.0305 m/yr	0.1000 ft/yr
	Partition Term, Cw/Csoil, (L/kg)	$\frac{C_{soil}}{C_w} \left( \frac{\theta_w + K_s \rho_s + H \theta_v}{\rho_s} \right) \left( \frac{K_s i d + q_i S_w}{q_i S_w} \right)$	
	Dilution Term, dimensionless	$\frac{C_{soil}}{C_w} \left( \frac{\theta_w + K_s \rho_s + H \theta_v}{\rho_s} \right) \left( \frac{K_s i d + q_i S_w}{q_i S_w} \right)$	
	Csoil/Cw = Partition term * Dilution term (mg/kg / mg/L) = L/kg	$\frac{C_{soil}}{C_w} \left( \frac{\theta_w + K_s \rho_s + H \theta_v}{\rho_s} \right) \left( \frac{K_s i d + q_i S_w}{q_i S_w} \right)$	
			8.840E+03
			3.480E+00
			3.076E+04
<b>Calculated Site Specific Target Level for Soil</b>			
	C <sub>soil</sub> calculated source soil concentration (SSL, mg/kg) = Cw*(partion term)*(dilution term)		15.4

- Cwt is based on the Drinking Water Standards and Health Advisories (EPA, 2000).
- H is from Table 3-2 of the Toxicological Profile for Polychlorinated Biphenyls (U.S. Department of Health & Human Services, 1995) adjusted to the dimensionless form (x 41).
- ks = koc x foc.
- koc is from the Superfund Chemical Data Matrix
- foc is from site data, sample 633SB009P1 analytical results (10,400 mg/kg = 1.04% TOC).
- Sw is the measured length of the source area exceeding the SSL along the groundwater flow direction.
- da is the minimum depth of the published saturated zone thickness for Zone G (USGS, 1999).
- d is the smaller of either the aquifer thickness (da) or the result of the mixing zone equation,  
 $d = (0.0112 Sw^2)^{0.5} + da \{1 - \exp[(-Sw qi)/Ks i da]\}$
- i is calculated (1/1000) from groundwater contours presented in Figure 1-4 Groundwater Monitoring Report (CH2M-Jones, 2001)
- Ks is from Figure 21 of the USGS Report Hydrology and Simulation of Ground-Water Flow in the Surficial Aquifer System in the Area of Charleston Naval Base, North Charleston, South Carolina, 1995-97 (USGS, 1999).
- θw is the default value presented in the Soil Screening Guidance: User's Guide (EPA, 1996)
- θv is calculates as total porosity (0.41) - θw (0.3) = 0.11
- ρs is the default value presented in the Soil Screening Guidance: User's Guide (EPA, 1996)
- qi is from the USGS Report Hydrology and Simulation of Ground-Water Flow in the Surficial Aquifer System in the Area of Charleston Naval Base, North Charleston, South Carolina, 1995-97 (USGS, 1999).



- ⊙ Surface Soil Samples
- Subsurface Soil Samples
- Roads
- - - Fence
- ▭ AOC Boundary
- ▭ Buildings



**Figure 2-1**  
Soil Sample Locations  
AOC 633, Zone G  
Charleston Naval Complex

**CH2MHILL**

## Section 3.0

---

## 1 3.0 Technical Approach

---

2 This section outlines the technical approach for the removal of PCB-impacted subsurface  
3 soil above the site-specific SSL of 15.4 mg/kg. The overall strategy for the work will be to  
4 excavate soil to a depth of approximately 2 ft bls, stockpile it on site, and use it for backfill  
5 material. PCB-impacted soil will then be excavated from this 2-ft depth down to a depth of  
6 approximately 4 ft bls (top of water table) and disposed of off site. The anticipated  
7 excavation area is illustrated in Figure 3-1, and it is based on analytical results of samples  
8 collected during the RFI and subsequent IM delineation sampling. The boundary of the area  
9 shown in Figure 3-1 was estimated via geostatistical kriging. The Aroclor-1260 data for  
10 these samples are presented in Table 3-1.

### 11 3.1 Delineation/Confirmation Sample Collection

12 Prior to excavation, six subsurface soil delineation samples will be collected from around  
13 the perimeter of the proposed excavation area and analyzed for PCBs to more precisely  
14 determine the areal extent of the excavation. Four additional sample locations from within  
15 the proposed excavation area will be sampled to determine the vertical extent of the  
16 excavation at a depth of 4 ft bls. In the event these samples are reported at concentrations  
17 that exceed the MCS of 15.4 mg/kg, the bottom of the excavation will be at the level of the  
18 top of the water-bearing zone. Approximate locations of the delineation samples are shown  
19 in Figure 3-2.

20 Within the larger proposed excavation area the vertical delineation samples will be  
21 collected at existing EEG sample locations (00EEG00010-2, 00EEG00017-1, and 00EEG00017-  
22 5) that previously exhibited PCB concentrations of 50 mg/kg or greater. The fourth vertical  
23 delineation sample will be collected near the center of the proposed excavation area at a  
24 depth of four ft bls. CH2M-Jones team members at the CNC will choose the final sampling  
25 locations in the field, based on site conditions (such as the presence of pavement or other  
26 obstructions). Once the limits of excavation have been established, the footprint of the area  
27 to be excavated will be clearly marked by staking the site.

28 The sampling strategy and procedures will be performed in accordance with the  
29 Environmental Services Division *Standard Operating Procedures and Quality Assurance*  
30 *Manual* (ESDSOPQAM) (EPA, 1996c).

## 3.2 Soil Sample Analysis

The delineation/confirmation samples will be delivered or sent via overnight carrier to an offsite laboratory, where they will be analyzed for PCBs using EPA Method SW846-8082. The soil analysis will follow the procedures provided in the approved Comprehensive Sampling and Analysis Plan (CSAP) portion of the *Final Comprehensive RFI Work Plan* (EnSafe/Allen & Hoshall, 1994). The CSAP outlines all monitoring procedures to be performed during the investigation to characterize the environmental setting, source, and releases of hazardous constituents. In addition, the CSAP includes the Quality Assurance Plan (QAP) and Data Management Plan (DMP) to verify that all information and data are valid and properly documented. Sample analysis will be conducted in accordance with the guidance in the EPA's *Test Methods for Evaluating Solid Waste, SW-846, 3rd Ed.*, Office of Solid Waste and Emergency Response (SW846) and in the EPA Environmental Services Division *Laboratory Operations and Quality Control Manual* (ESDLOQCM).

## 3.3 Soil Removal

Prior to commencement of removal activities, the upper 2 ft of soil and the gravel cover will be removed from the area of the proposed excavation area with a front-end loader (or similar equipment) and stored on site for use as subsurface fill material for the excavation. The upper 2 ft of soil should be suitable for use as fill because analytical results for the surface soil at AOC 633 indicate that PCBs in surface soil are below the cleanup level of 1 mg/kg. It is expected that approximately 250 ft<sup>3</sup> of soil will be stockpiled; three confirmatory samples will be collected from the stockpile(s).

Figure 3-1 presents the estimated areal extent of PCB-impacted subsurface soil above the 15.4 mg/kg SSL. Three areas in Figure 3-1 are illustrated as having PCB concentrations above the SSL (15.4 mg/kg). Sample 00EEG00017-6 contained Aroclor-1260 at a concentration of 17 mg/kg, which marginally exceeds the SSL. The location of this sample is illustrated on Figure 3-1 as the smallest area above the SSL. Because of the limited area of PCB-impacted subsurface soil in this area, the area around 00EEG00017-6 is not targeted for removal, as point exceedances close to the SSL do not represent a leaching hazard. In this case, the extremely small area of PCB-impacted subsurface soil is not expected to be a threat to local groundwater. The excavation is expected to encompass the other two areas illustrated on Figure 3-1. The area(s) may vary somewhat based on the results of the confirmation sampling. Removal of subsurface soil will be accomplished with a backhoe or similar equipment to the depth of approximately 4 ft bls.

1 Excavated subsurface soils will be transferred immediately to a disposal container (e.g., a  
2 roll-off box or similar container). Waste characterization samples will be collected from each  
3 disposal container at a frequency of one sample per each 100 ft<sup>3</sup> of soil, with a minimum of  
4 one sample per container. The analytical results of the waste characterization samples will  
5 determine the type of disposal facility to which the soil will be sent. Soil with PCB  
6 concentrations below 50 mg/kg will be transported to a RCRA Subtitle D landfill for  
7 disposal. Soil with PCB concentrations equal to, or greater than, 50 mg/kg will be disposed  
8 of in a hazardous waste landfill permitted by EPA under section 3004 of RCRA, by a State  
9 authorized under section 3006 of RCRA, or a TSCA-approved PCB disposal facility. The  
10 transported waste will be covered with a tarp during transport to minimize airborne  
11 transfer of soil particulates.

### 12 **3.4 Site Restoration**

13 Following completion of the excavation, the excavation will be backfilled with appropriate  
14 fill material starting with the surface soil that was previously stockpiled (assuming that  
15 analytical results for the stockpiled soil were below the cleanup criteria). Additional clean  
16 fill material will be brought in and the grade will be restored to match the original grade.

### 17 **3.5 Reporting**

18 The results of the IM will be summarized in an IM Completion Report that will be part of an  
19 RFI Report Addendum. The report addendum will document the field activities and  
20 provide the analytical results from the confirmation samples collected at the site.

**TABLE 3-1**  
 Aroclor-1260 Analytical Results for Subsurface Soil Samples  
 IM Work Plan, AOC 633, Zone G, Charleston Naval Complex

Chemical	Station ID	Sample ID	Results (mg/kg)	Qualifier	Residential Cleanup Level (mg/kg)	Site-Specific SSL (mg/kg)	
RFI Samples	G633SB001	633SB00102	0.10	U	1	15.4	
	G633SB002	633SB00202	0.13	U			
	G633SB003	633SB00302	0.10	U			
	G633SB004	633SB00402	0.31	=			
	G633SB007	633SB00702	<b>25.0</b>	=			
	G633SB008	633SB00802	0.110	U			
	G633SB009	633SB00902	0.028	U			
	G633SB010	633SB01002	0.080	U			
	G633SB011	633SB01102	0.041	U			
	G633SB012	633SB01202	0.037	U			
	G633SB013	633SB01302	0.050	U			
	G633SB014	633SB01402	0.057	U			
	G633SB015	633SB01502	0.054	=			
	G633SB017	633SB01702	0.039	U			
	G633SB018	633SB01802	0.240	J			
	G633SB019	633SB01902	0.039	U			
	G633SB020	633SB02002	0.230	=			
	G633SB021	633SB02102	0.080	U			
	Delineation Samples	PT-1	00EEG0009-1	7.0			=
		PT-2	00EEG0009-2	2.9			=
		PT-3	00EEG0009-3	3.1			=
PT-4		00EEG0009-4	4.8	=			
PT-5		00EEG0009-5	6.8	=			
PT-6		00EEG00010-1	0.52	=			
PT-7		00EEG00010-2	<b>60.0</b>	=			
PT-8		00EEG00010-3	9.9	=			
PT-9		00EEG00010-4	0.20	=			
PT-10		00EEG00017-1	<b>33.0</b>	=			
PT-11		00EEG00017-2	<b>61.0</b>	=			
PT-12		00EEG00017-3	1.4	=			
PT-13		00EEG00017-4	0.061	U			
PT-14		00EEG00017-5	<b>80.0</b>	=			
PT-15		00EEG00017-6	<b>17.0</b>	=			
PT-16		00EEG00017-7	0.30	=			
PT-17		00EEG00017-8	1.3	=			

Concentrations in bold and outlined in boxes exceeded the SSL.

The Residential Cleanup Level is the preliminary remediation goal presented in *Soil Screening Guidance: Technical Background Document* (EPA, 1996).

**TABLE 3-1**  
 Aroclor-1260 Analytical Results for Subsurface Soil Samples  
 IM Work Plan, AOC 633, Zone G, Charleston Naval Complex

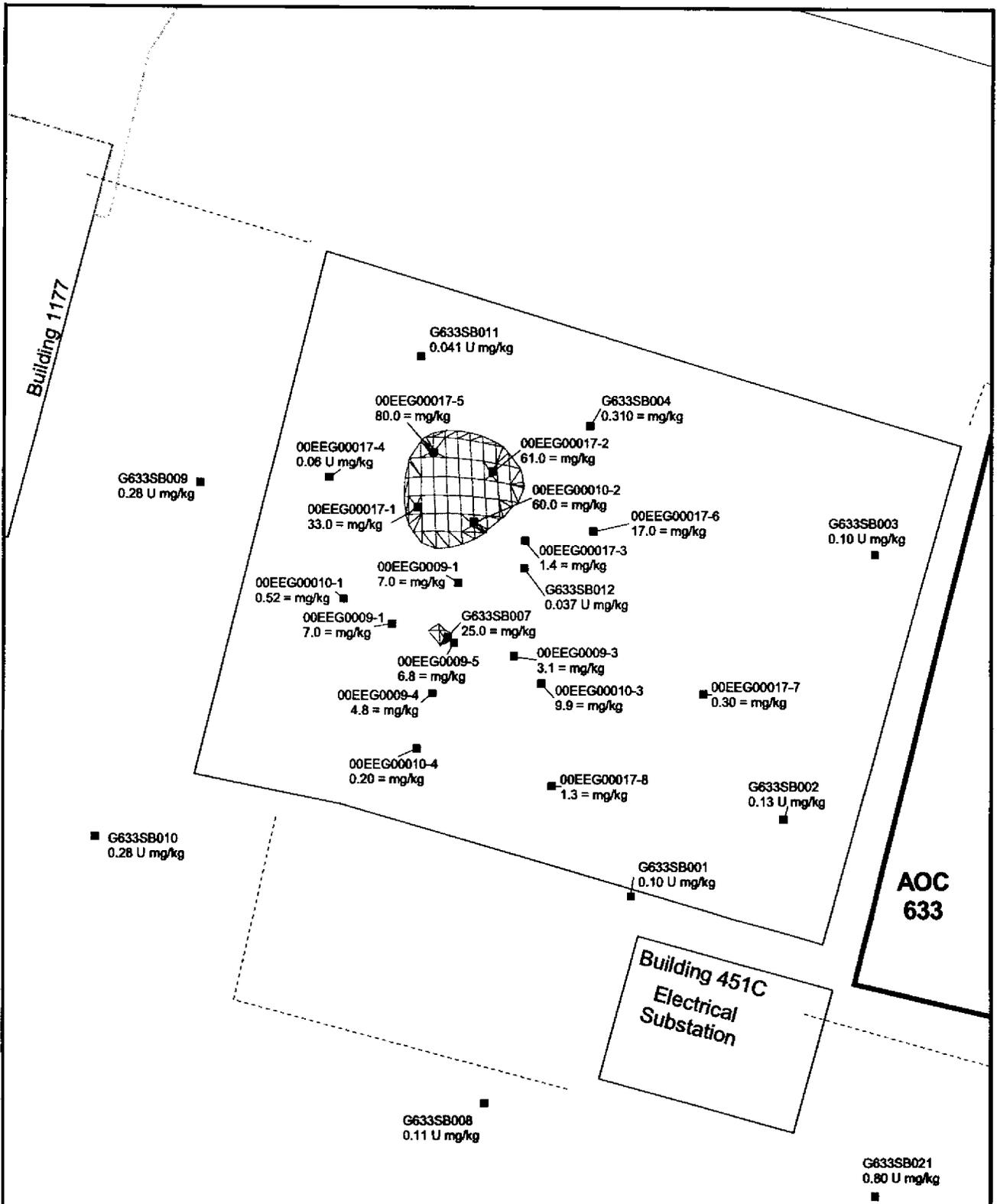
<b>Chemical</b>	<b>Station ID</b>	<b>Sample ID</b>	<b>Results (mg/kg)</b>	<b>Qualifier</b>	<b>Residential Cleanup Level (mg/kg)</b>	<b>Site-Specific SSL (mg/kg)</b>
-----------------	-------------------	------------------	----------------------------	------------------	--	--

= Analyte was detected, the reported concentration is the actual analytical concentration.

U Analyte was not detected, the reported concentration is the detection limit.

mg/kg milligram per kilogram

SSL soil screening level



J indicates that the analyte was detected, the reported value is an estimated concentration.

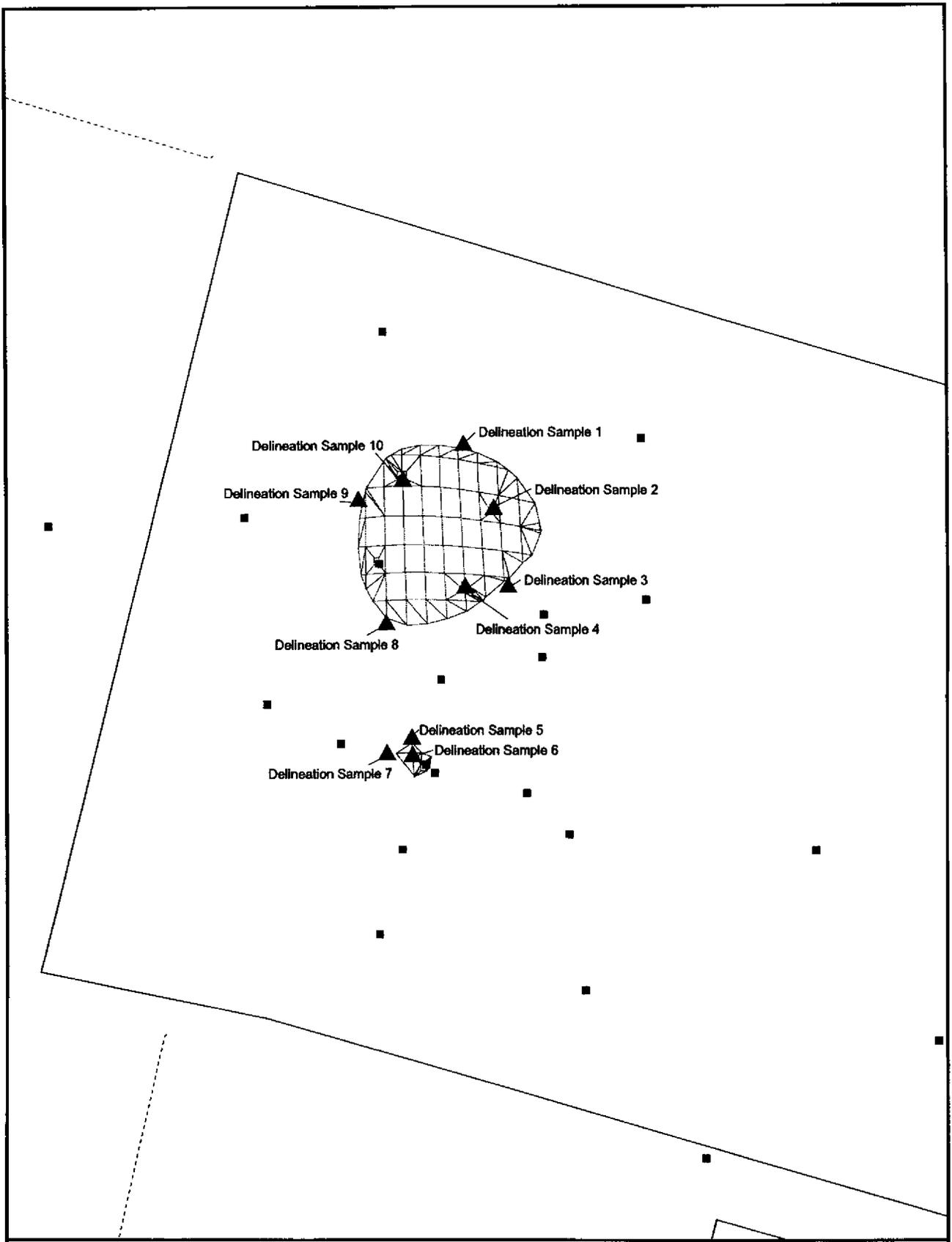
U indicates the analyte was undetected, the reported value is the detection limit.

- Subsurface Soil Samples
- ∕ Excavation Area
- ⋄ Fence
- Buildings
- ▭ AOC Boundary



**Figure 3-1**  
Excavation Area  
AOC 633, Zone G  
Charleston Naval Complex

**CH2MHILL**



- ▲ Proposed Delineation Sample Locations
- Subsurface Soil Samples
- ∕ Excavation Area
- ⌞ Fence
- Buildings



**Figure 3-2**  
 Proposed Delineation Sample Locations  
 AOC 633, Zone G  
 Charleston Naval Complex

**CH2MHILL**



## 1 **4.0 Investigation-Derived Waste**

---

- 2 Three waste streams will be generated as part of this IM: excavated soils, decontamination  
3 wastes, and PPE. Excavated soils will be characterized in accordance with South Carolina  
4 Hazardous Waste Management Regulations (Section SCDHEC R.61-79.261) and disposed of  
5 in accordance with all applicable regulations and permits. Assuming soils will be  
6 characterized as non-hazardous, they will be sent to a subtitle D landfill. Decontamination  
7 wastes and PPE also will be disposed of in accordance with regulations.
- 8 Offsite transportation and disposal will be performed by properly permitted and licensed  
9 subcontractors. Materials designated for offsite disposal will be documented, tracked, and  
10 their disposition verified. This information will be reported in the IM Completion Report.

## Section 5.0

---

## 1 5.0 References

---

- 2 EnSafe Inc./Allen & Hoshall. *Final Comprehensive RFI Work Plan*. 1994.
- 3 EnSafe Inc. *Zone G RFI Report, NAVBASE Charleston*. Revision 0. February 28, 1998.
- 4 EnSafe Inc. *Zone G RFI Report Workplan Addendum, NAVBASE Charleston*. January 17, 2000.
- 5 40 CFR 761. Title 40 Code of Federal Regulations Part 761, *Polychlorinated Biphenyls (PCBs)*  
6 *Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions*. July 1, 2000.
- 7 Environmental Enterprise Group. *Sampling Report, Site Delineation for PCBs at Area of*  
8 *Concern (AOC) 633, Charleston Naval Complex, Charleston, SC*. February 26, 2000a.
- 9 Environmental Enterprise Group. *Interim Stabilization Measure, Area of Concern (AOC) 633,*  
10 *Charleston Naval Complex, Charleston, SC*. September 15, 2000b.
- 11 U.S. Environmental Protection Agency. *Soil Screening Guidance: User's Guide*. Office of Solid  
12 Waste and Emergency Response (OSWER). April, 1996a.
- 13 U.S. Environmental Protection Agency. *Soil Screening Guidance: Technical Background*  
14 *Document*. Office of Solid Waste and Emergency Response (OSWER). May 1996b.
- 15 U.S. Environmental Protection Agency. Environmental Services Division. *Operating*  
16 *Procedures and Quality Assurance Manual (ESDSOPQAM)*. 1996c.



May 13, 2002

Mr. David Scaturo  
South Carolina Department of Health and  
Environmental Control  
Bureau of Land and Waste Management  
2600 Bull Street  
Columbia, SC 29201

Re: Phase II Interim Measure Work Plan (Revision 0) - LNAPL and LNAPL-Impacted  
Soil Removal - AOC 633, Zone G

Dear Mr. Scaturo:

Enclosed please find four copies of the Phase II Interim Measure Work Plan (Revision 0) for AOC 633 in Zone G of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

The principal author of this document is Jim Edens. Please contact him at 352/335-5877, extension 2491, if you have any questions or comments.

Sincerely,

CH2M HILL

A handwritten signature in black ink that reads "Dean Williamson".

Dean Williamson, P.E.

cc: Rob Harrell/Navy, w/att  
Gary Foster/CH2M HILL, w/att

# PHASE II INTERIM MEASURE WORK PLAN

## LNAPL and LNAPL-Impacted Soil Removal AOC 633, Zone G



*Charleston Naval Complex  
North Charleston, South Carolina*

SUBMITTED TO  
*U.S. Navy Southern Division  
Naval Facilities Engineering Command*

PREPARED BY  
**CH2M-Jones**

May 2002

Revision No. 0  
Contract N62467-99-C-0960  
158814 ZG PR 03

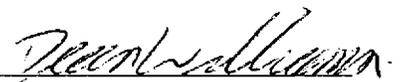
**Certification Page for the Phase II Interim Measure Work Plan,  
Revision 0 – AOC 633, Zone G**

**LNAPL and LNAPL-Impacted Soil Removal**

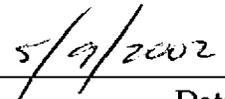
I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina

P.E. No. 21428



Dean Williamson, P.E.



Date

# 1 Contents

---

2 Section	Page
3 <b>Acronyms and Abbreviations</b> .....	v
4 <b>1.0 Introduction</b> .....	1-1
5 1.1 Purpose of the Phase II Interim Measure Work Plan.....	1-1
6 1.2 Site Background and Setting.....	1-1
7 1.3 Organization of the Phase II Interim Measure Work Plan .....	1-1
8 <b>2.0 Results of Previous Investigations</b> .....	2-1
9 Figure 2-1 RFI and DET Soil Sample Locations .....	2-2
10 Figure 2-2 Previous IM Boundary and Delineation Sample Locations.....	2-3
11 <b>3.0 Review of Post-Interim Measure Site Data</b> .....	3-1
12 3.1 Subsurface Soil Analytical Results.....	3-1
13 3.1.1 PCBs.....	3-1
14 3.1.2 VOCs.....	3-1
15 3.1.3 SVOCs .....	3-2
16 3.2 Groundwater and LNAPL Analytical Results .....	3-2
17 3.2.1 PCBs.....	3-2
18 3.2.2 VOCs.....	3-2
19 3.2.3 SVOCs .....	3-3
20 3.3 Summary.....	3-3
21 Table 3-1 Detected Compounds in Subsurface Soil Samples.....	3-4
22 Table 3-2 Detected Compounds in Groundwater and LNAPL .....	3-13
23 Figure 3-1 Subsurface Soil Approximate Locations (Post-IM) .....	3-14
24 <b>4.0 Technical Approach for the Phase II Interim Measure</b> .....	4-1
25 4.1 Excavation Approach.....	4-1
26 4.2 Confirmatory Sample Collection and Backfilling.....	4-2
27 4.3 Calculation of Site-Specific SSLs .....	4-2
28 4.4 Soil Sample Analysis.....	4-3
29 Table 4-1 Leachate Analysis Model (Revised SSL Calculation for Aroclor-1260).....	4-4
30 Table 4-2 Summary of Calculated Site-Specific SSLs.....	4-5
31 <b>5.0 Investigation-Derived Waste</b> .....	5-1
32 <b>6.0 References</b> .....	6-1

# 1 **Acronyms and Abbreviations**

---

2	AOC	Area of concern
3	CA	Corrective action
4	CFR	<i>Code of Federal Regulations</i>
5	CNC	Charleston Naval Complex
6	COC	Chemical of concern
7	COPC	Chemical of potential concern
8	CSAP	Comprehensive Sampling and Analysis Plan
9	DAF	Dilution attenuation factor
10	DMP	Data Management Plan
11	EEG	Environmental Enterprise Group
12	EnSafe	EnSafe Inc.
13	ESDSOPQAM	U.S. Environmental Protection Agency <i>Operating Procedures and</i>
14		<i>Quality Assurance Manual</i>
15	EPA	U.S. Environmental Protection Agency
16	ft bls	Feet below land surface
17	IDW	Investigation-derived waste
18	IM	Interim measure
19	LNAPL	Light non-aqueous phase liquid
20	MCL	Maximum contaminant level
21	µg/L	Micrograms per liter
22	µg/kg	Micrograms per kilogram
23	mg/kg	Milligrams per kilogram
24	NFA	No further action
25	QAP	Quality Assurance Plan
26	PCB	Polychlorinated biphenyl
27	PCE	Tetrachloroethene
28	PPE	Personal protective equipment

# 1 **Acronyms and Abbreviations, Continued**

---

2	RBC	Risk-based concentration
3	RCRA	Resource Conservation and Recovery Act
4	RFI	RCRA Facility Investigation
5	SSL	Soil screening level
6	SVOC	Semivolatile organic compound
7	VOC	Volatile organic compound

**Section 1.0**

---

# 1 1.0 Introduction

---

## 2 1.1 Purpose of the Phase II Interim Measure Work Plan

3 This Phase II Interim Measure (IM) Work Plan presents a technical approach to remove soil  
4 containing a weathered diesel fuel light non-aqueous phase liquid (LNAPL), which may  
5 contain polychlorinated biphenyls (PCBs) and other contaminants, from Area Of Concern  
6 (AOC) 633, which is located in Zone G of Charleston Naval Complex (CNC). The removal  
7 of the LNAPL-impacted soil will remove a source of contaminants from this site. This IM  
8 will be performed, documented, and reported in a manner consistent with the investigative  
9 and corrective action (CA) goals and requirements of the existing Resource Conservation  
10 and Recovery Act (RCRA) permit for the facility.

## 11 1.2 Site Background and Setting

12 AOC 633 is located near Building 451C, an electrical substation built in 1943. Building 451C  
13 is a block structure with a concrete roof and floor. Several high voltage switches, breakers,  
14 and transformers are located in the two-room block structure. The site contains several steel  
15 enclosures on concrete slabs and foundations from earlier buildings. In 1989, an electrical  
16 transformer at this substation was destroyed by Hurricane Hugo. Several historical PCB  
17 releases have been reported for this site, including a large leak of 10C oil in 1981. No  
18 remedial activities were known to have occurred at this site prior to commencement of the  
19 Zone G RCRA Facility Investigation (RFI) conducted by EnSafe, Inc. (EnSafe) in 1997.  
20 Recently, an IM was conducted at the site by CH2M-Jones to remove subsurface soil  
21 containing PCBs above the water-bearing zone.

## 22 1.3 Organization of the Phase II IM Work Plan

23 This Phase II IM Work Plan consists of the following sections, including this introductory  
24 section:

25 **1.0 Introduction** — Presents the purpose of the Phase II IM Work Plan and background  
26 information regarding the site.

27 **2.0 Results of Previous Investigations** – Presents the results of several soil investigations  
28 that were previously conducted at AOC 633.

- 1 **3.0 Review of Post-Interim Measure Site Data** – Presents the results of review and analysis  
2 of the data collected following the IM at the site.
- 3 **4.0 Technical Approach for the Phase II Interim Measure**— Provides a brief description of  
4 the technical approach for the Phase II IM that will be conducted at AOC 633, including a  
5 description of activities to be carried out prior to the implementation of the IM, and analysis  
6 of the data collected.
- 7 **5.0 Investigation-Derived Waste** — Describes the procedures that will be followed for the  
8 proper management and disposal of the waste generated from this IM.
- 9 **6.0 References** — Lists the references used in this document.



## 2.0 Results of Previous Investigations

---

Several soil investigations were conducted at AOC 633 that resulted in numerous soil samples being collected and analyzed. The locations of the samples collected at AOC 633 are presented on Figure 2-1.

EnSafe conducted an RFI in 1997 and 1998 to investigate the nature and extent of any environmental contamination at the site. The results of the RFI were reported in the *Zone G RFI Report, Revision 0* (EnSafe, 1998). The RFI report identified Aroclor-1260 as a chemical of potential concern (COPC), but did not identify any chemicals of concern (COCs). The site was recommended for No Further Action (NFA).

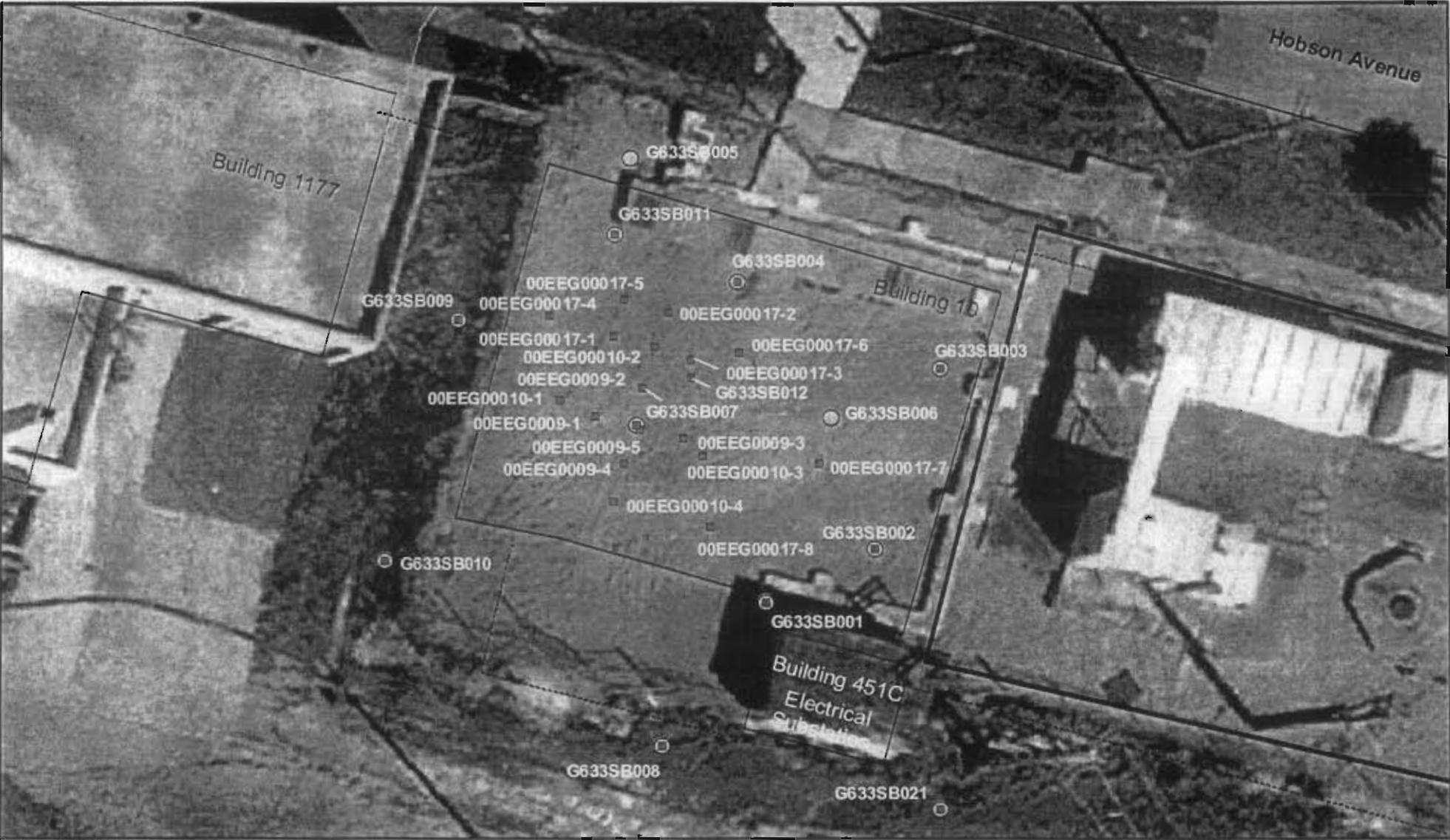
The *Zone G RFI Work Plan Addendum* (EnSafe, 2000) recommended one additional soil boring (G633SB021) to delineate the extent of Aroclor-1260 in surface and subsurface soil to the south of G633SB001. Aroclor-1260 was not detected in either sample.

Additional delineation samples were collected by the Environmental Enterprise Group (EEG) (formerly the Environmental Detachment Charleston [DET]) in cooperation with EnSafe, and analyzed for PCBs. These samples were collected to delineate the extent of Aroclor-1260 found at soil boring G633SB007. The analytical results of EEG's sampling were presented in the *Sampling Report, Site Delineation for PCBs at Area of Concern (AOC) 633, Charleston Naval Complex, Charleston, SC* (EEG, 2000a). The analytical results indicated that the extent of PCB-impacted soil was greater than expected.

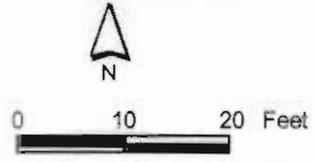
A soil excavation IM was then planned and subsequently executed by CH2M-Jones. The IM involved collecting delineation/confirmation samples and the removal of PCB-contaminated subsurface (3 to 5 feet below land surface [ft bls]) soil in excess of the site-specific soil screening level (SSL) (15.4 milligrams per kilogram [mg/kg]). Surface soil analytical results indicated that PCB-impacted surface soil was not present above the cleanup standard (1 mg/kg) presented in Title 40 *Code of Federal Regulations (CFR) Part 761.61* (40 CFR 761.61), *PCB Remediation Waste*. Therefore, surface soil was removed and stockpiled on site for use as fill material. The approximate areal boundary of the excavation is illustrated in Figure 2-2.

Near the completion of the IM, LNAPL was observed entering the excavation. LNAPL and groundwater samples were collected and submitted for analyses. The analytical results from these samples, which are discussed in detail in Section 3.2, indicated the presence of PCBs and other chemicals. The excavation was backfilled in accordance with the IM WP. The removal of the residual LNAPL and LNAPL-impacted soil is the objective of this Phase II IM WP.

NOTE: Aerial Photo Date is 1997

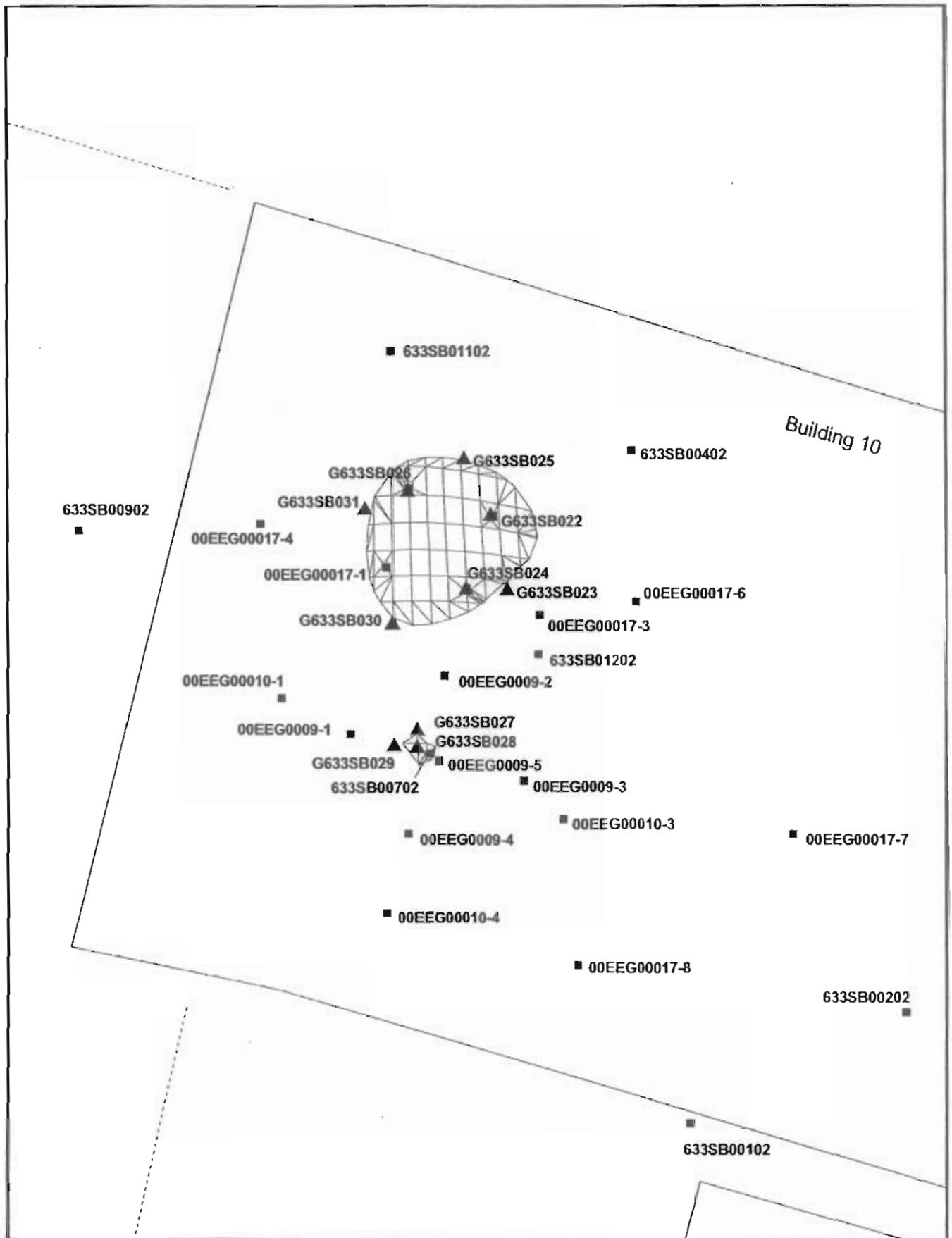


- Subsurface Soil Samples
- Surface Soil Samples
- Roads
- Fence
- Pavement
- Buildings
- AOC Boundary



**Figure 2-1**  
RFI and DET Soil Sample Locations  
AOC 633, Zone G  
Charleston Naval Complex

**CH2MHILL**



- ▲ Delineation Sample Locations
- Subsurface Soil Samples
- ⎓ Excavation Area
- ⎓ Fence
- Buildings



**Figure 2-2**  
 Previous IM Boundary and  
 Delineation Sample Locations  
 AOC 633, Zone G  
 Charleston Naval Complex



## 3.0 Review of Post-Interim Measure Site Data

Twelve soil borings were advanced around the site of the previous IM excavation and along Hobson Avenue to assess the extent and source of the LNAPL. A soil sample was collected at the top of the water-bearing zone from each boring (except at boring G633SB037, due to an obstruction that was encountered). The samples were collected from approximately 3.5 to 5 ft bls. The samples were analyzed for PCBs, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). Figure 3-1 presents the sample locations, and Table 3-1 summarizes the detected compounds from the samples.

### 3.1 Subsurface Soil Analytical Results

#### 3.1.1 PCBs

Aroclor-1254 was detected in one subsurface soil sample (633SB03603, 0.093 J mg/kg). Aroclor-1260 was detected in six samples (including 633SB03603) at concentrations ranging from 0.066 J to 2.4 mg/kg. No other PCBs were detected. A summary of these detections is provided in Table 3-1.

The single detection of Aroclor-1254 was below the SSL (0.55 mg/kg, dilution attenuation factor [DAF]=10) presented in the U.S. Environmental Protection Agency (EPA) Region III risk-based concentration (RBC) table (October 2000). The SSL from the Region III RBC table was used because a SSL was not available in Table A-1 of the EPA's *Soil Screening Guidance* (EPA, 1996b). The SSLs presented in the RBC table are based on protection of groundwater to the RBC values rather than maximum contaminant levels (MCLs), and therefore are highly conservative.

All detected concentrations of Aroclor-1260 were below its site-specific SSL of 15.4 mg/kg.

#### 3.1.2 VOCs

Twelve VOCs were detected in the subsurface soil samples. Three compounds (1,3-dichlorobenzene, bromomethane, and tetrachloroethene [PCE]) were detected in one or more samples at concentrations that exceed their respective SSLs. SSLs for VOCs were based on a DAF of 1. A summary of these detections is provided in Table 3-1.

1,3-Dichlorobenzene was detected in one sample (633SB03503) at a concentration of 9.1 micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ), exceeding its SSL of 4.4  $\mu\text{g}/\text{kg}$  (DAF=1). Because an SSL

1 was not available in Table A-1 of the EPA *Soil Screening Guidance*, the SSL value from the  
2 EPA Region III RBC table (October 2000) was used as a screening value.

3 Bromomethane was detected in two samples (633SB03303, 24 J  $\mu\text{g}/\text{kg}$  and 633SB03603, 31 J  
4  $\mu\text{g}/\text{kg}$ ) at concentrations above its SSL of 2.1  $\mu\text{g}/\text{kg}$  (DAF=1). Because an SSL was not  
5 available in Table A-1 of the *Soil Screening Guidance*, the SSL value from the EPA Region III  
6 RBC table (October 2000) was used as a screening value.

7 Tetrachloroethene (PCE) was detected in sample 633SB03503 at a concentration of 6.7  
8  $\mu\text{g}/\text{kg}$ , above its generic SSL (3  $\mu\text{g}/\text{kg}$ , DAF=1) presented in Table A-1 of the *Soil Screening*  
9 *Guidance*.

### 10 **3.1.3 SVOCs**

11 No SVOCs were detected above screening criterion in the subsurface soil samples collected  
12 after the IM.

## 13 **3.2 Groundwater and LNAPL Analytical Results**

14 Samples of the LNAPL and groundwater observed entering the excavation were collected  
15 and submitted for analyses. A small amount of product was observed to have been  
16 inadvertently collected with the groundwater sample. The LNAPL and groundwater  
17 samples were analyzed for PCBs, VOCs, and SVOCs. The LNAPL sample was also analyzed  
18 for fuel identification. The analytical results identified the LNAPL as weathered diesel fuel.

19 A summary of the detected compounds in the groundwater and LNAPL samples is  
20 provided in Table 3-2. Table 3-2 also presents the screening criteria for groundwater.

### 21 **3.2.1 PCBs**

22 The PCB Aroclor-1260 was detected in both the LNAPL and groundwater sample. It was  
23 detected at a concentration of 1,200 mg/kg in the LNAPL and 300 micrograms per liter  
24 ( $\mu\text{g}/\text{L}$ ) in the groundwater sample. No other PCBs were detected in either sample.

### 25 **3.2.2 VOCs**

26 Several VOCs including 1,2-dichlorobenzene (1,000 J  $\mu\text{g}/\text{kg}$ ), 1,3-dichlorobenzene (4,000  
27  $\mu\text{g}/\text{kg}$ ), and 1,4-dichlorobenzene (19,000  $\mu\text{g}/\text{kg}$ ) were detected in the LNAPL. These  
28 chlorobenzenes have been previously associated with PCB fluids at the CNC. Acetone  
29 (4,200 J  $\mu\text{g}/\text{kg}$ ) was also reported to be present, although it would be unusual to find  
30 acetone associated a PCB transformer oil. Its presence may be due to laboratory  
31 contamination.

1 Acetone (28 µg/L), chloroethane (4.2 J µg/L), chlorobenzene (1.8 J µg/L), 1,2-  
2 dichlorobenzene (0.69 J µg/L), 1,3-dichlorobenzene (2.9 J µg/L), and 1,4-dichlorobenzene  
3 (14 µg/L) were reported in the groundwater sample.

### 4 **3.2.3 SVOCs**

5 Target SVOCs were not detected in either the LNAPL or the groundwater sample. The  
6 SVOC detection limits in the LNAPL were greatly elevated due to the need to dilute the oil  
7 matrix to allow for analysis.

## 8 **3.3 Summary**

9 Three VOCs, 1,3-dichlorobenzene, bromomethane, and tetrachloroethene, were detected in  
10 subsurface soil samples above their respective SSLs (DAF=1). PCBs and SVOCs were not  
11 detected at concentrations that exceed conservative screening criteria.

12 The PCB Aroclor-1260 and three VOCs (1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-  
13 dichlorobenzene) were detected in the LNAPL and groundwater sample. Chloroethane and  
14 chlorobenzene were also detected in the groundwater sample. Comparison of groundwater  
15 data to groundwater screening criteria (MCLs or RBCs) results in Aroclor-1260 and  
16 chloroethane exceeding the screening criteria. Permanent monitoring well(s) will be  
17 installed and sampled at AOC 633 following the completion the IM to further assess  
18 potential groundwater impacts.

19 Aroclor-1260 has been detected in the LNAPL and underlying groundwater at AOC 633. It  
20 has not been detected in subsurface soil samples above its SSL around the perimeter of the  
21 excavation.

22 It is likely that transformers were stored on the concrete slab. These transformers may have  
23 leaked, contaminating subsurface soil with PCBs (and chlorobenzenes). In the presence of  
24 the diesel fuel, PCBs were likely mobilized locally and are now located within the LNAPL-  
25 saturated soil interval. Because the LNAPL is on top of the water table, the PCBs are likely  
26 located within the relatively thin layer of soil between the seasonally high and seasonally  
27 low water levels. Therefore, CH2M-Jones is recommending removal of this LNAPL-  
28 impacted soil interval (smear zone) as a source removal activity.

TABLE 3-1  
 Detected Compounds in Subsurface Soil Samples  
 Phase II Interim Measure Work Plan, AOC 633, Zone G, Charleston Naval Complex

Parameter Class	Compound	Station ID	Sample ID	Date Collected	Concentration (µg/kg)	Qualifier	SSL <sup>a</sup>	
VOCs	1,2,4-Trichlorobenzene	G633SB034	633SB03403	28-Feb-02	6.9	J	300	
		G633SB035	633SB03503	28-Feb-02	9.1	=	4.4 <sup>b</sup>	
	1,3-Dichlorobenzene	G633SB038	633SB03803	28-Feb-02	2.5	J		
		G633SB035	633SB03503	28-Feb-02	38	=	100	
		G633SB036	633SB03603	28-Feb-02	3.9	J		
	1,4-Dichlorobenzene	G633SB038	633SB03803	28-Feb-02	9.8	=		
		Acetone	G633SB033	633SB03303	28-Feb-02	240	J	800
			G633SB036	633SB03603	28-Feb-02	400	J	
	G633SB038		633SB03803	28-Feb-02	95	J		
	G633SB039		633SB03903	28-Feb-02	130	J		
	Bromomethane	G633SB040	633SB04003	28-Feb-02	140	J		
		G633SB042	633SB04203	28-Feb-02	210	J		
		G633SB033	633SB03303	28-Feb-02	24	J	2.1 <sup>b</sup>	
		G633SB036	633SB03603	28-Feb-02	31	J		
Carbon Disulfide	G633SB034	633SB03403	28-Feb-02	3.9	J	2,000		
	G633SB035	633SB03503	28-Feb-02	4	J			
	G633SB036	633SB03603	28-Feb-02	49	=			
	G633SB038	633SB03803	28-Feb-02	52	=			

TABLE 3-1  
 Detected Compounds in Subsurface Soil Samples  
 Phase II Interim Measure Work Plan, AOC 633, Zone G, Charleston Naval Complex

Parameter Class	Compound	Station ID	Sample ID	Date Collected	Concentration (µg/kg)	Qualifier	SSL <sup>a</sup>
VOCs	Carbon Disulfide	G633SB039	633SB03903	28-Feb-02	6.7	J	2,000
		G633SB040	633SB04003	28-Feb-02	21	=	
		G633SB041	633SB04103	28-Feb-02	2.4	J	
		G633SB042	633SB04203	28-Feb-02	6.4	J	
	Ethylbenzene	G633SB035	633SB03503	28-Feb-02	2	J	700
	m+p Xylene	G633SB035	633SB03503	28-Feb-02	10	=	10,000 (p-xylene)
	Methyl ethyl ketone (2-Butanone)	G633SB033	633SB03303	28-Feb-02	53	J	400 <sup>b</sup>
		G633SB036	633SB03603	28-Feb-02	56	J	
		G633SB038	633SB03803	28-Feb-02	11	J	
		G633SB039	633SB03903	28-Feb-02	23	J	
		G633SB040	633SB04003	28-Feb-02	25	J	
		G633SB041	633SB04103	28-Feb-02	6.9	J	
		G633SB042	633SB04203	28-Feb-02	37	J	
	o-Xylene	G633SB035	633SB03503	28-Feb-02	4.5	J	9,000
Tetrachloroethylene (PCE)	G633SB035	633SB03503	28-Feb-02	6.7	=	3	
Xylenes, Total	G633SB035	633SB03503	28-Feb-02	14	=	9,000 (o-xylene)	
SVOCs	Acenaphthene	G633SB038	633SB03803	28-Feb-02	6.2	J	285,000

**TABLE 3-1**  
 Detected Compounds in Subsurface Soil Samples  
 Phase II Interim Measure Work Plan, AOC 633, Zone G, Charleston Naval Complex

Parameter Class	Compound	Station ID	Sample ID	Date Collected	Concentration (µg/kg)	Qualifier	SSL <sup>a</sup>
		G633SB039	633SB03903	28-Feb-02	6.4	J	
		G633SB042	633SB04203	28-Feb-02	4.5	J	
	Acenaphthylene	G633SB036	633SB03603	28-Feb-02	14	J	285,000 (Acenaphthene)
		G633SB038	633SB03803	28-Feb-02	2.5	J	
		G633SB039	633SB03903	28-Feb-02	4.8	J	
		G633SB042	633SB04203	28-Feb-02	7.1	J	
	Anthracene	G633SB035	633SB03503	28-Feb-02	20	J	6,000,000
		G633SB038	633SB03803	28-Feb-02	14	=	
		G633SB039	633SB03903	28-Feb-02	18	=	
		G633SB042	633SB04203	28-Feb-02	6.8	J	
	Benzo(a)Anthracene	G633SB033	633SB03303	28-Feb-02	35	=	1,000
		G633SB035	633SB03503	28-Feb-02	9	J	
		G633SB036	633SB03603	28-Feb-02	60	J	
		G633SB038	633SB03803	28-Feb-02	66	=	
		G633SB039	633SB03903	28-Feb-02	130	=	
		G633SB040	633SB04003	28-Feb-02	31	J	
		G633SB041	633SB04103	28-Feb-02	18	J	
		G633SB042	633SB04203	28-Feb-02	35	=	

**TABLE 3-1**  
 Detected Compounds in Subsurface Soil Samples  
 Phase II Interim Measure Work Plan, AOC 633, Zone G, Charleston Naval Complex

Parameter Class	Compound	Station ID	Sample ID	Date Collected	Concentration (µg/kg)	Qualifier	SSL <sup>a</sup>
SVOCs	Benzo(a)Pyrene	G633SB032	633SB03203	28-Feb-02	1.9	J	4,000
		G633SB033	633SB03303	28-Feb-02	34	=	
		G633SB036	633SB03603	28-Feb-02	71	J	
		G633SB038	633SB03803	28-Feb-02	75	=	
		G633SB039	633SB03903	28-Feb-02	150	=	
		G633SB040	633SB04003	28-Feb-02	35	J	
		G633SB041	633SB04103	28-Feb-02	16	J	
		G633SB042	633SB04203	28-Feb-02	44	=	
	Benzo(b)Fluoranthene	G633SB032	633SB03203	28-Feb-02	2.1	J	2,500
		G633SB033	633SB03303	28-Feb-02	34	=	
		G633SB035	633SB03503	28-Feb-02	13	J	
		G633SB036	633SB03603	28-Feb-02	55	J	
		G633SB038	633SB03803	28-Feb-02	110	=	
		G633SB039	633SB03903	28-Feb-02	160	=	
		G633SB040	633SB04003	28-Feb-02	45	J	
		G633SB041	633SB04103	28-Feb-02	18	J	
	G633SB042	633SB04203	28-Feb-02	57	=		
	Benzo(g,h,i)Perylene	G633SB033	633SB03303	28-Feb-02	17	J	1,000 (Dibenz(a,h)anthracene)

TABLE 3-1  
 Detected Compounds in Subsurface Soil Samples  
 Phase II Interim Measure Work Plan, AOC 633, Zone G, Charleston Naval Complex

Parameter Class	Compound	Station ID	Sample ID	Date Collected	Concentration (µg/kg)	Qualifier	SSL <sup>a</sup>
SVOCs	Benzo(g,h,i)Perylene	G633SB036	633SB03603	28-Feb-02	36	J	1,000 (Dibenz(a,h)anthracene)
		G633SB038	633SB03803	28-Feb-02	33	=	
		G633SB039	633SB03903	28-Feb-02	57	=	
		G633SB040	633SB04003	28-Feb-02	20	J	
		G633SB042	633SB04203	28-Feb-02	18	=	
	Benzo(k)Fluoranthene	G633SB033	633SB03303	28-Feb-02	47	=	24,500
		G633SB035	633SB03503	28-Feb-02	17	J	
		G633SB036	633SB03603	28-Feb-02	77	=	
		G633SB038	633SB03803	28-Feb-02	110	=	
		G633SB039	633SB03903	28-Feb-02	180	=	
		G633SB040	633SB04003	28-Feb-02	33	J	
		G633SB041	633SB04103	28-Feb-02	13	J	
		G633SB042	633SB04203	28-Feb-02	55	=	
	Chrysene	G633SB033	633SB03303	28-Feb-02	43	=	80,000
		G633SB035	633SB03503	28-Feb-02	20	J	
		G633SB036	633SB03603	28-Feb-02	69	J	
		G633SB038	633SB03803	28-Feb-02	100	=	
		G633SB039	633SB03903	28-Feb-02	150	=	
		G633SB041	633SB04103	28-Feb-02	21	J	

**TABLE 3-1**  
 Detected Compounds in Subsurface Soil Samples  
 Phase II Interim Measure Work Plan, AOC 633, Zone G, Charleston Naval Complex

Parameter Class	Compound	Station ID	Sample ID	Date Collected	Concentration (µg/kg)	Qualifier	SSL <sup>a</sup>
	Chrysene	G633SB042	633SB04203	28-Feb-02	46	=	80,000
	Dibenz(a,h)anthracene	G633SB033	633SB03303	28-Feb-02	8.8	J	1,000
		G633SB036	633SB03603	28-Feb-02	18	J	
		G633SB038	633SB03803	28-Feb-02	18	=	
		G633SB039	633SB03903	28-Feb-02	32	=	
		G633SB042	633SB04203	28-Feb-02	11	J	
		Fluoranthene	G633SB032	633SB03203	28-Feb-02	3.1	
	G633SB033		633SB03303	28-Feb-02	80	=	
	G633SB035		633SB03503	28-Feb-02	44	=	
	G633SB036		633SB03603	28-Feb-02	73	=	
	G633SB038		633SB03803	28-Feb-02	160	=	
	G633SB039		633SB03903	28-Feb-02	180	=	
	G633SB040		633SB04003	28-Feb-02	45	J	
	G633SB041		633SB04103	28-Feb-02	35	J	
	G633SB042		633SB04203	28-Feb-02	54	=	
	Fluorene		G633SB038	633SB03803	28-Feb-02	6.6	J
		G633SB039	633SB03903	28-Feb-02	5.6	J	
		G633SB042	633SB04203	28-Feb-02	2.6	J	

TABLE 3-1  
 Detected Compounds in Subsurface Soil Samples  
 Phase II Interim Measure Work Plan, AOC 633, Zone G, Charleston Naval Complex

Parameter Class	Compound	Station ID	Sample ID	Date Collected	Concentration (µg/kg)	Qualifier	SSL <sup>a</sup>
SVOCs	Indeno(1,2,3-c,d)pyrene	G633SB033	633SB03303	28-Feb-02	17	J	7,000
		G633SB036	633SB03603	28-Feb-02	31	J	
		G633SB038	633SB03803	28-Feb-02	24	=	
		G633SB039	633SB03903	28-Feb-02	38	=	
		G633SB040	633SB04003	28-Feb-02	20	J	
		G633SB042	633SB04203	28-Feb-02	13	=	
	Naphthalene	G633SB038	633SB03803	28-Feb-02	2.1	J	42,000
		G633SB039	633SB03903	28-Feb-02	2.7	J	
		G633SB042	633SB04203	28-Feb-02	2.2	J	
	Phenanthrene	G633SB035	633SB03503	28-Feb-02	78	=	6,000,000 (Anthracene)
		G633SB036	633SB03603	28-Feb-02	22	J	
		G633SB038	633SB03803	28-Feb-02	84	=	
		G633SB039	633SB03903	28-Feb-02	57	=	
		G633SB040	633SB04003	28-Feb-02	12	J	
		G633SB041	633SB04103	28-Feb-02	8.3	J	
		G633SB042	633SB04203	28-Feb-02	16	=	
		Pyrene	G633SB032	633SB03203	28-Feb-02	2.5	
	G633SB033		633SB03303	28-Feb-02	79	=	
	G633SB035		633SB03503	28-Feb-02	34	=	

TABLE 3-1  
 Detected Compounds in Subsurface Soil Samples  
 Phase II Interim Measure Work Plan, AOC 633, Zone G, Charleston Naval Complex

Parameter Class	Compound	Station ID	Sample ID	Date Collected	Concentration (µg/kg)	Qualifier	SSL <sup>a</sup>
SVOCs	Pyrene	G633SB036	633SB03603	28-Feb-02	93	=	2,100,000
		G633SB038	633SB03803	28-Feb-02	140	=	
		G633SB039	633SB03903	28-Feb-02	190	=	
		G633SB040	633SB04003	28-Feb-02	58	J	
		G633SB041	633SB04103	28-Feb-02	38	J	
		G633SB042	633SB04203	28-Feb-02	49	=	
PCBs	PCB-1254 (Aroclor-1254)	G633SB036	633SB03603	28-Feb-02	93	J	550 <sup>b</sup>
	PCB-1260 (Aroclor-1260)	G633SB033	633SB03303	28-Feb-02	420	J	15,400 <sup>c</sup>
		G633SB034	633SB03403	28-Feb-02	960	J	
		G633SB035	633SB03503	28-Feb-02	2,400	J	
		G633SB036	633SB03603	28-Feb-02	1,100	=	
		G633SB039	633SB03903	28-Feb-02	66	J	
		G633SB043	633SB04303	28-Feb-02	350	J	

Concentrations in bold text and outlined within the table indicate an exceedance of the appropriate screening criteria.

SSL values with a compound name in parenthesis indicates that the named compound SSL was used as a surrogate.

<sup>a</sup> SSLs are based on a DAF of 1 for VOCs and 10 for all other compounds.

<sup>b</sup> SSL was not available in Table A-1 of the Soil Screening Guidance (EPA, 1996b). SSL from U.S. EPA Region III RBC Table (October, 2000).

<sup>c</sup> This value is the calculated SSL from the Phase I IM Work Plan for AOC 633, Zone G.

µg/kg - micrograms per kilogram

= indicates that the compound was detected. The reported concentration is the measured concentration.

J indicates that the compound was detected. The reported concentration is the estimated concentration.

TABLE 3-2  
 Detected Compounds in Groundwater and LNAPL Samples  
 Phase II Interim Measure Work Plan, AOC 633, Zone G, Charleston Naval Complex

Sampled Media	Parameter Class	Compound	Station ID	Sample ID	Date Collected	Concentration	Qualifier	Units	MCL	RBC <sup>a</sup>
LNAPL	VOA	1,2-Dichlorobenzene	G633WA001	633WA001M1	04-Feb-02	1,000	J	µg/kg	NA	NA
		1,3-Dichlorobenzene	G633WA001	633WA001M1	04-Feb-02	4,000	=		NA	NA
		1,4-Dichlorobenzene	G633WA001	633WA001M1	04-Feb-02	19,000	=		NA	NA
		Acetone	G633WA001	633WA001M1	04-Feb-02	4,200	J		NA	NA
	TPH	Diesel	G633WA001	633WA001M1	04-Feb-02	720,000	=	mg/kg	NA	NA
	PCB	PCB-1260 (Aroclor-1260)	G633WA001	633WA001M1	04-Feb-02	1,200	=		NA	NA
Groundwater	VOA	1,2-Dichlorobenzene	G633GA001	633GA001M1	21-Jan-02	0.69	J	µg/L	600	NA
		1,3-Dichlorobenzene	G633GA001	633GA001M1	21-Jan-02	2.9	J		NA	5.5
		1,4-Dichlorobenzene	G633GA001	633GA001M1	21-Jan-02	14	=		75	NA
		Acetone	G633GA001	633GA001M1	21-Jan-02	28	J		NA	610
		Chlorobenzene	G633GA001	633GA001M1	21-Jan-02	1.8	J		100	NA
		Chloroethane	G633GA001	633GA001M1	21-Jan-02	<b>4.2</b>	J		NA	3.6
	PCB	PCB-1260 (Aroclor-1260)	G633GA001	633GA001M1	21-Jan-02	<b>300</b>	=		0.5	NA

Concentrations in bold text and outlined within the table indicate an exceedance of the appropriate screening criteria.

<sup>a</sup> RBCs were used as screening criteria only in the absence of a MCL.

µg/kg - micrograms per kilogram

µg/L - micrograms per liter

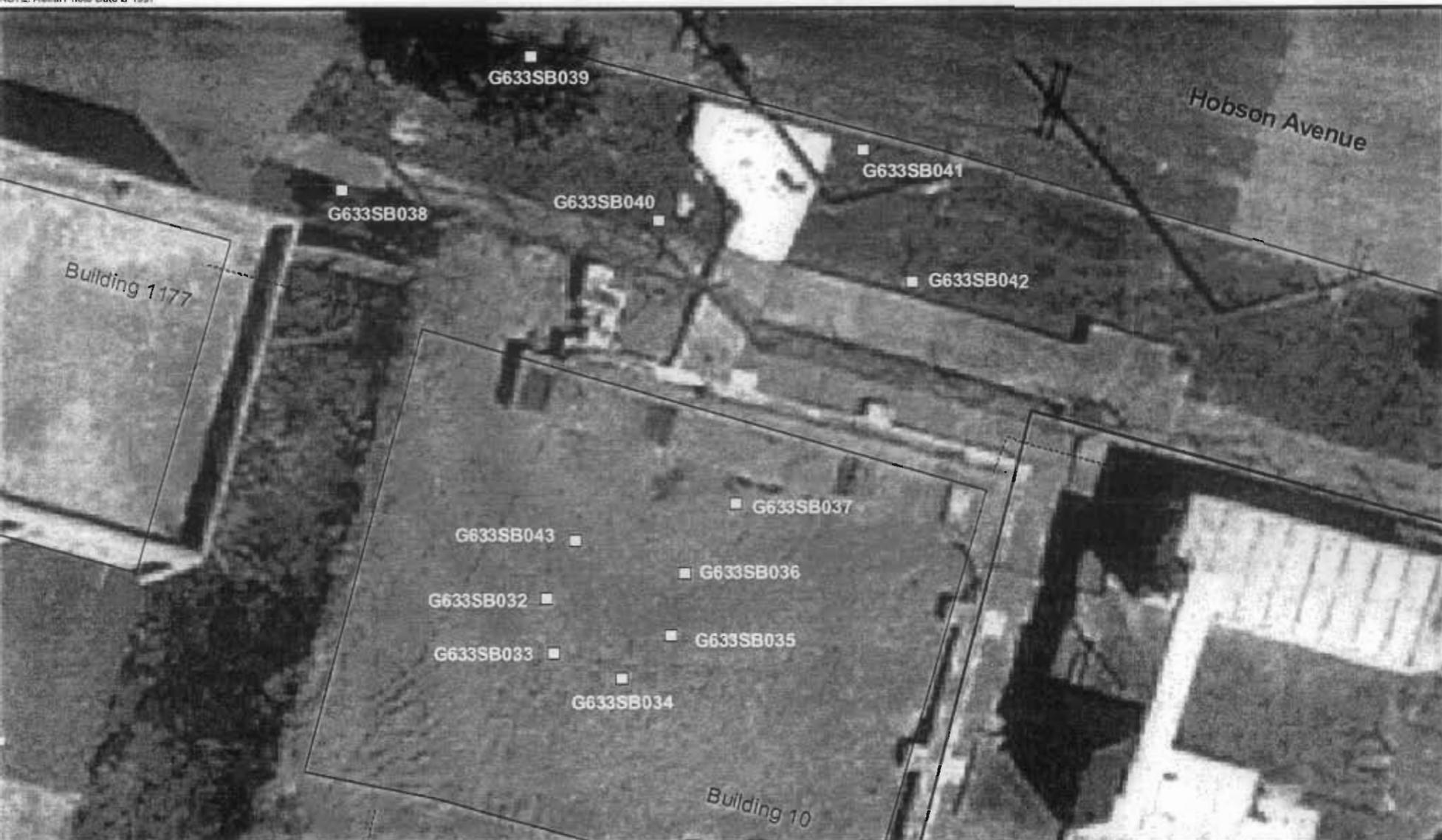
mg/kg - milligrams per kilogram

= indicates that the compound was detected. the reported concentration is the measured concentration.

J indicates that the compound was detected. The reported concentration is the estimated concentration.

NA indicates that information is not available or not applicable.

NOTE: Aerial Photo Date is 1997



**Figure 3-1**  
Subsurface Soil Sample Approximate Locations  
AOC 633, Zone G  
Charleston Naval Complex

**CH2MHILL**



## 1 **4.0 Technical Approach for the Phase II IM**

---

### 2 **4.1 Excavation Approach**

3 Prior to commencement of soil removal activities, the water within the concrete electrical  
4 conduit will be gauged for the presence of LNAPL, and a sample will be collected and  
5 submitted for PCB and VOC analysis.

6 The proposed removal action will be accomplished through excavation of the LNAPL-  
7 impacted soil and its associated "smear zone," and the offsite disposal of the excavated  
8 material. Initially, the overburden in the area of the previous IM will be excavated to a  
9 depth of 3 to 4 ft bls and stockpiled for later use as backfill (since this material has  
10 previously been determined to meet COPC screening criteria).

11 During the previous IM, the field team observed that the LNAPL appeared to be moving  
12 into the open excavation in the approximate vicinity of borings G633SB033 and G633SB043.  
13 The excavation will proceed initially in these areas, beginning at approximately 4 ft bls. The  
14 actual interval to be excavated will be determined based on field observations. Obviously  
15 stained or LNAPL-impacted soil will be removed. The excavation will be expanded in the  
16 direction in which LNAPL or LNAPL-impacted soil is observed until the limits of the  
17 LNAPL-impacted soil have effectively been determined and removed.

18 Dewatering of the excavation may be performed if necessary to allow more effective soil  
19 removal or backfilling. Any water removed from the excavation will be stored in a tank for  
20 subsequent treatment and/or disposal.

21 The excavated saturated soil will be stockpiled in suitable containers or within a lined  
22 containment area for temporary storage prior to offsite disposal. LNAPL that accumulates  
23 within the open excavation will be removed using sorbent pads, booms, and/or vacuum  
24 trucks. The soil pile will be covered when not in use. Any liquids draining from the  
25 stockpiled soil will be collected and stored in a tank or drum, pending analysis and  
26 appropriate disposal.

27 The contaminated soil will be transported to an appropriately permitted offsite disposal  
28 facility for appropriate disposal. The transported waste will be covered with a tarp to  
29 minimize airborne transfer of soil particulates.

1 If contaminated soil adjacent to the concrete structure has been removed, the concrete  
2 structure will be evaluated for possible contamination. If the concrete is determined to be  
3 significantly contaminated, it may be decontaminated or demolished and disposed of off  
4 site.

## 5 **4.2 Confirmatory Sample Collection and Backfilling**

6 Once all visible LNAPL-impacted soil has been removed and no more LNAPL is found to  
7 be migrating into the excavation, confirmatory samples will be collected from the perimeter  
8 of the excavation (in the unsaturated zone) to verify that residual concentrations of COPCs  
9 are below the their site-specific SSLs (see following section for derivation of site-specific  
10 SSLs). If confirmation samples contain COPCs that exceed their respective SSLs, additional  
11 soil will be considered for removal. The expanded boundary of the excavation will be re-  
12 sampled after each removal activity to verify that subsurface soil meets the site-specific  
13 SSLs.

14 Once sufficient data have been collected to confirm that the limits of excavation are  
15 adequate, the excavation will be backfilled with clean backfill plus the previously  
16 stockpiled overburden. If necessary, additional clean fill will be brought in for use as fill.

## 17 **4.3 Calculation of Site-Specific SSLs**

18 During the preparation of the previous IM WP, CH2M-Jones calculated a site-specific SSL  
19 for Aroclor-1260 (CH2M-Jones, 2001). The SSL calculation resulted in a site-specific SSL of  
20 15.4 mg/kg for Aroclor-1260, based on an infiltration rate of 0.1 ft/yr (1.2 in/yr). Since the  
21 development of that IM WP, CH2M-Jones has revised (increased) the assumed infiltration  
22 rate used in the SSL calculation for unpaved scenarios. The current infiltration rate value  
23 (0.45 ft/yr) is based on the regional precipitation, evapotranspiration, and a runoff  
24 coefficient based on site ground cover (unpaved). The derivation of the infiltration rate was  
25 presented in the Technical Memorandum, *Infiltration Variable Used in SSL Calculation*  
26 (CH2M-Jones, 2002). Prior to development of this technical memorandum, the infiltration  
27 rate (1.2 in/yr) was based on the USGS report (USGS, 1999).

28 As a result of changing the infiltration variable in the SSL calculation, CH2M-Jones has re-  
29 calculated the SSL for Aroclor-1260. The revised SSL calculation is presented in Table 4-1  
30 and is consistent with the EPA's *Soil Screening Guidance: User's Guide* (EPA, 1996a) and the  
31 *Soil Screening Guidance: Technical Background Document* (EPA, 1996b). The revised SSL for  
32 Aroclor-1260 was calculated to be 9.9 mg/kg.

1 Aroclor-1260, bromomethane, 1,3-dichlorobenzene, and tetrachloroethene (PCE) were  
2 detected in soil samples at concentrations above their respective screening criteria. Acetone,  
3 chloroethane, chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-  
4 dichlorobenzene were detected in the liquid samples (LNAPL and groundwater). SSLs were  
5 calculated for each of these constituents to be used as target media cleanup standards  
6 (MCSs) in unsaturated subsurface soil for the proposed IM. Table 4-1 presents the  
7 calculations and results. Table 4-2 presents a summary of the proposed MCSs.

#### 8 **4.4 Soil Sample Analysis**

9 Any confirmatory samples collected will be delivered or sent via overnight carrier to an  
10 offsite laboratory, where they will be analyzed for PCBs and VOCs using EPA Methods  
11 SW846-8082 and SW846-8260. The soil analysis will follow the procedures provided in the  
12 approved Comprehensive Sampling and Analysis Plan (CSAP) portion of the *Final*  
13 *Comprehensive RFI Work Plan* (EnSafe/Allen & Hoshall, 1994). The CSAP outlines all  
14 monitoring procedures to be performed during the investigation to characterize the  
15 environmental setting, source, and releases of hazardous constituents. In addition, the  
16 CSAP includes the Quality Assurance Plan (QAP) and Data Management Plan (DMP) to  
17 verify that all information and data are valid and properly documented. Sample analysis  
18 will be conducted in accordance with the guidance in the EPA's *Test Methods for Evaluating*  
19 *Solid Waste, SW-846, 3rd Ed.*, Office of Solid Waste and Emergency Response (SW846) and in  
20 the EPA Environmental Services Division *Laboratory Operations and Quality Control Manual*  
21 (ESDLOQCM) (1996c).

22 The results of the IM will be summarized in an IM Completion Report. The IM Completion  
23 Report will document the field activities and provide the analytical results from any  
24 confirmation samples collected at the site.

**Table 4-1**  
 Leachate Transport Analysis Model (Revised SSL Calculations for Aroclor-1260)  
 Phase II Interim Measure Work Plan, AOC 633, Zone G, Charleston Naval Complex

Parameter	Acetone	Bromoethane	Chloroethane	Chlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Tetrachloroethene	Aroclor-1260
<b>Chemical Specific Input Parameters</b>									
C <sub>w</sub> = Target groundwater concentration MCL (mg/L)	6.10E-01	0.0085	0.0036	0.1	0.6	0.0055	0.075	0.005	0.0005
H = Henry's Law Constant, dimensionless	7.67E-04	2.56E-01	4.55E-01	1.55E-01	6.15E-02	1.16E-01	1.11E-01	7.26E-01	1.89E-01
K <sub>s</sub> = Soil-water sorption coefficient (cm <sup>3</sup> water / g soil - L/kg) - K <sub>oc</sub> x f <sub>oc</sub> where K <sub>oc</sub> = organic carbon-water sorption coefficient, (cm <sup>3</sup> (ml) water) / (g soluble organic carbon) f <sub>oc</sub> = Fraction of organic content, dimensionless	1.04E-02	1.31E+00	2.50E-01	1.65E+00	2.61E+01	4.14E+01	4.65E+01	2.27E+00	8.84E+03
	0.0104	1	126	24	159	2512	3981	4467	218.5
<b>Site Specific Input Parameters</b>									
S <sub>w</sub> = Width of Source Parallel to Groundwater Flow Direction (impacted soil zone)	3.7 m	12 ft							
d <sub>a</sub> = Aquifer Thickness	4.9 m	16 ft							
d = Groundwater Mixing Zone thickness	1.39 m	4.6 ft							
i = Groundwater Gradient		1.0E-03 (unitless)							
K <sub>s</sub> = Saturated Hydraulic Conductivity	445.0 m/yr	1460.0 ft/yr							
θ <sub>w</sub> = Volumetric Water Content of Soil Pore Space	0.3 cm <sup>3</sup> v <sub>app</sub> /cm <sup>3</sup> soil	0.3 in <sup>3</sup> v <sub>app</sub> /in <sup>3</sup> soil							
θ <sub>v</sub> = Volumetric Vapor Content of Soil Pore Space	0.11 cm <sup>3</sup> v <sub>app</sub> /cm <sup>3</sup> soil	0.11 in <sup>3</sup> v <sub>app</sub> /in <sup>3</sup> soil							
ρ <sub>s</sub> = Soil Bulk Density	1.5 g/cm <sup>3</sup>	93.64 lb <sub>m</sub> /ft <sup>3</sup>							
q <sub>i</sub> = Water Infiltration Rate	0.1372 m/yr	0.4500 ft/yr							
Partition Term, C <sub>w</sub> /C <sub>soil</sub> , (L/kg)	$\frac{C_{soil}}{C_w} \left( \frac{\theta_w + K_d \rho_s + H \theta_v}{\rho_s} \right) \left( \frac{K_d i d + q_i S_w}{q_i S_w} \right)$	2.10E-01	1.53E+00	4.83E-01	1.86E+00	2.63E+01	4.16E+01	4.67E+01	2.53E+00
Dilution Term, dimensionless	$\frac{C_{soil}}{C_w} \left( \frac{\theta_w + K_d \rho_s + H \theta_v}{\rho_s} \right) \left( \frac{K_d i d + q_i S_w}{q_i S_w} \right)$	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.24E+00	2.236E+00
C <sub>soil</sub> /C <sub>w</sub> = Partition term * Dilution term (mg/kg / mg/L) = L/kg	4.71E-01	3.42E+00	1.08E+00	4.17E+00	5.89E+01	9.31E+01	1.04E+02	5.65E+00	1.977E+04
<b>Calculated Site Specific Target Level for Soil</b>									
C <sub>soil</sub> calculated source soil concentration (SSI, mg/kg) C <sub>w</sub> *(partition term)*(dilution term)	0.29	0.029	0.0039	0.42	35.3	0.51	7.8	0.028	9.9

C<sub>w</sub> is based on the Drinking Water Standards and Health Advisories (EPA, 2000) where available. Where MCLs were not available (acetone, bromomethane, chloroethane, and 1,3-dichlorobenzene) the RBC from the EPA Region III RBC Table (October, 2000) was used.  
 H is from the Hazardous Substances Data Bank (HSDB, search 5/1,2002) or Table 3-2 of the Toxicological Profile for Polychlorinated Biphenyls (U.S. Department of Health & Human Services, 1995) [Aroclor-1260] adjusted to the dimensionless form (x 4).  
 K<sub>s</sub> = K<sub>oc</sub> x f<sub>oc</sub>.  
 K<sub>oc</sub> is from the Hazardous Substances Data Bank (HSDB, search 5/1,2002) [bromomethane] or from the Superfund Chemical Data Matrix (Aroclor-1260)  
 f<sub>oc</sub> is from site data, sample 633SB009P1 analytical results (10,400 mg/kg = 1.04% TOC).  
 S<sub>w</sub> is the measured length of the source area exceeding the SSL along the groundwater flow direction.  
 d is calculated as d = (0.0112 L<sup>2</sup>)<sup>0.5</sup> + d<sub>a</sub>[1 - e<sup>-L q<sub>i</sub> K<sub>s</sub> d<sub>a</sub> / (K<sub>s</sub> d<sub>a</sub>)</sup>] or d<sub>a</sub>, whichever is less.  
 d<sub>a</sub> is the difference between the top of the Ashley formation (~ -20 ft msf) and the depth to water (~ -4 ft msf).  
 i is calculated (1/1000) from groundwater contours presented in Figure 1-4 Groundwater Monitoring Report (CH2M-Jones, 2001)  
 K<sub>s</sub> is from Figure 21 of the USGS Report Hydrology and Simulation of Ground-Water Flow in the Surficial Aquifer System in the Area of Charleston Naval Base, North Charleston, South Carolina, 1995-97 (USGS, 1999).  
 θ<sub>w</sub> is the default value presented in the Soil Screening Guidance: User's Guide (EPA, 1996)  
 θ<sub>v</sub> is calculated as total porosity (0.41) - θ<sub>w</sub> (0.3) = 0.11  
 ρ<sub>s</sub> is the default value presented in the Soil Screening Guidance: User's Guide (EPA, 1996)  
 q<sub>i</sub> is from the USGS Report Hydrology and Simulation of Ground-Water Flow in the Surficial Aquifer System in the Area of Charleston

**TABLE 4-2**  
 Summary of Calculated Site-Specific SSLs  
 Phase II Interim Measure Work Plan, AOC 633, Zone G, Charleston Naval Complex

Compound	SSL (µg/kg)	Basis
Acetone	290	RBC
Bromomethane	29	RBC
Chloroethane	3.9	RBC
Chlorobenzene	420	MCL
1,2-Dichlorobenzene	3.5E+4	MCL
1,3-Dichlorobenzene	510	RBC
1,4-Dichlorobenzene	7.8E+3	MCL
Tetrachloroethene (PCE)	28	MCL
Aroclor-1260	9.9E+3	MCL

Notes: The "Basis" column indicates whether the SSL was calculated to meet an MCL or tap water RBC concentration in groundwater.



## 1 **5.0 Investigation-Derived Waste**

---

2 Five waste streams will be generated as part of this IM: excavated soils, removed  
3 groundwater/LNAPL, adsorbent material, decontamination wastes, and personal  
4 protective equipment (PPE). Excavated soil and liquid wastes will be characterized in  
5 accordance with South Carolina Hazardous Waste Management Regulations (Section  
6 SCDHEC R.61-79.261) and disposed of in accordance with all applicable regulations and  
7 permits. Assuming the soils will be characterized as non-hazardous, they will be sent to a  
8 subtitle D landfill. Liquid wastes will be characterized and disposed of in accordance with  
9 applicable regulations. Decontamination wastes and PPE also will be disposed of in  
10 accordance with regulations.

11 Offsite transportation and disposal will be performed by properly permitted and licensed  
12 subcontractors. Materials designated for offsite disposal will be documented, tracked, and  
13 their disposition verified. This information will be reported in the IM Completion Report.



## 1 6.0 References

---

- 2 40 CFR 761.61. Title 40 Code of Federal Regulations Part 761.61, *PCB Remediation Waste*. July  
3 1, 2000.
- 4 CH2M-Jones. *Interim Measure Work Plan, Subsurface Soil Removal, AOC 633, Zone G*. Revision  
5 0. September 2001.
- 6 CH2M-Jones. *Infiltration Variable Used in SSL Calculation*. Technical Memorandum. April 12,  
7 2002.
- 8 EnSafe Inc. *Zone G RFI Report, NAVBASE Charleston*. Revision 0. February 28, 1998.
- 9 EnSafe Inc. *Zone G RFI Report Workplan Addendum, NAVBASE Charleston*. January 17, 2000.
- 10 EnSafe Inc./Allen & Hoshall. *Final Comprehensive RFI Work Plan*. 1994.
- 11 Environmental Enterprise Group (EEG). *Sampling Report, Site Delineation for PCBs at Area of*  
12 *Concern (AOC) 633, Charleston Naval Complex, Charleston, SC*. February 26, 2000a.
- 13 Environmental Enterprise Group (EEG). *Interim Stabilization Measure, Area of Concern (AOC)*  
14 *633, Charleston Naval Complex, Charleston, SC*. September 15, 2000b.
- 15 U.S. Environmental Protection Agency (EPA). *Soil Screening Guidance: User's Guide*. Office of  
16 Solid Waste and Emergency Response (OSWER). April, 1996a.
- 17 U.S. Environmental Protection Agency (EPA). *Soil Screening Guidance: Technical Background*  
18 *Document*. Office of Solid Waste and Emergency Response (OSWER). May 1996b.
- 19 U.S. Environmental Protection Agency (EPA). *Operating Procedures and Quality Assurance*  
20 *Manual (ESDSOPQAM)*. 1996c.
- 21 USGS. *Hydrogeology and Simulation of Ground-Water Flow in the Surficial Aquifer System in the*  
22 *Area of Charleston Naval Base, North Charleston, South Carolina, 1995-1997*. 1999.



**CH2MHILL**

**CH2M HILL**  
3011 S.W. Williston Road  
Gainesville, FL  
32608-3928  
Mailing address:  
P.O. Box 147009  
Gainesville, FL  
32614-7009  
Tel 352.335.7991  
Fax 352.335.2959

September 19, 2002

Mr. David Scaturo  
South Carolina Department of Health and  
Environmental Control  
Bureau of Land and Waste Management  
2600 Bull Street  
Columbia, SC 29201

Re: Interim Measure Completion Report (Revision 0) – AOC 633, Zone G

Dear Mr. Scaturo:

Enclosed please find four copies of the Interim Measure Completion Report (Revision 0) for AOC 633 in Zone G of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

The principal author of this document is Jim Edens. Please contact him at 352/335-5877, extension 2491, if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

cc: Rob Harrell/Navy, w/att  
Gary Foster/CH2M HILL, w/att

# INTERIM MEASURE COMPLETION REPORT

## AOC 633, Zone G



***Charleston Naval Complex  
North Charleston, South Carolina***

SUBMITTED TO  
***U.S. Navy Southern Division  
Naval Facilities Engineering Command***

PREPARED BY  
***CH2M-Jones***

*September 2002*

Revision No. 0  
Contract N62467-99-C-0960  
158814.ZG.PR.03

## Certification Page for the Interim Measure Completion Report, Revision 0 – AOC 633, Zone G

I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina

P.E. No. 21428

  
\_\_\_\_\_  
Dean Williamson, P.E.

  
\_\_\_\_\_  
Date

# 1 Contents

---

2	Section	Page
3	<b>Acronyms and Abbreviations</b> .....	vi
4	<b>1.0 Introduction</b> .....	1-1
5	1.1 Background.....	1-1
6	1.2 Report Organization.....	1-1
7	Figure 1-1 Location of AOC 633, Zone G.....	1-3
8	Figure 1-2 Aerial Photograph of AOC 633.....	1-4
9	<b>2.0 Interim Measure Implementation</b> .....	2-1
10	2.1 Delineation/Confirmation Sampling.....	2-1
11	2.2 Excavation Activities.....	2-2
12	2.3 LNAPL-Extent Assessment Activities.....	2-4
13	2.4 Phase II IM Work Plan.....	2-5
14	Table 2-1 Delineation/Confirmation Sample Results for Detected PCBs.....	2-8
15	Table 2-2 Detected Compounds in the Stockpile and Waste Characterization Samples....	2-9
16	Table 2-3 Detected Compounds in the Water and Product Samples.....	2-10
17	Table 2-4 Detected Compounds in the LNAPL Delineation Borings.....	2-11
18	Table 2-5 Detected Compounds in the Electrical Vault Sample.....	2-16
19	Table 2-6 Detected Compounds in the Project Sample 633ZB001M6.....	2-17
20	Table 2-7 Detected Compounds in the Confirmation Samples.....	2-18
21	Table 2-8 Detected Compounds in the Waste Characterization Samples.....	2-19
22	Figure 2-1 Delineation Sample Locations.....	2-20
23	Figure 2-2 LNAPL Delineation Borings.....	2-21
24	Figure 2-3 Approximate LNAPL Excavation Locations.....	2-22
25	Figure 2-4 Confirmation Sample Locations.....	2-23
26	<b>3.0 Interim Measure Outcome</b> .....	3-1
27	Table 3-1 Residual Aroclor-1260 Calculation.....	3-3
28	<b>4.0 Recommendations</b> .....	4-1
29	<b>5.0 References</b> .....	5-1

# 1 **Contents, Continued**

---

## 2 **Appendices**

3

4 **A** Figures Depicting Historic Sampling Locations at AOC 633

5 **B** Analytical Data Summary for the Delineation/Confirmation and Waste  
6 Characterization Samples

7 **C** Data Validation Report for the IM Analytical Data

8 **D** Waste Manifests (Waste Management Inc.)

# 1 Acronyms and Abbreviations

---

2	AOC	Area of concern
3	COPC	Chemical of potential concern
4	DAF	Dilution attenuation factor
5	ft bls	Feet below land surface
6	IM	Interim measure
7	LNAPL	Light non-aqueous phase liquid
8	MCL	Maximum contaminant level
9	MCS	Media cleanup standard
10	$\mu\text{g/L}$	Micrograms per liter
11	mg/kg	Milligrams per kilogram
12	NFI	No further investigation
13	PAH	Polycyclic aromatic hydrocarbon
14	PCB	Polychlorinated biphenyl
15	PID	Photoionization detector
16	SAP	Sampling and analysis plan
17	SSL	Soil screening level
18	TSCA	Toxic Substances Control Act
19	VOC	Volatile organic compound
20	WMI	Waste Management Inc.

**Section 1.0**

---

# 1 1.0 Introduction

---

## 2 1.1 Background

3 Located near the intersection of Hobson Avenue and Viaduct Road, Area of Concern (AOC)  
4 633 is comprised of an electrical substation. The facility is still in service, but is operating at  
5 a reduced capacity. Several polychlorinated biphenyl (PCB) releases have been reported at  
6 the site. The location of AOC 633 is illustrated in Figure 1-1. Figure 1-2 presents an aerial  
7 photograph of the site.

8 In September 2001, an Interim Measure Work Plan (IM WP) was developed to remove PCB-  
9 impacted subsurface soil within AOC 633 (CH2M-Jones, 2001). Soil samples were collected  
10 to delineate the areal extent of the PCB-impacted soil above the target cleanup level of 9.9  
11 milligrams per kilogram (mg/kg). The analytical results of these samples indicated that the  
12 areal extent of PCB-impacted soil above the target cleanup level was identified.

13 Analytical data from surface soil samples indicated that the top 2 feet (ft) of soil was not  
14 significantly impacted with PCBs. Therefore, the IM WP specified that this overburden be  
15 removed and stockpiled onsite for use as fill material.

16 The removal of subsurface soil containing PCBs above the media cleanup standard (MCS)  
17 of 9.9 mg/kg was expected to complete the necessary soil related corrective measures.  
18 During the IM, light non-aqueous phase liquid (LNAPL) was encountered. The LNAPL was  
19 determined to be weathered diesel fuel and contained PCBs at a concentration of 1,200  
20 mg/kg. To address the presence of the LNAPL, CH2M-Jones implemented a second IM.  
21 The goal of the second IM was the removal of LNAPL-impacted soil from the site. This IM  
22 Completion Report summarizes these two IMs and related sampling activity.

## 23 1.2 Report Organization

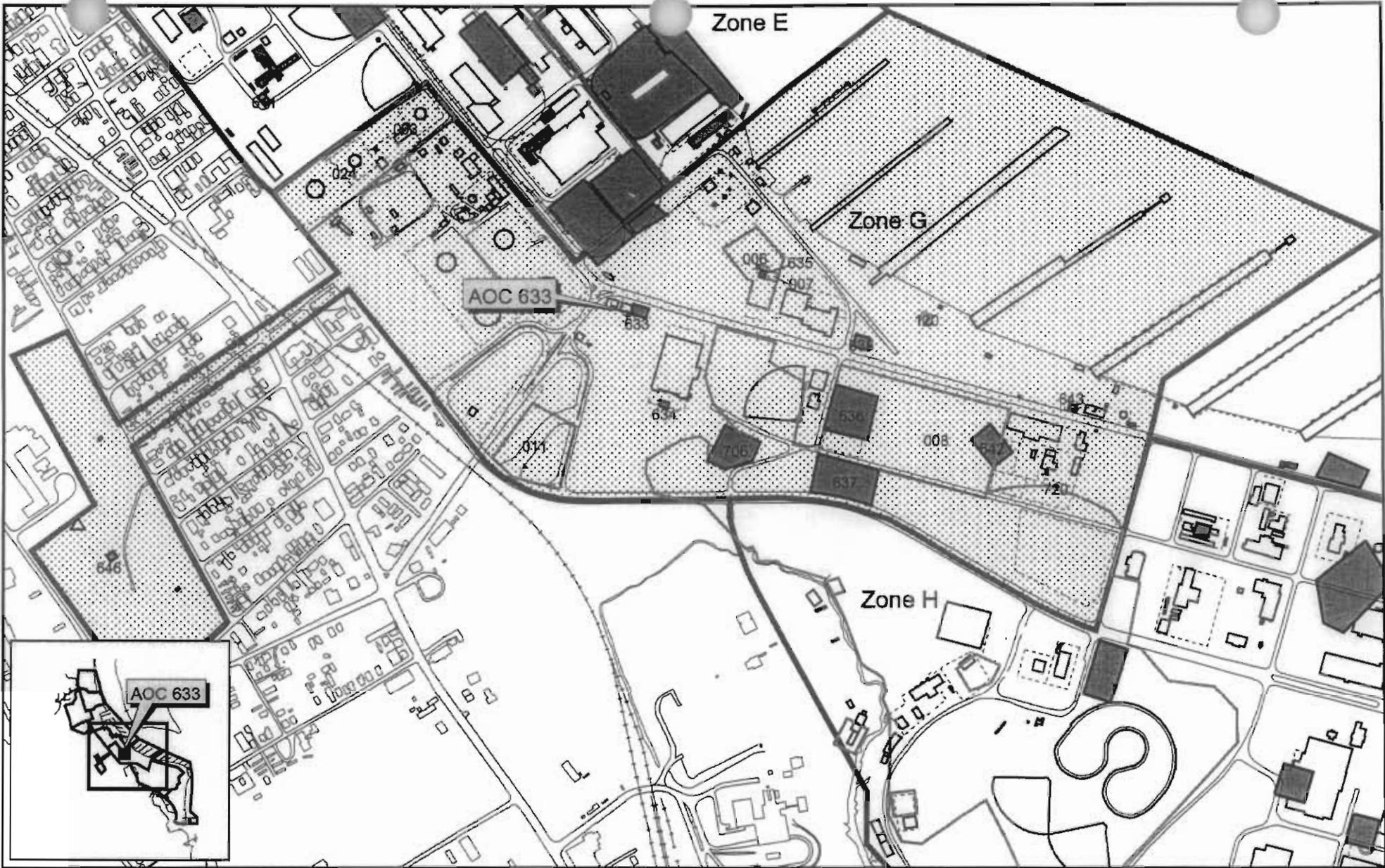
24 This IM Completion Report consists of the following sections:

25 **1.0 Introduction** — Presents the purpose of the report and background information relating  
26 to the two IMs that were performed.

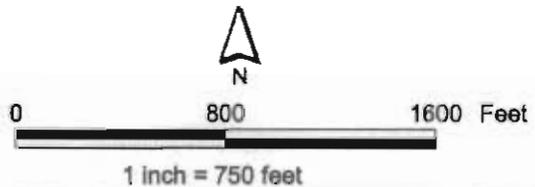
27 **2.0 Interim Measure Implementation** — Summarizes the excavation activities at AOC 633.

28 **3.0 Interim Measure Outcome** — Provides a discussion of post-IM activities.

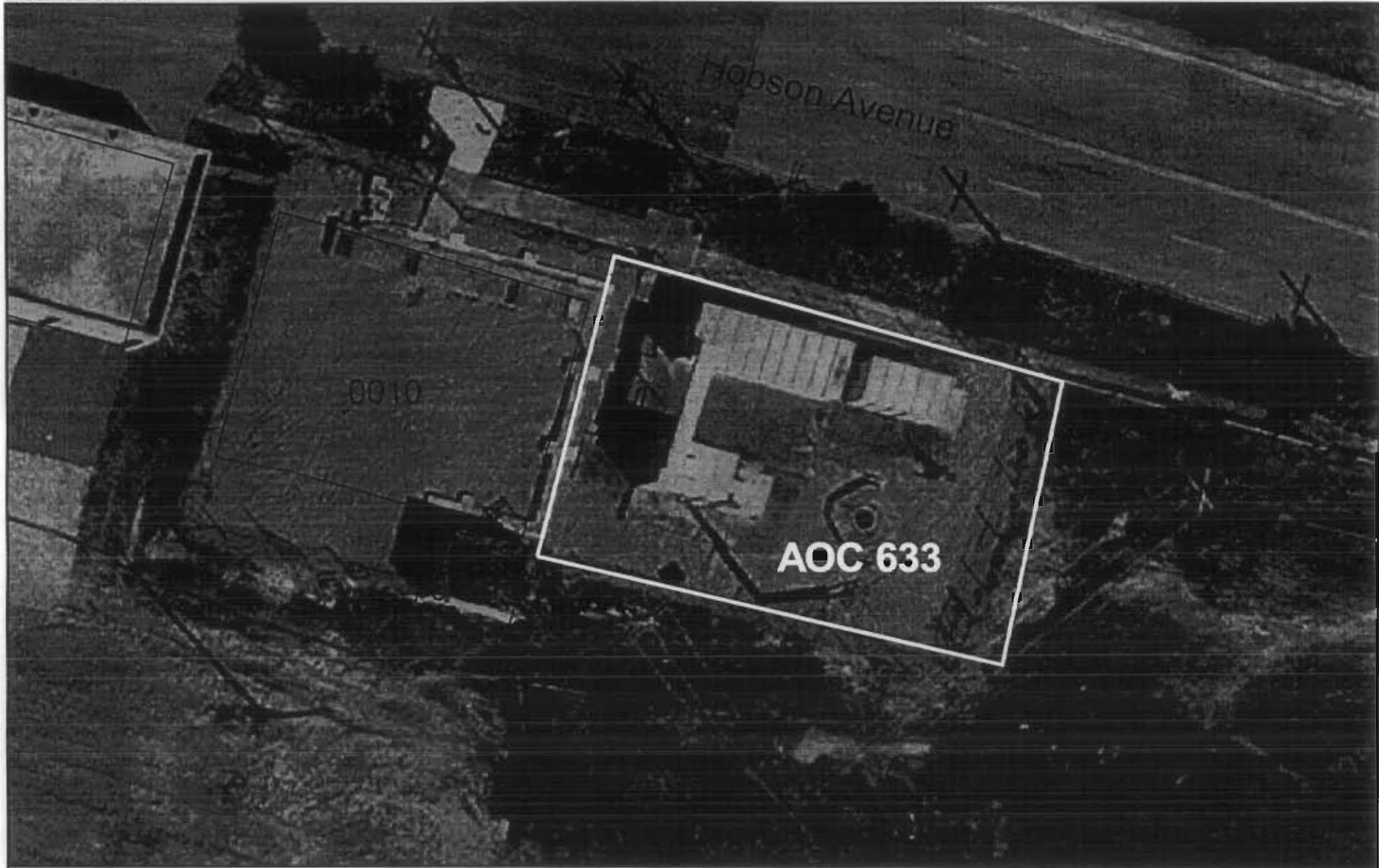
- 1 **4.0 Recommendations** — Provides recommendations for proceeding with additional RCRA
- 2 corrective action activities.
- 3 **5.0 References** — Lists the references used in this document.
- 4 **Appendix A** contains figures from previous Work Plans that illustrate historical sampling
- 5 locations.
- 6 **Appendix B** contains the analytical data from the delineation/confirmation and waste
- 7 characterization samples collected at AOC 633.
- 8 **Appendix C** contains the data validation summary for the IM analytical data.
- 9 **Appendix D** contains the waste manifests from Waste Management Inc. (WMI) for soil
- 10 disposal.
- 11 All tables and figures appear at the end of their respective sections.



- Fence
- Railroads
- Roads
- Shoreline
- AOC Boundary
- SWMU Boundary
- Buildings
- Zone Boundary
- Zone G



**Figure 1-1**  
 Location of AOC 633  
 Zone G  
 Charleston Naval Complex



- Fence
- Roads - Lines
- SWMU / AOC
- Buildings



0 30 60 Feet

1 inch = 25 feet

**Figure 1-2**  
Aerial Photograph  
AOC 633, Zone G  
Charleston Naval Complex

**CH2MHILL**



## 2.0 Interim Measure Implementation

---

### 2.1 Delineation/Confirmation Sampling

Extensive previous soil sampling (see locations in Figure 2-1 from the *IM Work Plan, Subsurface Soil Removal, AOC 633, Zone G* [CH2M-Jones, 2001] and Figure 2-2 of the *Phase II IM Work Plan, LNAPL and LNAPL-Impacted Soil Removal, AOC 633, Zone G* [CH2M-Jones, 2002], copies of which are presented in Appendix A of this IM Completion Report) established the target excavation limits for the IM. Surface soil analytical results showed that chemicals of potential concern (COPCs) were not present in surface soil above screening criteria. Several additional samples were collected, as described below, to better refine the excavation boundaries.

On November 6, 2001, in general accordance with the *IM Work Plan, Subsurface Soil Removal, AOC 633, Zone G* (CH2M-Jones, 2001), nine of the proposed ten subsurface soil samples were collected to determine the horizontal extent of subsurface soil containing Aroclor-1260 above the MCS of 9.9 mg/kg. The sample proposed to be collected at the location of Delineation Sample 1 was not collected at this time due to encountering a subsurface obstruction. Figure 2-1 shows the locations and sample identifications of the delineation/confirmation borings.

On January 11, 2002, a second attempt was made to collect the sample from the location of Delineation Sample 1. The CH2M-Jones field team used a slender metal rod to locate the edge of the subsurface obstruction. It was determined that the obstruction was a large section of concrete that extended into the northern portion of the proposed excavation approximately 2 ft. CH2M-Jones decided that a confirmation sample would be collected from the northern excavation face near this concrete element to replace Delineation Sample 1 (633SB04403).

Six subsurface soil samples were collected at 4 feet below land surface (ft bls) to define the horizontal excavation boundaries. Four samples, collected at 4 ft bls from within the proposed excavation boundary, were collected to define the vertical extent of the excavation (see Figure 2-1 of this report). A summary of the analytical results from these samples is presented in Table 2-1. Appendix B contains the complete data set for the IM samples; Appendix C contains the data validation report.

1 The reported PCB concentrations from the six horizontal delineation samples were below  
2 the cleanup levels established in the *IM Work Plan, Subsurface Soil Removal* for Aroclor-1260.  
3 Sample 633SB02703 contained Aroclor-1254 at a concentration of 1.6 mg/kg in addition to  
4 Aroclor-1260 (5.4 mg/kg). A cleanup criterion was not established for Aroclor-1254 (it was  
5 only detected in this one sample), but it would be expected to approximate that the MCS  
6 established for Aroclor-1260 and the sum of the detected PCBs (7.0 mg/kg) is below the  
7 MCS for Aroclor-1260. Therefore, the detection of Aroclor-1254 is not considered an  
8 exceedance of the MCS. These data indicate that the horizontal extent of PCB-impacted  
9 subsurface soil was adequately defined along the southern, western, and eastern  
10 boundaries. Delineation of soil contamination along the northern boundary was  
11 accomplished during the excavation activities by collecting a confirmation sample  
12 (633SB04403) from the northern face of the excavation. No PCBs, VOCs, or SVOCs were  
13 detected in the confirmation sample from this location.

14 Analytical results for Aroclor-1260 from the vertical delineation/confirmation subsurface  
15 soil samples 633SB02203 (21.0 mg/kg), 633SB02403 (17.0 mg/kg), and 633SB02603 (98.0  
16 mg/kg) were reported at concentrations above the MCS. All three of these samples were  
17 collected from locations within the boundary of the larger excavation. These data, collected  
18 at 4 ft bls, indicate that the depth of the excavation needed to proceed to the top of the water  
19 bearing zone as specified in the *IM Work Plan, Subsurface Soil Removal* (CH2M-Jones, 2001).

20 The analytical results from the vertical delineation/confirmation sample (633SB02803, 4.4  
21 mg/kg) collected from within the smaller excavation area were reported as being below the  
22 MCS for Aroclor-1260. No other PCB was detected in the sample. These data indicate that  
23 the depth of the small excavation could terminate at 4 ft bls.

24 Based on the analytical results, the horizontal area requiring soil removal was adequately  
25 defined in the IM WP. The target depth of the excavations were to the top of the water-  
26 bearing zone in the larger excavation, and to 4 ft bls in the smaller excavation. The resulting  
27 excavation areas measured approximately 10 ft in diameter and 5 ft deep (assumed depth to  
28 water) for the larger excavation (160 cubic ft ~ 6 yd<sup>3</sup>); and 1.5 ft<sup>2</sup> and 4 ft deep (5 cubic feet ~  
29 0.2 yd<sup>3</sup>).

## 30 **2.2 Excavation Activities**

31 On January 21, 2002, equipment and personnel were mobilized to AOC 633 to begin  
32 preparing the site for removal activities in accordance with the AOC 633 IM WP. All work

1 was performed in general accordance with the work plan. The approximate final excavation  
2 boundary is presented on Figure 2-1.

3 Excavation activities at AOC 633 began with removal and stockpiling of the top 2 ft of soil  
4 in accordance with the IM WP. A composite sample was collected from the stockpile to  
5 verify that it was suitable for use as fill material. The analytical results from this sample  
6 (633SB024M1) indicated that concentrations of PCBs were below the MCS and the soil was  
7 suitable to be returned to the excavation. The remainder of the excavated soil was placed  
8 directly into a lined roll off container for disposal. The soil in the roll off container was also  
9 sampled to determine the method of disposal for the PCB-impacted soil. Soil with PCB  
10 concentrations less than 10 mg/kg can be disposed of in a Subtitle D landfill. Soil with PCB  
11 concentrations greater than 10 mg/kg must be disposed of in a Subtitle C landfill and soil  
12 with PCB concentrations greater than 50 mg/kg must be disposed of in a Toxic Substances  
13 Control Act (TSCA)-approved landfill. Analytical results for the sample collected from the  
14 roll off container (633VA001M1; Aroclor-1260, 8.7 mg/kg) indicated that the soil could be  
15 disposed of in a Subtitle D landfill. The soil was disposed of by WMI at the Oakridge  
16 Landfill, 2183 Highway 78, PO Box 145, Dorchester, SC 29437. The waste manifests are  
17 included in Appendix D. The waste manifests from Waste Management Inc. (WMI) indicate  
18 that 8.29 tons of soil were excavated from the site and disposed of off site.

19 Table 2-2 presents a summary of detected compounds in the stockpile and waste disposal  
20 sample (the complete data summary is contained in Appendix B).

21 Observations of soil characteristics made during excavation activities supported the site  
22 conceptual model presented in the IM WP. Gravel was found in approximately the top 6  
23 inches of removed material. From 6 inches bls to approximately 2 ft bls light colored sandy  
24 soil was noted. The soil color and texture of the sandy soil are consistent with fill material.  
25 The IM WP concluded that fill material was brought on site based on the fact that the  
26 analytical data indicated subsurface soil beneath the fill was contaminated with PCBs  
27 without corresponding surface soil contamination.

28 During the course of excavating the subsurface soil at AOC 633, a dark, oily substance  
29 seeped into the larger excavation near the locations of soil borings G633SB033 and  
30 G633SB043. Approximately ¼ inch of assumed "product" accumulated within the  
31 excavation. The product and the water below the product were sampled. The analytical  
32 results of the collected samples indicated that the product was likely "weathered diesel  
33 fuel." Both the product and water contained the PCB Aroclor-1260, acetone, 1,2-  
34 dichlorobenzene (1,2-DCB), 1,3-dichlorobenzene (1,3-DCB), and 1,4-dichlorobenzene (1,4-

1 DCB). Additionally the water sample contained chloroethane and chlorobenzene. It was not  
2 unexpected that the water sample contained many of the same compounds as the product  
3 sample as it was not possible to completely separate the product from the water during  
4 sampling. A summary of the detected compounds is presented in Table 2-3.

5 Following completion of the excavation, a grab soil sample (633SB04403) was collected at  
6 the location of northern most delineation sample not previously collected due to a concrete  
7 subsurface obstruction. PCBs were not detected in the sample. The excavation area was  
8 graded to match the existing grade.

## 9 **2.3 LNAPL-Extent Assessment Activities**

10 In an attempt to determine the extent and possible source of the diesel fuel, CH2M-Jones  
11 advanced eleven soil borings to just above the water table. The locations of the soil borings  
12 are presented in Figure 2-2.

13 The soil was examined visually to determine if obvious contamination was present, and  
14 photoionization detector (PID) readings of the soil were measured, and a sample was  
15 collected just above the water table at each boring. PID readings ranged from 0.0 at five  
16 locations to 2.1 at boring E633SB035. The collected samples were analyzed for volatile  
17 organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), and PCBs. Table  
18 2-4 summarizes the detected compounds from these samples. Acetone and bromomethane  
19 were detected in one sample each at concentrations that marginally exceeded their  
20 respective soil screening levels (SSLs). Table 2-4 also presents the mean detected  
21 concentrations for these two compounds. The mean detected concentrations are below the  
22 SSLs indicating that existing concentrations of these compounds are sufficiently protective  
23 of shallow groundwater. The mean concentrations would be expected to be lower if the  
24 non-detect data were included in the calculation.

25 Based on these data, neither the source of the LNAPL nor the presence of additional LNAPL  
26 were identified.

27 Based on the site setting, several potential sources of LNAPL were considered possible,  
28 including the FDS pipeline along Hobson Avenue and the fire station adjacent to the site.  
29 None of the borings identified any LNAPL-saturated soil. Thus, the possibility of the  
30 LNAPL originating at these offsite sources could not be confirmed, and it appeared more  
31 likely that the LNAPL originated from a small onsite release of diesel fuel.

## 2.4 Phase II Interim Measure Work Plan

In May 2002, CH2M-Jones submitted the *Phase II IM Work Plan, LNAPL and LNAPL-Impacted Soil Removal, AOC 633, Zone G*. The Phase II IM WP called for determining the presence, or absence, of LNAPL in the concrete electrical vault, the collection of a water sample from within the vault and the removal of LNAPL-impacted soil.

On June 5, 2002, the field team collected the sample from the electrical vault. The planned collection method was to slowly lower a bailer into the water in order to remove the water sample along with any LNAPL, if present. The depth of the water was only a couple of inches, making it difficult to collect the sample. In order to collect a sufficient liquid volume, the bailer was laid on its side. This resulted in disturbing the water and the collection of suspended solids within the water sample. The presence of LNAPL was not noted. The results of the water sample from the concrete electrical vault are presented in Table 2-5. Screening criteria are not available, and therefore not presented for this sample.

On July 22, 2002, personnel and equipment were mobilized to the site to begin LNAPL-impacted soil removal in accordance with the Phase II IM WP. Seven excavations were sequentially made at the site as described below. The approximate locations of the excavations are presented in Figure 2-3.

During the excavations at AOC 633 for the LNAPL investigation, the subsurface geology observed was consistent with other sites in Zone G which had been backfilled with dredge spoil and construction debris to increase land elevations for development.

At the surface, run of crusher gravel was scraped off, exposing a tan to orangish-brown silty sand, which extended to approximately 2 ft bls. This material is believed to be fill from the previous IM work. At approximately 2 to 2.5 ft bls, a sharp transition to an orangish-brown clayey material was noted. The clayey material contained decayed plant material and iron staining, variable amounts of sand, and was approximately 0.5 to 2 ft in thickness, with low moisture content.

At variable depths around 3 feet bls, the orange material grades abruptly to a dark gray to grayish brown clayey material, which contains decaying plant materials and a variety of debris, including, bricks, glass bottles, wood pallets, concrete block, wire, rope and wood scraps. This material was observed to extend to depth of about 8 feet bls in one excavation. The gray clayey material is dense and highly plastic, and slightly moist, with moisture content increasing with depth.

1 Groundwater, and LNAPL when present, in the excavations was noted to be entering the  
2 excavation near the bottom, from a zone of debris within the gray clayey material at depths  
3 of approximately 4 to 6 ft bls.

4 The initial excavation was made in the area of soil borings G633SB033 and G633SB043 as  
5 specified in the Phase II IM WP. These locations are near soil borings G633SB031 and  
6 G633SB031 (see Figures 2-1 and 2-2) where LNAPL was observed entering the initial  
7 excavation. A small amount of LNAPL (less than ¼-inch) was noted to migrate into the  
8 excavation. LNAPL-saturated soil was not observed. Because LNAPL-stained soil was not  
9 observed, it was decided to excavate additional areas to determine the extent of the LNAPL.  
10 A total of six additional excavations were made as shown on Figure 2-3, stepping out  
11 towards potential source areas, to confirm that the LNAPL-impacted area was limited in  
12 size.

13 LNAPL (less than ¼-inch) was observed migrating into Excavations 1 and 2 (see Figure 2-3).  
14 A small amount (a few droplets) of LNAPL was also noted in Excavation 3. LNAPL was not  
15 observed in any of the other excavations. A sample (633ZB001M6) of the product was  
16 collected, and the analytical results again identified the product as "weathered" diesel.  
17 Aroclor-1260 was also detected in the product sample at a concentration of 2,900 mg/kg.  
18 Table 2-6 presents a summary of detected compounds in the sample. The sample was  
19 collected as remote as possible from the PCB-impacted soil in an attempt to determine if the  
20 LNAPL source was site-related or migrating onto the site from the west. If the sample did  
21 not contain PCBs, the LNAPL was likely migrating onto the site. If PCBs were present, the  
22 LNAPL may have more likely originated at the site. Aroclor-1260 was detected in the  
23 product sample and the presence of the LNAPL was considered to be potentially site-  
24 related. Because of the apparent limited areal extent and the thin layer of LNAPL, the  
25 LNAPL is considered likely due to a small onsite diesel fuel spill.

26 On July 24, 2002, CH2M-Jones pumped the product and water from the excavations with  
27 product present. Approximately 190 gallons (3.5 drums) of water/product was removed  
28 and placed into 55-gallon drums. The excavations were periodically checked for the  
29 accumulation of product over the next two weeks. On July 30, 2002, a small amount (a  
30 heavy sheen) of LNAPL was observed in Excavation 2 (see Figure 2-3). The sheen was  
31 adsorbed with adsorbent pads. The presence of a recoverable amount of product in the  
32 excavations was not noted in later site visits. This information further supports that the  
33 presence of the LNAPL at AOC 633 was likely the result of a small onsite diesel spill; it has  
34 been adequately remediated as a result of this IM.

1 On July 26, 2002, confirmation samples were collected from the walls of Excavations 1 and 2  
2 (see Figure 2-3). Waste characterization samples were also collected from the soil in the  
3 dumpster (633SB04901) and the drummed water (633VADRMM6) on this date. The  
4 locations of the confirmation samples are shown on Figure 2-4. Summaries of detected  
5 compounds are presented in Tables 2-7 and 2-8 for the confirmation samples and waste  
6 characterization samples, respectively.

7 Upon review of the data presented in Table 2-7, no compounds were detected above their  
8 respective SSLs. These data further support that the presence of LNAPL at the site was  
9 likely the result of a small on-site spill and that the LNAPL and impacted subsurface soil  
10 have been adequately remediated. Therefore, the excavations were backfilled and graded to  
11 match the existing grade on August 8, 2002.

12 The analytical results from the excavated soil indicated that it could be handled as non-  
13 hazardous and was disposed of by WMI at the Oakridge Landfill, 2183 Highway 78, PO Box  
14 145, Dorchester, SC 29437. The waste manifests are included in Appendix D. The waste  
15 manifests from WMI indicate that a total of 17.34 tons of soil were excavated from the site  
16 during the Phase II IM and disposed of off site.

17 A waste characterization sample (633VADRMM6) was collected from the drummed water  
18 removed from the excavations at AOC 633. The analytical results for detected compounds  
19 in that sample are presented in Table 2-8. The analytical results indicated that the water  
20 could be disposed of as non-hazardous. CH2M-Jones submitted the results along with a  
21 request to dispose of the water in the sanitary sewer to the Charleston Sewer District. On  
22 September 4, 2002 CH2M-Jones received permission to discharge the water into the sanitary  
23 sewer.

**TABLE 2-1**  
 Delineation/Confirmation Sample Results for Detected PCBs  
*Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex*

Location ID	Sample ID	Collection Date	PCB	Concentration (mg/kg)
<b>Horizontal Delineation Samples</b>				
A633SB027	633SB02703	11/06/2001	Aroclor-1254	1.6
A633SB027	633SB02703	11/06/2001	Aroclor-1260	5.4
A633SB029	633SB02903	11/06/2001		7.0
A633SB030	633SB03003	11/06/2001		1.4
A633SB031	633SB03103	11/06/2001		3.9
A633SB023	633SB02303	11/06/2001		0.74
<b>Vertical Delineation Samples</b>				
A633SB022	633SB02203	11/06/2001	Aroclor-1260	<b>21.0</b>
A633SB024	633SB02403	11/06/2001		<b>17.0</b>
A633SB026	633SB02603	11/06/2001		<b>98.0</b>
A633SB028	633SB02803	11/06/2001		4.4

**Bold** and outlined results indicate exceedances of the site-specific SSL of 9.9 mg/kg.

**TABLE 2-2**  
 Detected Compounds in the Stockpile and Waste Characterization Samples  
*Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex*

Station ID	Sample ID	Date Collected	Parameter Class	Compound	Concentration (mg/kg)	Qualifier	SSL
<b>Stockpile</b>							
G633SB024	633SB024M1	11-Feb-02	PCB	PCB-1260 (Aroclor-1260)	0.31	J	9.9
<b>Waste Characterization</b>							
G633VA001	633VA001M1	11-Feb-02	PCB	PCB-1260 (Aroclor-1260)	8.7	=	
			SVOA	Benzo[a]Anthracene	0.012	=	
				Benzo[a]Pyrene	0.01	=	
				Benzo[b]Fluoranthene	0.022	=	
				Benzo[g,h,i]Perylene	0.013	=	
				Benzo[k]Fluoranthene	0.012	=	
				Chrysene	0.029	=	
				Dibenz[a,h]anthracene	0.0029	J	
				Fluoranthene	0.052	=	
				Indeno[1,2,3-c,d]pyrene	0.011	=	
				Phenanthrene	0.023	=	
				Pyrene	0.039	=	
			VOA	1,4-Dichlorobenzene	0.002	J	

All values are presented in units of milligrams per kilogram (mg/kg).

- = Indicates that the analyte was detected at the concentration shown.
- J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits, or the value was detected below the laboratory's quantification limit.

**TABLE 2-3**  
 Detected Compounds in the Water and Product Samples  
 Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex

Station ID	Sample ID	Date Collected	Parameter Class	Compound	Concentration	Qualifier
<b>Water</b>					<b>(<math>\mu\text{g/L}</math>)</b>	
G633GA001	633GA001M1	21-Jan-02	PCB	PCB-1260 (Aroclor-1260)	300	=
			VOA	1,2-Dichlorobenzene	0.69	J
				1,3-Dichlorobenzene	2.9	J
				1,4-Dichlorobenzene	14	=
				Acetone	28	J
				Chlorobenzene	1.8	J
				Chloroethane	4.2	J
<b>Product</b>					<b>(<math>\text{mg/kg}</math>)</b>	
G633WA001	633WA001M1	04-Feb-02	PCB	PCB-1260 (Aroclor-1260)	1,200	=
			TPH	Diesel Components	720,000	=
			VOA	1,2-Dichlorobenzene	1	J
				1,3-Dichlorobenzene	4	=
				1,4-Dichlorobenzene	19	=
				Acetone	4.2	J

All values are presented in units of milligrams per kilogram (mg/kg) or micrograms per kilogram ( $\mu\text{g/L}$ ).

- = Indicates that the analyte was detected at the concentration shown.
- J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits, or the value was detected below the laboratory's quantification limit.

**TABLE 2-4**  
 Detected Compounds in the LNAPL Delineation Borings  
*Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex*

Parameter Class	Station ID	Sample ID	Date Collected	Compound	Concentration (mg/kg)	Qualifier	SSL
<b>PCB</b>							
	G633SB036	633SB03603	28-Feb-02	PCB-1254 (Aroclor-1254)	0.093	J	0.55 <sup>REG III</sup>
	G633SB033	633SB03303	28-Feb-02	PCB-1260 (Aroclor-1260)	0.42	J	9.9 <sup>site-specific</sup>
	G633SB034	633SB03403	28-Feb-02		0.96	J	
	G633SB035	633SB03503	28-Feb-02		2.4	J	
	G633SB036	633SB03603	28-Feb-02		1.1	=	
	G633SB039	633SB03903	28-Feb-02		0.066	J	
	G633SB043	633SB04303	28-Feb-02		0.35	J	
<b>SVOA</b>							
	G633SB038	633SB03803	28-Feb-02	Acenaphthene	0.0062	J	285
	G633SB039	633SB03903	28-Feb-02		0.0064	J	
	G633SB042	633SB04203	28-Feb-02		0.0045	J	
	G633SB036	633SB03603	28-Feb-02	Acenaphthylene	0.014	J	
	G633SB038	633SB03803	28-Feb-02		0.0025	J	285 <sup>Acenaphthene</sup>
	G633SB039	633SB03903	28-Feb-02		0.0048	J	
	G633SB042	633SB04203	28-Feb-02		0.0071	J	
	G633SB035	633SB03503	28-Feb-02	Anthracene	0.02	J	6,000
	G633SB038	633SB03803	28-Feb-02		0.014	=	
	G633SB039	633SB03903	28-Feb-02		0.018	=	
	G633SB042	633SB04203	28-Feb-02		0.0068	J	
	G633SB033	633SB03303	28-Feb-02	Benzo[a]Anthracene	0.035	=	1
	G633SB035	633SB03503	28-Feb-02		0.009	J	
	G633SB036	633SB03603	28-Feb-02		0.06	J	
	G633SB038	633SB03803	28-Feb-02		0.066	=	
	G633SB039	633SB03903	28-Feb-02		0.13	=	
	G633SB040	633SB04003	28-Feb-02		0.031	J	
	G633SB041	633SB04103	28-Feb-02		0.018	J	
	G633SB042	633SB04203	28-Feb-02		0.035	=	
	G633SB032	633SB03203	28-Feb-02	Benzo[a]Pyrene	0.0019	J	4
	G633SB033	633SB03303	28-Feb-02		0.034	=	

**TABLE 2-4**  
 Detected Compounds in the LNAPL Delineation Borings  
 Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex

Parameter Class	Station ID	Sample ID	Date Collected	Compound	Concentration (mg/kg)	Qualifier	SSL		
SVOA	G633SB036	633SB03603	28-Feb-02	Benzo[a]Pyrene	0.071	J	4		
	G633SB038	633SB03803	28-Feb-02		0.075	=			
	G633SB039	633SB03903	28-Feb-02		0.15	=			
	G633SB040	633SB04003	28-Feb-02		0.035	J			
	G633SB041	633SB04103	28-Feb-02		0.016	J			
	G633SB042	633SB04203	28-Feb-02		0.044	=			
	G633SB032	633SB03203	28-Feb-02	Benzo[b]Fluoranthene	0.0021	J	2.5		
	G633SB033	633SB03303	28-Feb-02		0.034	=			
	G633SB035	633SB03503	28-Feb-02		0.013	J			
	G633SB036	633SB03603	28-Feb-02		0.055	J			
	G633SB038	633SB03803	28-Feb-02		0.11	=			
	G633SB039	633SB03903	28-Feb-02		0.16	=			
	G633SB040	633SB04003	28-Feb-02		0.045	J			
	G633SB041	633SB04103	28-Feb-02		0.018	J			
	G633SB042	633SB04203	28-Feb-02		0.057	=			
	G633SB033	633SB03303	28-Feb-02		Benzo[g,h,i]Perylene	0.017		J	NA
	G633SB036	633SB03603	28-Feb-02			0.036		J	
	G633SB038	633SB03803	28-Feb-02			0.033		=	
	G633SB039	633SB03903	28-Feb-02	0.057		=			
	G633SB040	633SB04003	28-Feb-02	0.02		J			
	G633SB042	633SB04203	28-Feb-02	0.018		=			
	G633SB033	633SB03303	28-Feb-02	Benzo[k]Fluoranthene	0.047	=	24.5		
	G633SB035	633SB03503	28-Feb-02		0.017	J			
	G633SB036	633SB03603	28-Feb-02		0.077	=			
	G633SB038	633SB03803	28-Feb-02		0.11	=			
	G633SB039	633SB03903	28-Feb-02		0.18	=			
G633SB040	633SB04003	28-Feb-02	0.033		J				
G633SB041	633SB04103	28-Feb-02	0.013		J				
G633SB042	633SB04203	28-Feb-02	0.055		=				
SVOA	G633SB033	633SB03303	28-Feb-02	Chrysene	0.043	=	80		

**TABLE 2-4**  
 Detected Compounds in the LNAPL Delineation Borings  
*Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex*

Parameter Class	Station ID	Sample ID	Date Collected	Compound	Concentration (mg/kg)	Qualifier	SSL		
SVOA	G633SB035	633SB03503	28-Feb-02	Chrysene	0.02	J	80		
	G633SB036	633SB03603	28-Feb-02		0.069	J			
	G633SB038	633SB03803	28-Feb-02		0.1	=			
	G633SB039	633SB03903	28-Feb-02		0.15	=			
	G633SB041	633SB04103	28-Feb-02		0.021	J			
	G633SB042	633SB04203	28-Feb-02		0.046	=			
	G633SB033	633SB03303	28-Feb-02		Dibenz(a,h)anthracene	0.0088		J	1
	G633SB036	633SB03603	28-Feb-02			0.018		J	
	G633SB038	633SB03803	28-Feb-02			0.018		=	
	G633SB039	633SB03903	28-Feb-02			0.032		=	
	G633SB042	633SB04203	28-Feb-02			0.011		J	
	G633SB032	633SB03203	28-Feb-02			Fluoranthene		0.0031	
	G633SB033	633SB03303	28-Feb-02		0.08			=	
	G633SB035	633SB03503	28-Feb-02	0.044	=				
	G633SB036	633SB03603	28-Feb-02	0.073	=				
	G633SB038	633SB03803	28-Feb-02	0.16	=				
	G633SB039	633SB03903	28-Feb-02	0.18	=				
	G633SB040	633SB04003	28-Feb-02	0.045	J				
	G633SB041	633SB04103	28-Feb-02	0.035	J				
	G633SB042	633SB04203	28-Feb-02	0.054	=				
	G633SB038	633SB03803	28-Feb-02	Fluorene	0.0066	J	280		
	G633SB039	633SB03903	28-Feb-02		0.0056	J			
	G633SB042	633SB04203	28-Feb-02		0.0026	J			
G633SB033	633SB03303	28-Feb-02	Indeno(1,2,3-c,d)pyrene		0.017	J		7	
G633SB036	633SB03603	28-Feb-02		0.031	J				
G633SB038	633SB03803	28-Feb-02		0.024	=				
G633SB039	633SB03903	28-Feb-02		0.038	=				
G633SB040	633SB04003	28-Feb-02		0.02	J				
G633SB042	633SB04203	28-Feb-02		0.013	=				
SVOA	G633SB038	633SB03803		28-Feb-02	Naphthalene	0.0021	J		42



**TABLE 2-4**  
 Detected Compounds in the LNAPL Delineation Borings  
 Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex

Parameter Class	Station ID	Sample ID	Date Collected	Compound	Concentration (mg/kg)	Qualifier	SSL
VOA	G633SB040	633SB04003	28-Feb-02	Acetone	0.14	J	0.29 <sup>site-specific</sup>
	G633SB042	633SB04203	28-Feb-02		0.21	J	
	G633SB033	633SB03303	28-Feb-02	Bromomethane	0.024	J	0.029 <sup>site-specific</sup>
	G633SB036	633SB03603	28-Feb-02		<b>0.031</b>	J	(mean 0.0275)
	G633SB034	633SB03403	28-Feb-02	Carbon Disulfide	0.0039	J	2
	G633SB035	633SB03503	28-Feb-02		0.004	J	
	G633SB036	633SB03603	28-Feb-02		0.049	=	
	G633SB038	633SB03803	28-Feb-02		0.052	=	
	G633SB039	633SB03903	28-Feb-02		0.0067	J	
	G633SB040	633SB04003	28-Feb-02		0.021	=	
	G633SB041	633SB04103	28-Feb-02		0.0024	J	
	G633SB042	633SB04203	28-Feb-02		0.0064	J	
	G633SB035	633SB03503	28-Feb-02	Ethylbenzene	0.002	J	0.7
	G633SB035	633SB03503	28-Feb-02	m+p Xylene	0.01	=	9 <sup>o-xylene</sup>
	G633SB033	633SB03303	28-Feb-02	Methyl ethyl ketone (2-Butanone)	0.053	J	0.4 <sup>REG III</sup>
	G633SB036	633SB03603	28-Feb-02		0.056	J	
	G633SB038	633SB03803	28-Feb-02		0.011	J	
	G633SB039	633SB03903	28-Feb-02		0.023	J	
	G633SB040	633SB04003	28-Feb-02		0.025	J	
	G633SB041	633SB04103	28-Feb-02		0.0069	J	
	G633SB042	633SB04203	28-Feb-02		0.037	J	
	G633SB035	633SB03503	28-Feb-02	o-Xylene	0.0045	J	9
	G633SB035	633SB03503	28-Feb-02	Tetrachloroethylene (PCE)	0.0067	=	0.028 <sup>site-specific</sup>
	G633SB035	633SB03503	28-Feb-02	Xylenes, Total	0.014	=	9 <sup>o-xylene</sup>

SSLs are from the *Soil Screening Guidance: Technical Background Document* (EPA, 1996) unless otherwise indicated. Generic SSLs are based on a dilution-attenuation factor (DAF) of 1 for VOCs and 10 for all other compounds. The source for SSLs other than from the *Soil Screening Guidance* are indicated in superscript next to the value. Surrogate compounds for SSLs are indicated in superscript next to the value.

= Indicates that the analyte was detected at the concentration shown.

J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits, or the value was detected below the laboratory's quantification limit.

**TABLE 2-5**  
 Detected Compounds in the Electrical Vault Sample  
*Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex*

Station ID	Sample ID	Date Collected	Parameter Class	Compound	Concentration ( $\mu\text{g/L}$ )	Qualifier
G633ZA001	633ZA001M4	05-Jun-02	VOCs	Acetone	2.9	J
			SVOCs	bis(2-Ethylhexyl) Phthalate	6.2	J
				Fluoranthene	3.1	J
				Pyrene	3	J
			PCBs	PCB-1254 (Aroclor-1254)	1.6	J
				PCB-1260 (Aroclor-1260)	9.5	J

All values presented in units of micrograms per liter ( $\mu\text{g/L}$ ).

- J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits, or the value was detected below the laboratory's quantification limit.

**TABLE 2-6**  
 Detected Compounds in the Product Sample 633ZB001M6  
*Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex*

Station ID	Sample ID	Date Collected	Parameter Class	Compound	Concentration (mg/kg)	Qualifier
G633ZB001	633ZB001M6	24-Jul-02	TPH	Diesel Components	690,000	=
			PCB	PCB-1260 (Aroclor-1260)	2,900	=

All values are presented in units of milligrams per kilogram (mg/kg).

= Indicates that the analyte was detected at the concentration shown.

**TABLE 2-7**  
 Detected Compounds in Confirmation Samples  
*Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex*

Parameter Class	Station ID	Sample ID	Date Collected	Compound	Concentration (mg/kg)	Qualifier	SSL
PCB	G633SB045	633SB04504	26-Jul-02	PCB-1260 (Aroclor-1260)	5.57	=	9.9 <sup>site-specific</sup>
	G633SB046	633SB04604	26-Jul-02	PCB-1260 (Aroclor-1260)	0.0521	J	
	G633SB047	633SB04704	26-Jul-02	PCB-1260 (Aroclor-1260)	0.434	J	
	G633SB048	633SB04804	26-Jul-02	PCB-1260 (Aroclor-1260)	0.648	J	
VOCs	G633SB046	633SB04604	26-Jul-02	1,4-Dichlorobenzene	0.00053	J	7.8 <sup>site-specific</sup>
	G633SB048	633SB04804	26-Jul-02	1,4-Dichlorobenzene	0.00063	J	
	G633SB047	633SB04704	26-Jul-02	m+p Xylene	0.00088	J	9 <sup>o-xylene</sup>
	G633SB048	633SB04804	26-Jul-02	m+p Xylene	0.0011	J	
	G633SB047	633SB04704	26-Jul-02	Xylenes, Total	0.00088	J	9 <sup>o-xylene</sup>
	G633SB048	633SB04804	26-Jul-02	Xylenes, Total	0.0011	J	

SSLs are from the *Soil Screening Guidance: Technical Background Document* (EPA,1996) unless otherwise indicated.

Generic SSLs are based on a dilution-attenuation factor (DAF) of 1 for VOCs and 10 for all other compounds.

The source for SSLs other than from the *Soil Screening Guidance* are indicated in superscript next to the value.

Surrogate compounds for SSLs are indicated in superscript next to the value.

= Indicates that the analyte was detected at the concentration shown.

J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits, or the value was detected below the laboratory's quantification limit.

**TABLE 2-8**  
 Detected Compounds in Waste Characterization Samples  
*Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex*

Station ID	Sample ID	Date Collected	Parameter Class	Compound	Concentration	Qualifier
<b>Water Drums</b>					<b>(µg/L)</b>	
G633VADRM	633VADRMM6	26-Jul-02	VOCs	1,3-Dichlorobenzene	1.2	J
				1,4-Dichlorobenzene	5.2	=
				Acetone	17.5	=
				Chlorobenzene	0.37	J
				Methyl ethyl ketone (2-Butanone)	2.3	J
			PCBs	PCB-1260 (Aroclor-1260)	195	J
<b>Soil Dumpster</b>					<b>(mg/kg)</b>	
G633SB049	633SB04901	26-Jul-02	VOCs	Acetone	0.0042	J
				m+p Xylene	0.001	J
				Xylenes, Total	0.001	J
			PCBs	PCB-1260 (Aroclor-1260)	0.0117	J

All values are presented in units of milligrams per kilogram (mg/kg).

= Indicates that the analyte was detected at the concentration shown.

J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits, or the value was detected below the laboratory's quantification limit.

Hobson Avenue

G633S  
G633S  
G633S

AOC 633

- Delineation Sample
- ∨ Roads
- ∨ Fence
- ▭ AOC Boundary
- ▨ Excavation Area
- ▩ Buildings
- ▧ Electrical Conduit

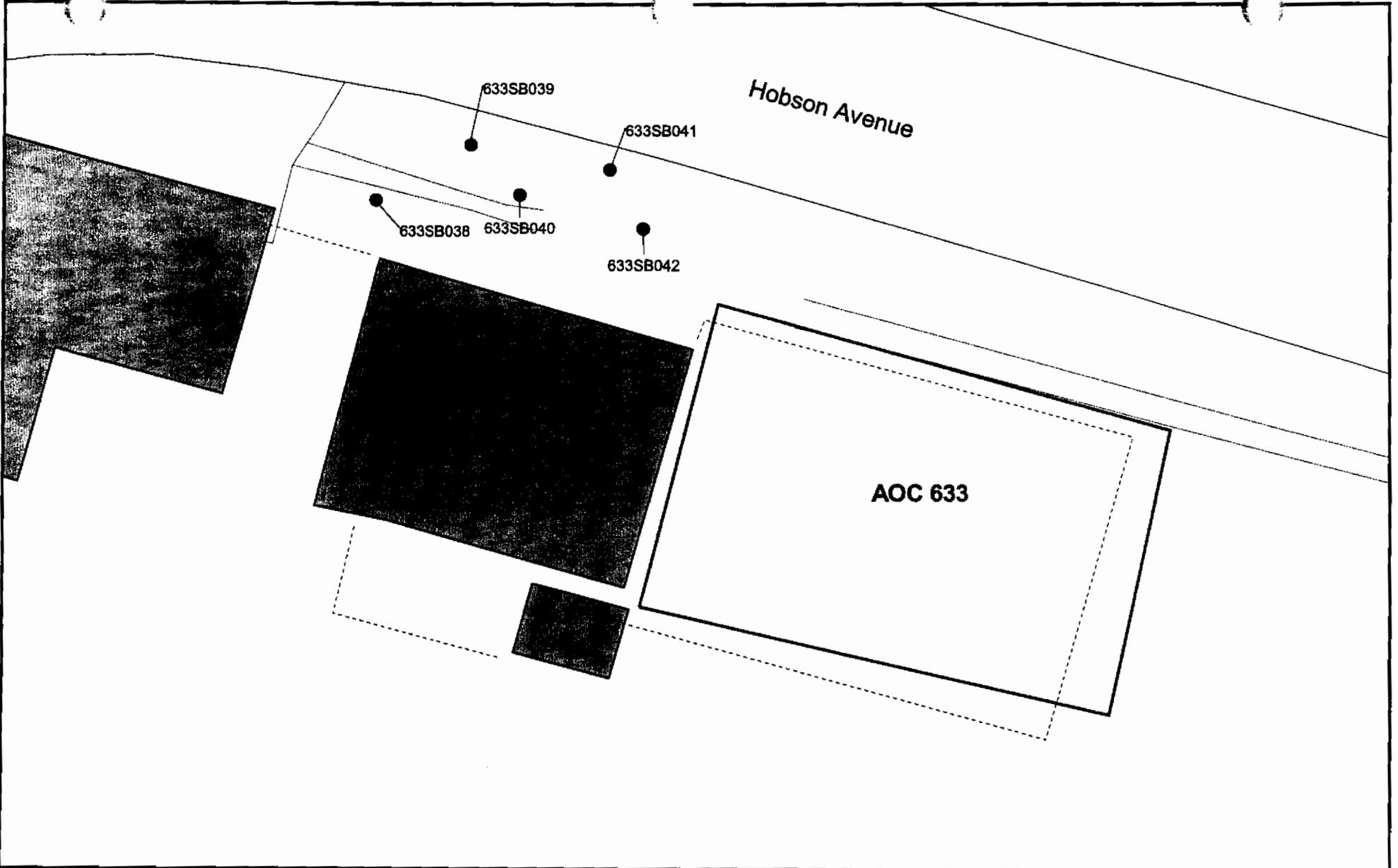


0 30 60 Feet

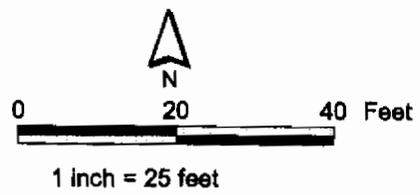
1 inch = 25 feet

**Figure 2-1**  
Delineation Sample Locations  
AOC 633, Zone G  
Charleston Naval Complex

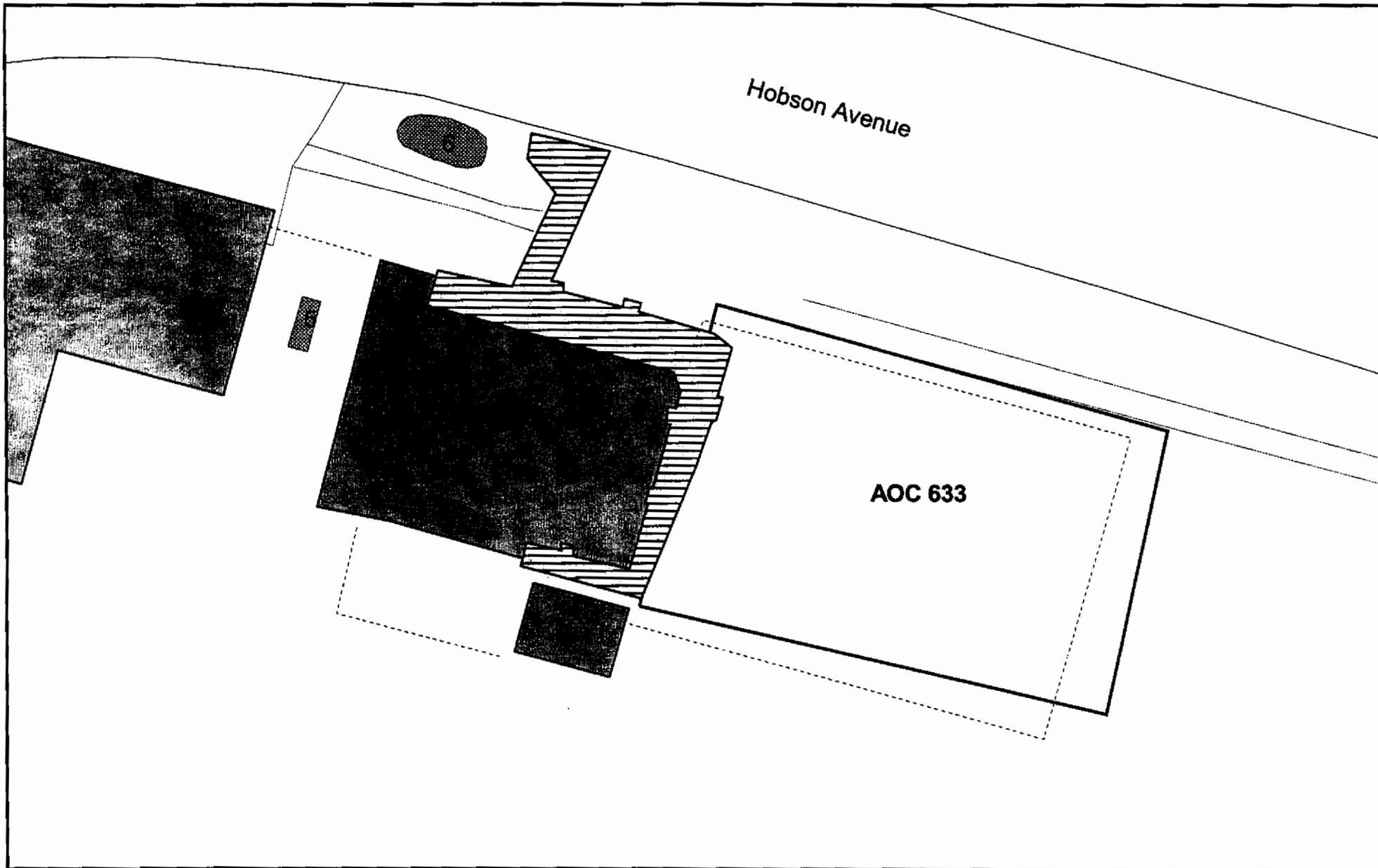
**CH2MHILL**



- LNAPL Boring
- - - Fence
- Roads
- Excavated Area
- AOC Boundary
- Buildings

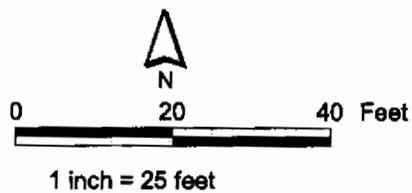


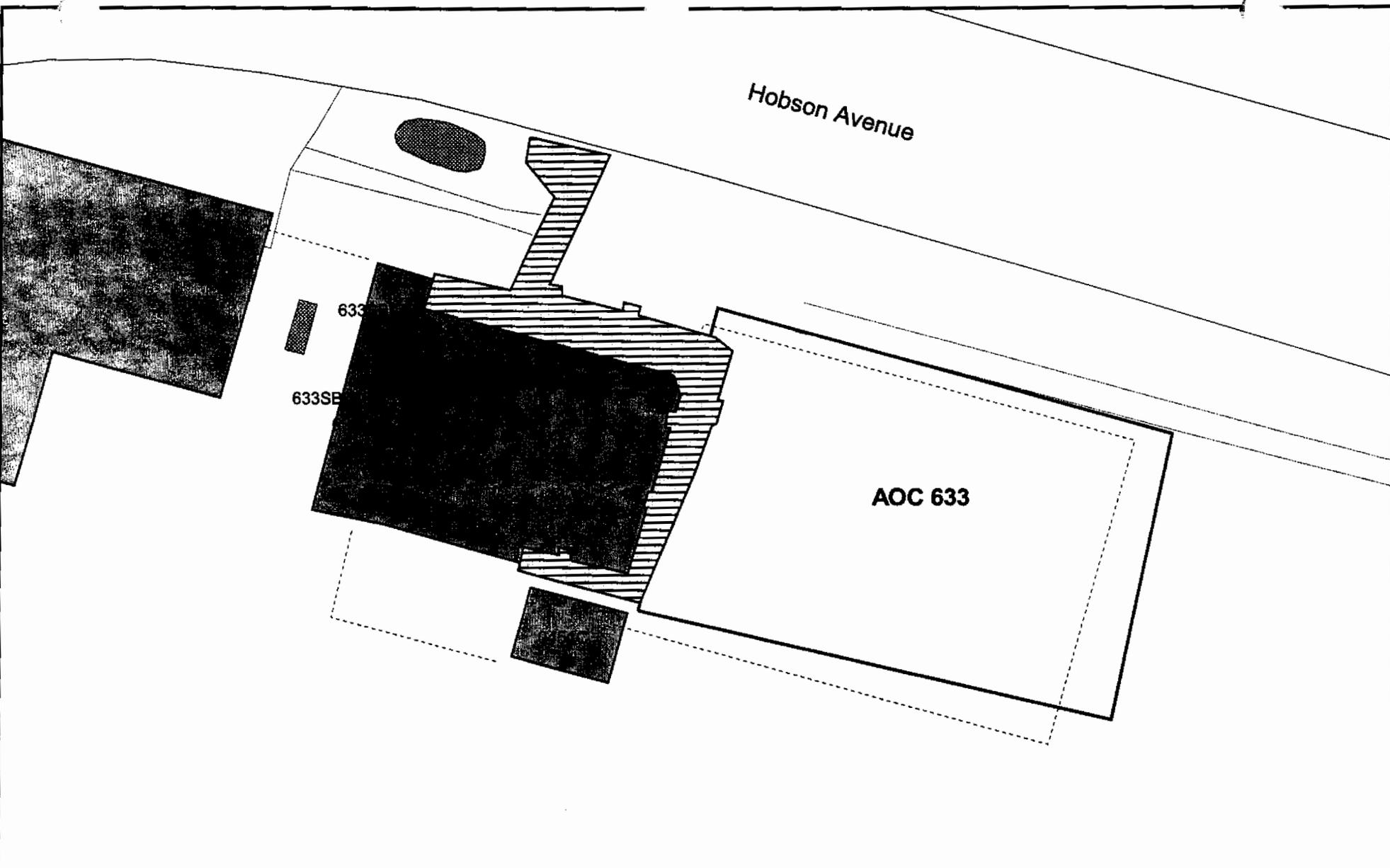
**Figure 2-2**  
LNAPL Delineation Borings  
AOC 633, Zone G  
Charleston Naval Complex



**Figure 2-3**  
 Approximate LNAPL Excavation Locations  
 AOC 633, Zone G  
 Charleston Naval Complex

-  Excavation Area
-  Fence
-  Roads
-  Pavement
-  Buildings
-  AOC Boundary
-  Electrical Conduit





**Figure 2-4**  
 Confirmation Sample Locations  
 AOC 633, Zone G  
 Charleston Naval Complex

File Path: C:\18gle\Projects\Zone\_G\AOC\_633\aoe\_633.apr, Date: 23 Aug 2002 8:17, User: NMOUDRY, Figure 2-4 Confirmation Sample



## 3.0 Interim Measure Outcome

---

Prior to the initial excavation, a total of ten delineation/confirmation samples (633SB02203 through 633SB03103) were collected at a depth of 4 ft bls and submitted for PCB analysis. The depth was chosen based on the depth of the contamination, and to coincide with the expected floor of the excavation. The vertical delineation samples collected from within the excavation boundary contained Aroclor-1260 above the target cleanup level of 9.9 mg/kg. As a result, the excavation was terminated at the top of the water-bearing zone. The horizontal extent of contamination was adequately defined during the delineation/confirmation sampling effort. No sample collected from the proposed excavation boundary contained Aroclor-1260 above the media cleanup standard (MCS) of 9.9 mg/kg, which was established in the Phase II IM WP for AOC 633. Additionally, the confirmation sample (633SB04403, 0.16 U mg/kg) collected from the north wall of the excavation, did not contain Aroclor-1260. Please refer to Figure 2-1 for the locations of the samples collected as part of the IM. A summary of the analytical results is presented in Table 2-1; the complete data are provided in Appendix B.

Following the removal of subsurface soil at AOC 633, one residual subsurface soil sample (00EEG00017-6, 17.0 mg/kg) remains in place that exceeds the site-specific SSL (9.9 mg/kg). As discussed in the IM WP (CH2M-Jones, 2001), the data in this area indicate a very small area of PCB-impacted soil. Additionally, point exceedances of individual constituents do not necessarily pose a leaching risk. Average concentrations are a better indication of whether a constituent is likely to impact shallow groundwater. Therefore, CH2M-Jones evaluated the subsurface analytical data to determine the residual Aroclor-1260 concentration.

Table 3-1 presents the subsurface analytical results for Aroclor-1260. Analytical results from samples that were removed during the IM were replaced with the concentration (0.069 U mg/kg) reported for the fill material. These data were used to calculate the residual mean Aroclor-1260 concentration. Analytical results for samples in which Aroclor-1260 was not detected were replaced by ½ the reported value. This resulted in a mean Aroclor-1260 concentration of 1.54 mg/kg, which is below the site-specific SSL (9.9 mg/kg).

These data indicate that PCB-impacted soil at AOC 633 has been adequately remediated, and no further investigative or remedial actions are warranted for soil at AOC 633.

1 Following the removal of PCB-impacted soil, the excavation was backfilled with the  
2 stockpiled overburden and fill obtained from the Butler Ware Trucking Co. The backfill was  
3 compacted and graded to match the existing grade.

4 The observations made during the Phase II IM indicate that the LNAPL discovered during  
5 the initial IM was likely the result of a small onsite spill of diesel fuel. The LNAPL was  
6 removed to the extent practical during the Phase II IM. Analytical results from the LNAPL  
7 delineation borings and the excavation confirmation samples did not indicate a residual  
8 presence of PCBs, PAHs, or VOCs above conservative screening criteria.

9 Based on this information, the LNAPL and LNAPL-impacted soil have been adequately  
10 remediated, and no further investigative or remedial actions are warranted for LNAPL at  
11 AOC 633.

**TABLE 3-1**  
 Residual Aroclor-1260 Calculation  
 Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex

Chemical	Station ID	Sample ID	Notes	Date Collected	Adjusted Results <sup>a</sup> (mg/kg)	Qualifier
<b>RFI Samples</b>						
	G633SB001	633SB00102		10/02/1996	0.100	U
	G633SB002	633SB00202		10/02/1996	0.130	U
	G633SB003	633SB00302		10/02/1996	0.100	U
	G633SB004	633SB00402		10/02/1996	0.310	=
	G633SB007	633SB00702	removed	10/02/1996	0.069	U
	G633SB008	633SB00802		01/07/1997	0.110	U
	G633SB009	633SB00902		01/07/1997	0.028	U
	G633SB010	633SB01002		01/07/1997	0.080	U
	G633SB011	633SB01102		07/29/1999	0.041	U
	G633SB012	633SB01202		07/29/1999	0.037	U
	G633SB013	633SB01302		07/27/1999	0.050	U
	G633SB014	633SB01402		07/27/1999	0.057	U
	G633SB015	633SB01502		07/28/1999	0.054	=
	G633SB017	633SB01702		07/28/1999	0.039	U
	G633SB018	633SB01802		07/27/1999	0.240	J
	G633SB019	633SB01902		07/27/1999	0.039	U
	G633SB020	633SB02002		07/27/1999	0.230	=
	G633SB021	633SB02102		01/28/2000	0.080	U
<b>Delineation Samples</b>						
	PT-1	00EEG0009-1		01/12/2000	7.000	=
	PT-2	00EEG0009-2		01/12/2000	2.900	=
	PT-3	00EEG0009-3		01/12/2000	3.100	=
	PT-4	00EEG0009-4		01/12/2000	4.800	=
	PT-5	00EEG0009-5		01/12/2000	6.800	=
	PT-6	00EEG00010-1		10/13/1996	0.520	=
	PT-7	00EEG00010-2	removed	10/13/1996	0.069	U
	PT-8	00EEG00010-3		10/13/1996	9.900	=
	PT-9	00EEG00010-4		10/13/1996	0.200	=
	PT-10	00EEG00017-1	removed	02/01/2000	0.069	U

**TABLE 3-1**  
 Residual Aroclor-1260 Calculation  
 Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex

Chemical	Station ID	Sample ID	Notes	Date Collected	Adjusted Results <sup>a</sup> (mg/kg)	Qualifier
<b>Delineation Samples</b>						
	PT-11	00EEG00017-2	removed	02/01/2000	0.069	U
	PT-12	00EEG00017-3		02/01/2000	1.400	=
	PT-13	00EEG00017-4		02/01/2000	0.061	U
	PT-14	00EEG00017-5	removed	02/01/2000	0.069	U
	PT-15	00EEG00017-6		02/01/2000	17.000	=
	PT-16	00EEG00017-7		02/01/2000	0.300	=
	PT-17	00EEG00017-8		02/01/2000	1.300	=
<b>Post-RFI Samples</b>						
	G633SB022	633SB02203	removed	11/06/2001	0.069	U
	G633SB023	633SB02303		11/06/2001	0.740	J
	G633SB024	633SB02403	removed	11/06/2001	0.069	U
	G633SB026	633SB02603	removed	11/06/2001	0.069	U
	G633SB027	633SB02703		11/06/2001	5.400	=
	G633SB028	633SB02803		11/06/2001	4.400	=
	G633SB029	633SB02903		11/06/2001	7.000	=
	G633SB030	633SB03003		11/06/2001	1.400	=
	G633SB031	633SB03103		11/06/2001	3.900	=
	G633SB032	633SB03203		02/28/2002	0.086	UJ
	G633SB033	633SB03303		02/28/2002	0.420	=
	G633SB034	633SB03403		02/28/2002	0.960	J
	G633SB035	633SB03503		02/28/2002	2.400	J
	G633SB036	633SB03603		02/28/2002	1.100	=
	G633SB038	633SB03803		02/28/2002	0.820	U
	G633SB039	633SB03903		02/28/2002	0.066	J
	G633SB040	633SB04003		02/28/2002	0.240	UJ
	G633SB041	633SB04103		02/28/2002	0.160	U
	G633SB042	633SB04203		02/28/2002	0.240	UJ
	G633SB043	633SB04303		02/28/2002	0.350	J
	G633SB044	633SB04403		11/06/2001	0.160	U

**TABLE 3-1**  
 Residual Aroclor-1260 Calculation  
*Interim Measure Completion Report, AOC 633, Zone G, Charleston Naval Complex*

Chemical	Station ID	Sample ID	Notes	Date Collected	Adjusted Results <sup>a</sup> (mg/kg)	Qualifier
<b>Post-RFI Samples</b>						
	G633SB045	633SB04504		07/26/2002	5.570	=
	G633SB046	633SB04604		07/26/2002	0.052	J
	G633SB047	633SB04704		07/26/2002	0.434	J
	G633SB048	633SB04804		07/26/2002	0.648	J
<b>Residual Mean Aroclor-1260 Concentration</b>					<b>1.54</b>	

<sup>a</sup> Analytical results for samples that were removed during the IM were replaced by the analytical results from the fill material (0.069 U mg/Kg).

"Removed" in the "Notes" column indicated that the sample location was removed during the IM excavation.

U indicates that the analyte was not detected, the reported concentration is the detection limit.

UJ indicates that the analyte was not detected, the reported concentration is an estimated detection limit.

J indicates that the analyte was detected, the reported concentration is an estimated concentration.

= indicates that the analyte was detected, the reported concentration is the actual analytical concentration.

"Residual Mean Aroclor-1260 Concentration" was calculated using 1/2 the reported value for non-detect samples.



## 1 **4.0 Recommendations**

---

- 2 Characterization and remedial actions for groundwater at AOC 633 have not been  
3 completed. A sampling and analysis plan (SAP) for groundwater has been developed and  
4 submitted for the site. The groundwater SAP is intended to assess groundwater quality at  
5 AOC 633. Analytical results and recommendations for groundwater will be presented in a  
6 CMS once the data have been collected and evaluated.
- 7 Because the data support the conclusion that the soil at AOC 633 has been adequately  
8 remediated, this IM effort is expected to be the final soil remedial action at AOC 633.  
9 Therefore, CH2M-Jones recommends no further investigation (NFI) for soil at the site and  
10 that the groundwater investigation proceed as quickly as practical.

**Section 5.0**

---

## 1 **5.0 References**

---

- 2 EnSafe Inc. *Zone G RCRA Facility Investigation Report, Comprehensive Long-Term*
- 3 *Environmental Action Navy, Charleston Naval Complex, Charleston, South Carolina.*
- 4 *Revision 0. March 31, 1999.*
  
- 5 CH2M-Jones Inc. *Interim Measure Work Plan – Subsurface Soil Removal, AOC 633, Zone G,*
- 6 *Charleston Naval Complex. Revision 0. September 2001.*
  
- 7 CH2M-Jones Inc. *Phase II Interim Measure Work Plan – LNAPL and LNAPL-Impacted Soil*
- 8 *Removal, AOC 633, Zone G, Charleston Naval Complex. Revision 0. May 2002.*

## Comments Prepared by Stacey French

### SCDHEC Comment 8:

#### Section 10.2.4.1 Nature of Contamination in Sediment, Page 10.12.19, Line 7

This sentence states that Figure 1.2-4 presents bis(2-ethylhexyl)phthalate concentrations detected in sediment at AOC 643. This AOC number is incorrect and should be changed to AOC 633. The detection of bis(2-ethylhexyl)phthalate and its relationship to AOC should be discussed.

#### **CH2M-Jones Response:**

*Comments regarding sediment samples collected outside of AOC 633 will be addressed as part of the Zone J investigations.*

### SCDHEC Comment 9:

#### Section 10.2.5.2 Soil-to-Sediment Cross-Media Transport, Page 10.2.41, Line 5

This sentence states that two of the sediment sampling locations are "clearly associated with other sites in Zone G." However, there is no map showing the "other sites" and their relationship with AOC 633, which makes this statement unclear to the Department. In order to clarify, please include a figure labeling the "other sites" and showing their proximity to AOC 633.

#### **CH2M-Jones Response:**

*Figure 2-1 of the AOC 633 RFIRA depicts locations of the six sediment samples collected by EnSafe during the first phase of the RFI. As indicated on the figure, these samples were collected up to several hundred feet away from AOC 633, in areas which could be affected by activities at other SWMUs/AOCs/buildings. In addition, many of the sediment sample locations are not from beneath standing water, and therefore are not considered to be representative sediment samples for screening against SSVs. The areal extent of PCB contamination in surface soil at AOC 633 has been defined by sampling and is confined to an area inside the fence bounded by samples with results below screening criteria. Overland stormwater flow of PCB-containing runoff to remote areas from this AOC is not an issue.*

### SCDHEC Comment 10:

#### Section 10.2.5.2 Soil-to-Sediment Cross-Media Transport, Page 10.2.41, Line 15 & 16

This sentence states that it is most likely that the pesticide detections in sediment represent residuals from routine pesticide application around and near the drainage paths. In order to support this theory, records documenting the use of the detected pesticides and their method of application at the CNC should be researched and provided.

#### **CH2M-Jones Response:**

*Pesticides are not COCs at AOC 633; please see response to Stacey French Comment 9 above.*

### SCDHEC Comment 42:

#### Table 11.1 Site Conclusions and Zone G Preliminary Recommendations

AOC 633	The Department does not agree with the no further action recommendation for this site. Section 10.2 suggests that additional sediment samples be taken in order to determine the attribution of sediment constituents to a particular
---------	---

site. This should be discussed in Section 11.2.

**CH2M-Jones Response:**

*AOC 633 has been further investigated with additional soil delineation/confirmatory samples, a soil excavation IM, an LNAPL recovery IM, and groundwater investigation by installation and sampling of monitoring wells. As discussed in the RFIRA, no further action is believed to be necessary for site soils, and site groundwater will be addressed through a separate CMSWP.*

**Comments Prepared by Susan Byrd**

**SCDHEC Comment 5:**

Section 10.2.4, Page 10.2.10, Line 4

The text states that six sediment samples were collected during the investigation of AOC 633. However, Figure 10.2-1, Sampling Locations Maps of AOC #663 Substation, contained only two sediment sample locations. Other maps presented later in the AOC 633 section showed all 6 sediment locations and the contaminants detected at each location. Figure 10.2-1 should be modified to show all sample locations, or it should be re-titled to reflect the locations of soil samples only. If the figure is re-titled then an additional map should be provided immediately following Figure 10.2-1 to show the locations of all 6 sediment samples.

**CH2M-Jones Response:**

*Please see CH2M-Jones response to Stacey French Comment 9 above.*

**SCDHEC Comment 6:**

Section 10.2.5.2, Page 10.2.41, Lines 4 and 5

The text states that locations 633M005 and 633M006 are clearly associated with other sites in Zone G. Based on Figure 10.2-12, it appears that 633M006 could potentially be located "down gradient" of 633M004. It may also receive influence from other sites with Zone G, but this is not clearly presented in the figures nor the text. A clarification should be given for this statement.

**CH2M-Jones Response:**

*Please see CH2M-Jones response to Stacey French Comment 9 above.*

**SCDHEC Comment 7:**

Section 10.2.7, Page 10.2.62

This section recommends no corrective measures at this time for AOC 633. Since contamination was detected in the sediment, additional sampling is needed to determine the source of the sediment contamination.

**CH2M-Jones Response:**

*Please see CH2M-Jones response to Stacey French Comment 9 above.*

**Comments by Michael Danielsen**

**SCDHEC Comment 2:**

AOC 633 Section 10.2.4 Sediment Sampling and Analysis

After reading the report and making a site visit, the areas AOC 633/634/706 and SWMU 11 may all be interrelated with regard to sediment contaminants. The sediment sampling results show that lead and mercury have been found above the RBC. These contaminants are not directly attributable to the known waste at AOC 633/634. The contaminants, however, must be addressed. This could be done as a new SWMU/AOC or under an existing SWMU/AOC. See comment #13 B.

**CH2M-Jones Response:**

*Lead and mercury are not COCs at AOC 633; please see CH2M-Jones' responses to Stacey French Comments 8 and 9 above.*

**SCDHEC Comment 3:**

Page 10.2.1 AOC 633 Section 10.2.2 Field Investigation Approach

A) The text states that the purpose of the field investigation is to confirm or deny the presence of contamination, however there were no subsurface soil or groundwater samples taken. The sampling in this area does not adequately address the presence or absence of contamination in the groundwater or subsurface soil. Therefore these media need to be investigated with the addition of monitoring wells and sampling.

B) Grid wells or other wells close by might be used for information for this site. This information should be reviewed by the Navy, if available, otherwise additional wells should be proposed.

**CH2M-Jones Response:**

*Additional soil and groundwater samples have been collected to evaluate AOC 633, as discussed in the RFIRA; also see response to Stacey French Comment 42 above.*

**Comments Prepared by Michael W. Danielsen**

"Furthermore, the Navy has not completed groundwater characterizations for AOCs 628, 633, 638, 643, 646, 706, and SWMUs 3, 11, 12, and 24. The Department suggests that the Navy review these areas for further groundwater characterization locations to be added to this work plan addendum."

**CH2M-Jones Response:**

*The CH2M-Jones RFIRA presents results of groundwater investigation at AOC 633, as well as a CMSWP for addressing site groundwater issues.*

**SCDHEC Comment 7:**

**Page 2.8 Section 2.2.2, Data Gaps**

This section states that one soil and subsurface soil sample will be taken and analyzed for PCBs. However, in the Comments and Responses on the Draft Final Zone G RFI Report, dated June 25, 1999, the Navy stated that (response 42) "Additional sediment sampling will be conducted to attempt attribution of the pesticides and metals associated with the sediments taken in AOC 633". This response goes on to state, "A subsurface soil sample will also be collected in the vicinity of 633SB005 to delineate the extent of Aroclor 1260". Please explain whether these proposed samples were ever taken. If these samples were not taken, please add these locations to the current work plan addendum.

**CH2M-Jones Response:**

*Please see CH2M-Jones response to Susan Byrd Comment 3 above.*

**Comments Prepared by Susan Peterson**

**SCDHEC Comment 1:**

The Department approved (September 1, 1999) an interim measure work plan for the removal of PCB-contaminated soil around 633SB007. The addendum does not mention this work effort or its results. The Navy should at least state that the IM has been conducted. The Navy mentions similar IM's for AOCs for SWMU 8 and SWMU 3. The addendum proposes soil sampling to delineate Aroclor-1260 south of 633SB001, but does not mention the subsurface contaminated soil at 633SB007, supporting the possibility that the IM has been conducted. The section on the subsurface data gaps (p. 2.8) should mention the IM. Without knowledge of whether the IM has been conducted, the statement "this soil sample is surrounded by other sample locations that are either below the SSL or nondetect for Aroclor-1260" does not provide an adequate rationale for the exclusion of future sampling at SB007.

**CH2M-Jones Response:**

*Section 3.0 of the CH2M-Jones RFIRA discusses the EEG IM and the CH2M-Jones IM in detail. EEG did not complete the IM; the work was reassigned to CH2M-Jones.*

StationID	G633SB011	G633SB011	G633SB011
SampleID	633CB01101 (0-1ft)	633SB01101 (0-1ft)	633SB01102 (3-5ft)
DateCollected	7/29/1999	7/29/1999	7/29/1999
DateExtracted	8/2/1999	8/2/1999	8/2/1999
DateAnalyzed	8/17/1999	8/17/1999	8/17/1999
SDGNumber	39715	39715	39715

Parameter	Units	G633SB011		G633SB011		G633SB011	
Aldrin	ug/Kg	1.5	U	1.5	U	1.7	U
Alpha BHC (Alpha Hexachlorocyclohexane)	ug/Kg	1.5	U	1.5	U	1.7	U
Alpha-chlordane	ug/Kg	1.5	U	1.5	U	1.7	U
Beta BHC (Beta Hexachlorocyclohexane)	ug/Kg	1.5	U	1.5	U	1.7	U
Delta BHC (Delta Hexachlorocyclohexane)	ug/Kg	1.5	U	1.5	U	1.7	U
Dieldrin	ug/Kg	2.9	U	2.8	U	3.3	U
Endosulfan I	ug/Kg	1.5	U	1.5	U	1.7	U
Endosulfan II	ug/Kg	2.9	U	2.8	U	3.3	U
Endosulfan Sulfate	ug/Kg	2.9	U	2.8	U	3.3	U
Endrin Aldehyde	ug/Kg	2.9	U	2.8	U	3.3	U
Endrin Ketone	ug/Kg	3	U	3	U	3	U
Endrin	ug/Kg	2.9	U	2.8	U	3.3	U
Gamma BHC (Lindane)	ug/Kg	1.5	U	1.5	U	1.7	U
Gamma-chlordane	ug/Kg	1.5	U	1.5	U	1.7	U
Heptachlor Epoxide	ug/Kg	1.5	U	1.5	U	1.7	U
Heptachlor	ug/Kg	1.5	U	1.5	U	1.7	U
Methoxychlor	ug/Kg	15	U	15	U	17	U
p,p'-DDD	ug/Kg	2.9	U	2.8	U	3.3	U
p,p'-DDE	ug/Kg	2.9	U	2.8	U	3.3	U
p,p'-DDT	ug/Kg	2.9	U	2.8	U	3.3	U
Toxaphene	ug/Kg	96	U	94	U	110	U

Analytical Data Summary

02/28/2003 2:30 PM

StationID	G633SB013		G633SB013		G633SB014		
SampleID	633SB01301 (0-1ft)		633SB01302 (3-5ft)		633SB01401 (0-1ft)		
DateCollected	7/27/1999		7/27/1999		7/27/1999		
DateExtracted	7/30/1999		7/30/1999		7/30/1999		
DateAnalyzed	8/7/1999		8/7/1999		8/7/1999		
SDGNumber	39679		39679		39679		
Parameter	Units						
Aldrin	ug/Kg	1.7	U	1.8	U	1.6	UJ
Alpha BHC (Alpha Hexachlorocyclohexane)	ug/Kg	1.7	U	1.8	U	1.6	UJ
Alpha-chlordane	ug/Kg	1.7	U	1.8	U	1.6	UJ
Beta BHC (Beta Hexachlorocyclohexane)	ug/Kg	1.7	U	1.8	U	1.6	UJ
Delta BHC (Delta Hexachlorocyclohexane)	ug/Kg	1.7	U	1.8	U	1.6	UJ
Dieldrin	ug/Kg	3.3	U	3.5	U	3.2	UJ
Endosulfan I	ug/Kg	1.7	U	1.8	U	1.6	UJ
Endosulfan II	ug/Kg	3.3	U	3.5	U	3.2	UJ
Endosulfan Sulfate	ug/Kg	3.3	U	3.5	U	3.2	UJ
Endrin Aldehyde	ug/Kg	3.3	U	3.5	U	3.2	UJ
Endrin Ketone	ug/Kg	3.3	U	3.5	U	3.2	UJ
Endrin	ug/Kg	3.3	U	3.5	U	3.2	UJ
Gamma BHC (Lindane)	ug/Kg	1.7	U	1.8	U	1.6	UJ
Gamma-chlordane	ug/Kg	1.7	U	1.8	U	1.6	UJ
Heptachlor Epoxide	ug/Kg	1.7	U	1.8	U	4.5	J
Heptachlor	ug/Kg	1.7	U	2.8	U	1.6	UJ
Methoxychlor	ug/Kg	17	UJ	18	UJ	16	UJ
p,p'-DDD	ug/Kg	3.3	U	3.5	U	3.2	UJ
p,p'-DDE	ug/Kg	3.3	U	7.4	J	91	J
p,p'-DDT	ug/Kg	3.3	U	5.2	=	11	J
Toxaphene	ug/Kg	110	U	120	U	100	U

StationID	G633SB014	G633SB015	G633SB015
SampleID	633SB01402 (3-5ft)	633SB01501 (0-1ft)	633SB01502 (3-5ft)
DateCollected	7/27/1999	7/28/1999	7/28/1999
DateExtracted	7/30/1999	7/30/1999	7/30/1999
DateAnalyzed	8/7/1999	8/5/1999	8/5/1999
SDGNumber	39679	39714	39714

Parameter	Units	G633SB014		G633SB015		G633SB015	
Aldrin	ug/Kg	2.2	U	1.4	U	1.6	U
Alpha BHC (Alpha Hexachlorocyclohexane)	ug/Kg	2.2	U	1.4	U	1.6	U
Alpha-chlordane	ug/Kg	2.2	U	22	J	11	=
Beta BHC (Beta Hexachlorocyclohexane)	ug/Kg	2.2	U	1.4	U	1.6	U
Delta BHC (Delta Hexachlorocyclohexane)	ug/Kg	2.2	U	1.4	U	1.6	U
Dieldrin	ug/Kg	4.2	U	2.8	U	3.1	U
Endosulfan I	ug/Kg	2.2	U	1.4	U	1.6	U
Endosulfan II	ug/Kg	4.2	U	2.8	U	3.1	U
Endosulfan Sulfate	ug/Kg	4.2	U	2.8	U	3.1	U
Endrin Aldehyde	ug/Kg	4.2	U	2.8	U	3.1	U
Endrin Ketone	ug/Kg	4.2	U	2.8	U	3.1	U
Endrin	ug/Kg	4.2	U	2.8	U	3.1	U
Gamma BHC (Lindane)	ug/Kg	2.2	U	1.4	U	1.6	U
Gamma-chlordane	ug/Kg	2.2	U	47	=	17	=
Heptachlor Epoxide	ug/Kg	2.2	U	6.2	=	1.6	U
Heptachlor	ug/Kg	2.2	U	6.5	=	1.6	U
Methoxychlor	ug/Kg	21	J	14	U	16	U
p,p'-DDD	ug/Kg	4.2	U	2.8	U	9.1	=
p,p'-DDE	ug/Kg	6	J	13	=	14	J
p,p'-DDT	ug/Kg	4.2	U	7.5	=	9.6	=
Toxaphene	ug/Kg	140	U	92	U	100	U

Analytical Data Summary

02/28/2003 2:30 PM

StationID	G633SB016		G633SB017		G633SB017		
SampleID	633SB01601 (0-1ft)		633SB01701 (0-1ft)		633SB01702 (3-5ft)		
DateCollected	7/28/1999		7/28/1999		7/28/1999		
DateExtracted	7/30/1999		7/30/1999		7/30/1999		
DateAnalyzed	8/5/1999		8/5/1999		8/5/1999		
SDGNumber	39714		39714		39714		
Parameter	Units						
Aldrin	ug/Kg	1.4	U	1.4	U	1.5	U
Alpha BHC (Alpha Hexachlorocyclohexane)	ug/Kg	1.4	U	1.4	U	1.5	U
Alpha-chlordane	ug/Kg	6.8	J	23	J	23	J
Beta BHC (Beta Hexachlorocyclohexane)	ug/Kg	1.4	U	1.4	U	1.5	U
Delta BHC (Delta Hexachlorocyclohexane)	ug/Kg	1.4	U	1.4	U	1.5	U
Dieldrin	ug/Kg	2.7	U	2.7	U	2.9	U
Endosulfan I	ug/Kg	1.4	U	1.4	U	1.5	U
Endosulfan II	ug/Kg	2.7	U	2.7	U	2.9	U
Endosulfan Sulfate	ug/Kg	2.7	U	2.7	U	2.9	U
Endrin Aldehyde	ug/Kg	2.7	U	2.7	U	2.9	U
Endrin Ketone	ug/Kg	2.7	U	2.7	U	2.9	U
Endrin	ug/Kg	2.7	U	2.7	U	2.9	U
Gamma BHC (Lindane)	ug/Kg	1.4	U	1.4	U	1.5	U
Gamma-chlordane	ug/Kg	12	J	31	=	56	=
Heptachlor Epoxide	ug/Kg	1.9	J	1.4	U	1.5	U
Heptachlor	ug/Kg	1.4	U	1.4	U	1.7	J
Methoxychlor	ug/Kg	14	U	14	U	15	U
p,p'-DDD	ug/Kg	7	J	2.7	U	92	=
p,p'-DDE	ug/Kg	17	J	6.2	J	38	=
p,p'-DDT	ug/Kg	18	J	2.7	U	20	J
Toxaphene	ug/Kg	89	U	90	U	95	U

StationID	G633SB018		G633SB018		G633SB019		
SampleID	633SB01801 (0-1ft)		633SB01802 (3-5ft)		633SB01901 (0-1ft)		
DateCollected	7/27/1999		7/27/1999		7/27/1999		
DateExtracted	7/30/1999		7/30/1999		7/30/1999		
DateAnalyzed	8/7/1999		8/7/1999		8/7/1999		
SDGNumber	39679		39679		39679		
Parameter	Units						
Aldrin	ug/Kg	1.4	UJ	1.7	UJ	1.6	U
Alpha BHC (Alpha Hexachlorocyclohexane)	ug/Kg	1.4	UJ	1.7	UJ	1.6	U
Alpha-chlordane	ug/Kg	5	J	1.7	UJ	1.6	U
Beta BHC (Beta Hexachlorocyclohexane)	ug/Kg	1.4	UJ	1.7	UJ	1.6	U
Delta BHC (Delta Hexachlorocyclohexane)	ug/Kg	1.4	UJ	1.7	UJ	1.6	U
Dieldrin	ug/Kg	2.7	UJ	3.3	UJ	3.1	U
Endosulfan I	ug/Kg	1.4	UJ	1.7	UJ	1.6	U
Endosulfan II	ug/Kg	2.7	UJ	3.3	UJ	3.1	U
Endosulfan Sulfate	ug/Kg	2.7	UJ	3.4	U	3.1	U
Endrin Aldehyde	ug/Kg	2.7	UJ	3.3	UJ	3.1	U
Endrin Ketone	ug/Kg	2.7	UJ	3.3	UJ	3.1	U
Endrin	ug/Kg	2.7	UJ	3.3	UJ	3.1	U
Gamma BHC (Lindane)	ug/Kg	1.4	UJ	1.7	UJ	1.6	U
Gamma-chlordane	ug/Kg	2.8	J	3.2	U	2.3	U
Heptachlor Epoxide	ug/Kg	1.4	UJ	1.7	UJ	1.6	U
Heptachlor	ug/Kg	1.4	UJ	1.7	UJ	1.6	U
Methoxychlor	ug/Kg	14	UJ	17	UJ	16	UJ
p,p'-DDD	ug/Kg	5.7	J	3.3	UJ	3.1	U
p,p'-DDE	ug/Kg	10	J	9.2	J	9.5	J
p,p'-DDT	ug/Kg	2.7	UJ	3.3	UJ	3.1	U
Toxaphene	ug/Kg	89	U	110	U	100	U

## Analytical Data Summary

02/28/2003 2:30 PM

StationID	G633SB019		G633SB020		G633SB020		
SampleID	633SB01902 (3-5ft)		633SB02001 (0-1ft)		633SB02002 (3-5ft)		
DateCollected	7/27/1999		7/27/1999		7/27/1999		
DateExtracted	7/30/1999		7/30/1999		7/30/1999		
DateAnalyzed	8/7/1999		8/7/1999		8/7/1999		
SDGNumber	39679		39679		39679		
Parameter	Units						
Aldrin	ug/Kg	1.5	UJ	1.5	U	1.6	U
Alpha BHC (Alpha Hexachlorocyclohexane)	ug/Kg	1.5	UJ	1.5	U	1.6	U
Alpha-chlordane	ug/Kg	1.5	UJ	1.5	U	2.6	U
Beta BHC (Beta Hexachlorocyclohexane)	ug/Kg	1.5	UJ	1.5	U	1.6	U
Delta BHC (Delta Hexachlorocyclohexane)	ug/Kg	1.5	UJ	1.5	U	1.6	U
Dieldrin	ug/Kg	2.9	UJ	2.9	U	3.1	U
Endosulfan I	ug/Kg	1.5	UJ	1.5	U	1.6	U
Endosulfan II	ug/Kg	2.9	UJ	2.9	U	3.1	U
Endosulfan Sulfate	ug/Kg	2.9	UJ	2.9	U	3.1	U
Endrin Aldehyde	ug/Kg	2.9	UJ	2.9	U	3.1	U
Endrin Ketone	ug/Kg	2.9	UJ	2.9	U	3.1	U
Endrin	ug/Kg	2.9	UJ	2.9	U	3.1	U
Gamma BHC (Lindane)	ug/Kg	1.5	UJ	1.5	U	1.6	U
Gamma-chlordane	ug/Kg	2	J	1.5	U	10	=
Heptachlor Epoxide	ug/Kg	1.5	UJ	1.5	U	1.6	U
Heptachlor	ug/Kg	1.5	UJ	1.5	U	1.6	U
Methoxychlor	ug/Kg	15	UJ	15	UJ	16	UJ
p,p'-DDD	ug/Kg	2.9	UJ	2.9	U	10	J
p,p'-DDE	ug/Kg	2.9	UJ	2.9	U	7.4	J
p,p'-DDT	ug/Kg	2.9	UJ	2.9	U	3.1	U
Toxaphene	ug/Kg	96	U	95	U	100	U

Analytical Data Summary

02/28/2001 2:30 PM

StationID	G633SB011		G633SB011		G633SB011		G633SB012		
SampleID	633CB01101 (0-1ft)		633SB01101 (0-1ft)		633SB01102 (3-5ft)		633SB01202 (3-5ft)		
DateCollected	7/29/1999		7/29/1999		7/29/1999		7/29/1999		
DateExtracted	8/2/1999		8/2/1999		8/2/1999		8/2/1999		
DateAnalyzed	8/17/1999		8/17/1999		8/17/1999		8/17/1999		
SDGNumber	39715		39715		39715		39715		
Parameter	Units								
PCB-1016 (Arochlor 1016)	ug/Kg	39	U	36	U	41	U	37	U
PCB-1221 (Arochlor 1221)	ug/Kg	39	U	36	U	41	U	37	U
PCB-1232 (Arochlor 1232)	ug/Kg	39	U	36	U	41	U	37	U
PCB-1242 (Arochlor 1242)	ug/Kg	39	U	36	U	41	U	37	U
PCB-1248 (Arochlor 1248)	ug/Kg	39	U	36	U	41	U	37	U
PCB-1254 (Arochlor 1254)	ug/Kg	39	U	36	U	41	U	37	U
PCB-1260 (Arochlor 1260)	ug/Kg	39	U	36	U	41	U	37	U

Analytical Data Summary

02/28/2003 2:30 PM

<b>StationID</b>	G633SB013	G633SB013	G633SB014	G633SB014
<b>SampleID</b>	633SB01301 (0-1ft)	633SB01302 (3-5ft)	633SB01401 (0-1ft)	633SB01402 (3-5ft)
<b>DateCollected</b>	7/27/1999	7/27/1999	7/27/1999	7/27/1999
<b>DateExtracted</b>	7/30/1999	7/30/1999	7/30/1999	7/30/1999
<b>DateAnalyzed</b>	8/7/1999	8/7/1999	8/7/1999	8/7/1999
<b>SDGNumber</b>	39679	39679	39679	39679

<b>Parameter</b>	<b>Units</b>	G633SB013		G633SB014		G633SB014	
PCB-1016 (Arochlor 1016)	ug/Kg	43	U	50	U	40	U
PCB-1221 (Arochlor 1221)	ug/Kg	43	U	50	U	40	U
PCB-1232 (Arochlor 1232)	ug/Kg	43	U	50	U	40	U
PCB-1242 (Arochlor 1242)	ug/Kg	43	U	50	U	40	U
PCB-1248 (Arochlor 1248)	ug/Kg	43	U	50	U	40	U
PCB-1254 (Arochlor 1254)	ug/Kg	43	U	50	U	40	U
PCB-1260 (Arochlor 1260)	ug/Kg	43	U	50	U	40	U

StationID	G633SB015		G633SB015		G633SB016		G633SB017	
SampleID	633SB01501 (0-1ft)		633SB01502 (3-5ft)		633SB01601 (0-1ft)		633SB01701 (0-1ft)	
DateCollected	7/28/1999		7/28/1999		7/28/1999		7/28/1999	
DateExtracted	7/30/1999		7/30/1999		7/30/1999		7/30/1999	
DateAnalyzed	8/5/1999		8/5/1999		8/5/1999		8/5/1999	
SDGNumber	39714		39714		39714		39714	
Parameter	Units							
PCB-1016 (Arochlor 1016)	ug/Kg	35 U	41 U	32 U	36 U			
PCB-1221 (Arochlor 1221)	ug/Kg	35 U	41 U	32 U	36 U			
PCB-1232 (Arochlor 1232)	ug/Kg	35 U	41 U	32 U	36 U			
PCB-1242 (Arochlor 1242)	ug/Kg	35 U	41 U	32 U	36 U			
PCB-1248 (Arochlor 1248)	ug/Kg	35 U	41 U	32 U	36 U			
PCB-1254 (Arochlor 1254)	ug/Kg	35 U	41 U	32 U	36 U			
PCB-1260 (Arochlor 1260)	ug/Kg	35 U	54 =	88 J	36 U			

Analytical Data Summary

02/28/2003 2:30 PM

<b>StationID</b>	G633SB017	G633SB018	G633SB018	G633SB018
<b>SampleID</b>	633SB01702 (3-5ft)	633SB01801 (0-1ft)	633SB01802 (3-5ft)	633SB01802DL (3-5ft)
<b>DateCollected</b>	7/28/1999	7/27/1999	7/27/1999	7/27/1999
<b>DateExtracted</b>	7/30/1999	7/30/1999	7/30/1999	7/30/1999
<b>DateAnalyzed</b>	8/5/1999	8/7/1999	8/7/1999	8/9/1999
<b>SDGNumber</b>	39714	39679	39679	39679

<b>Parameter</b>	<b>Units</b>	G633SB017		G633SB018		G633SB018		G633SB018	
PCB-1016 (Arochlor 1016)	ug/Kg	39	U	38	U	44	U		
PCB-1221 (Arochlor 1221)	ug/Kg	39	U	38	U	44	U		
PCB-1232 (Arochlor 1232)	ug/Kg	39	U	38	U	44	U		
PCB-1242 (Arochlor 1242)	ug/Kg	39	U	38	U	44	U		
PCB-1248 (Arochlor 1248)	ug/Kg	39	U	38	U	44	U		
PCB-1254 (Arochlor 1254)	ug/Kg	39	U	38	U	44	U		
PCB-1260 (Arochlor 1260)	ug/Kg	39	U	38	U	240	J	240	J

Analytical Data Summary

02/28/2000 1:30 PM

StationID	G633SB019		G633SB019		G633SB020		G633SB020		
SampleID	633SB01901 (0-1ft)		633SB01902 (3-5ft)		633SB02001 (0-1ft)		633SB02002 (3-5ft)		
DateCollected	7/27/1999		7/27/1999		7/27/1999		7/27/1999		
DateExtracted	7/30/1999		7/30/1999		7/30/1999		7/30/1999		
DateAnalyzed	8/7/1999		8/7/1999		8/7/1999		8/7/1999		
SDGNumber	39679		39679		39679		39679		
Parameter	Units								
PCB-1016 (Arochlor 1016)	ug/Kg	89	=	39	U	37	U	86	J
PCB-1221 (Arochlor 1221)	ug/Kg	40	U	39	U	37	U	41	U
PCB-1232 (Arochlor 1232)	ug/Kg	40	U	39	U	37	U	41	U
PCB-1242 (Arochlor 1242)	ug/Kg	40	U	39	U	37	U	41	U
PCB-1248 (Arochlor 1248)	ug/Kg	40	U	39	U	37	U	41	U
PCB-1254 (Arochlor 1254)	ug/Kg	40	U	39	U	37	U	41	U
PCB-1260 (Arochlor 1260)	ug/Kg	270	=	39	U	37	U	230	=

Analytical Data Summary

02/28/2003 2:30 PM

<b>StationID</b>	G633SB021	G633SB021
<b>SampleID</b>	633SB02101 (0-1ft)	633SB02102 (3-5ft)
<b>DateCollected</b>	12/14/1999	1/28/2000
<b>DateExtracted</b>	12/20/1999	1/30/2000
<b>DateAnalyzed</b>	12/23/1999	2/2/2000
<b>SDGNumber</b>	EN032	41899

<b>Parameter</b>	<b>Units</b>				
PCB-1016 (Arochlor 1016)	ug/Kg	42	U	80	U
PCB-1221 (Arochlor 1221)	ug/Kg	86	U	80	U
PCB-1232 (Arochlor 1232)	ug/Kg	42	U	80	U
PCB-1242 (Arochlor 1242)	ug/Kg	42	U	80	U
PCB-1248 (Arochlor 1248)	ug/Kg	42	U	80	U
PCB-1254 (Arochlor 1254)	ug/Kg	42	U	80	U
PCB-1260 (Arochlor 1260)	ug/Kg	42	U	80	U

StationID	G633SB013		G633SB013		G633SB014		G633SB014		
SampleID	633SB01301 (0-1ft)		633SB01302 (3-5ft)		633SB01401 (0-1ft)		633SB01402 (3-5ft)		
DateCollected	7/27/1999		7/27/1999		7/27/1999		7/27/1999		
DateExtracted	8/12/1999		8/12/1999		8/12/1999		8/12/1999		
DateAnalyzed	8/13/1999		8/13/1999		8/13/1999		8/13/1999		
SDGNumber	39679		39679		39679		39679		
Parameter	Units								
Tin (Sn)	mg/Kg	5.1	U	6.4	U	4.3	U	7	U
Aluminum	mg/Kg	15400	=	26700	=	15200	=	20900	=
Antimony	mg/Kg	0.36	UJ	0.41	UJ	0.34	UJ	0.51	UJ
Arsenic	mg/Kg	8.7	=	20	=	10.9	=	35.3	=
Barium	mg/Kg	21	J	43.7	J	30.6	J	75.5	J
Beryllium	mg/Kg	0.7	=	1.3	=	0.84	=	1.3	=
Cadmium	mg/Kg	0.09	J	0.35	J	0.44	J	0.31	J
Calcium	mg/Kg	7030	=	18500	=	90900	=	54400	=
Chromium, Total	mg/Kg	26.4	J	47.9	J	38.8	J	41.2	J
Cobalt	mg/Kg	3.9	=	8.3	=	3.1	J	9.2	=
Copper	mg/Kg	21	J	41.5	J	23.3	J	28.5	J
Iron	mg/Kg	15800	=	31200	=	12900	=	35800	=
Lead	mg/Kg	25.7	J	68.3	J	39	J	43.8	J
Magnesium	mg/Kg	2550	=	5630	=	5350	=	5740	=
Manganese	mg/Kg	325	=	1200	=	179	=	2400	=
Nickel	mg/Kg	8.4	=	17.1	=	15.1	=	13.7	=
Potassium	mg/Kg	1040	J	2200	J	1050	J	1850	J
Selenium	mg/Kg	0.44	U	0.5	U	0.91	=	1.1	=
Silver	mg/Kg	0.16	U	0.18	U	0.15	U	0.23	U
Sodium	mg/Kg	1490	=	2950	=	1190	=	2590	=
Thallium	mg/Kg	0.47	J	0.51	U	0.42	U	0.72	J
Vanadium	mg/Kg	32.9	=	70.8	=	35.9	=	63.6	=
Zinc	mg/Kg	63.7	J	141	J	86.9	J	121	J
Mercury	mg/Kg	0.22	=	0.52	=	0.32	=	0.65	=

Analytical Data Summary

02/28/2003 2:30 PM

StationID	G633SB015		G633SB015		G633SB016		G633SB017		
SampleID	633SB01501 (0-1ft)		633SB01502 (3-5ft)		633SB01601 (0-1ft)		633SB01701 (0-1ft)		
DateCollected	7/28/1999		7/28/1999		7/28/1999		7/28/1999		
DateExtracted	8/17/1999		8/17/1999		8/17/1999		8/17/1999		
DateAnalyzed	8/18/1999		8/18/1999		8/18/1999		8/18/1999		
SDGNumber	39714		39714		39714		39714		
Parameter	Units								
Tin (Sn)	mg/Kg	3.4	U	3.8	U	10.7	J	3.3	U
Aluminum	mg/Kg	8030	=	10200	=	6890	=	4140	=
Antimony	mg/Kg	0.58	U	0.64	U	14.4	=	0.55	U
Arsenic	mg/Kg	2.8	=	6	=	5	=	1.2	=
Barium	mg/Kg	13.8	=	26.8	=	43.9	=	6	=
Beryllium	mg/Kg	0.2	J	0.34	J	0.3	J	0.07	J
Cadmium	mg/Kg	0.07	J	0.16	J	0.5	J	0.04	J
Calcium	mg/Kg	7590	=	7150	=	83600	=	1570	=
Chromium, Total	mg/Kg	8.6	=	15.5	=	19	=	4.9	=
Cobalt	mg/Kg	0.86	J	1.9	J	2	J	0.78	J
Copper	mg/Kg	4.8	J	28.3	=	73	=	1.8	J
Iron	mg/Kg	4640	=	10500	=	8120	=	3140	=
Lead	mg/Kg	17.3	=	42.5	=	69	=	4.8	=
Magnesium	mg/Kg	525	=	982	=	1710	=	237	=
Manganese	mg/Kg	44.9	=	125	=	114	=	12.6	=
Nickel	mg/Kg	3.5	J	5.6	=	10.8	=	2.1	J
Potassium	mg/Kg	188	J	467	=	556	=	85	J
Selenium	mg/Kg	0.38	U	0.42	U	0.34	U	0.37	U
Silver	mg/Kg	0.14	U	0.15	U	0.22	J	0.13	U
Sodium	mg/Kg	286	J	552	=	1250	=	216	J
Thallium	mg/Kg	0.27	U	0.29	U	0.24	U	0.25	U
Vanadium	mg/Kg	10.2	=	21.4	=	17	=	6	=
Zinc	mg/Kg	20.3	=	65.5	=	187	=	14.3	=
Mercury	mg/Kg	0.08	=	0.31	=	0.24	=	0.04	=

StationID	G633SB017		G633SB018		G633SB018		G633SB019		
SampleID	633SB01702 (3-5ft)		633SB01801 (0-1ft)		633SB01802 (3-5ft)		633SB01901 (0-1ft)		
DateCollected	7/28/1999		7/27/1999		7/27/1999		7/27/1999		
DateExtracted	8/17/1999		8/12/1999		8/12/1999		8/12/1999		
DateAnalyzed	8/18/1999		8/13/1999		8/13/1999		8/13/1999		
SDGNumber	39714		39679		39679		39679		
Parameter	Units								
Tin (Sn)	mg/Kg	3.4	U	4.3	U	5	U	5.3	U
Aluminum	mg/Kg	9340	=	7620	=	10700	=	6870	=
Antimony	mg/Kg	0.97	J	0.31	UJ	0.53	UJ	0.51	UJ
Arsenic	mg/Kg	7.7	=	4.3	=	7	=	7.3	=
Barium	mg/Kg	20.5	=	27.7	J	31.9	J	26.4	J
Beryllium	mg/Kg	0.19	J	0.41	J	0.5	J	0.37	J
Cadmium	mg/Kg	0.17	J	0.15	J	0.26	J	0.3	J
Calcium	mg/Kg	1890	=	21500	=	28300	=	16400	=
Chromium, Total	mg/Kg	14.4	=	45.5	J	37.9	J	19.3	J
Cobalt	mg/Kg	1.3	J	2.3	J	2.4	J	2	J
Copper	mg/Kg	21	=	23.6	J	32	J	153	J
Iron	mg/Kg	12000	=	7580	=	11700	=	8740	=
Lead	mg/Kg	21.7	=	51.9	J	49.5	J	38	J
Magnesium	mg/Kg	721	=	1690	=	2300	=	1160	=
Manganese	mg/Kg	130	=	67.9	=	91.6	=	106	=
Nickel	mg/Kg	4.1	J	6.3	=	8.8	=	6.4	=
Potassium	mg/Kg	329	=	358	J	652	J	448	J
Selenium	mg/Kg	0.47	J	0.38	J	0.47	J	0.42	U
Silver	mg/Kg	0.14	U	0.14	U	0.16	U	0.15	U
Sodium	mg/Kg	809	=	613	=	1130	=	537	=
Thallium	mg/Kg	0.29	J	0.38	U	0.44	U	0.43	U
Vanadium	mg/Kg	23.4	=	16.2	=	22.2	=	17.8	=
Zinc	mg/Kg	40.7	=	59.5	J	93.6	J	87.2	J
Mercury	mg/Kg	0.16	=	0.18	=	0.28	=	0.29	=

Analytical Data Summary

02/28/2003 2:30 PM

StationID	G633SB019		G633SB020		G633SB020	
SampleID	633SB01902 (3-5ft)		633SB02001 (0-1ft)		633SB02002 (3-5ft)	
DateCollected	7/27/1999		7/27/1999		7/27/1999	
DateExtracted	8/12/1999		8/12/1999		8/12/1999	
DateAnalyzed	8/13/1999		8/13/1999		8/13/1999	
SDGNumber	39679		39679		39679	
Parameter	Units					
Tin (Sn)	mg/Kg	4	U	3.4	U	141 =
Aluminum	mg/Kg	10400	=	3750	=	8200 =
Antimony	mg/Kg	0.37	UJ	0.33	UJ	6.8 J
Arsenic	mg/Kg	7	=	2.9	=	6.7 =
Barium	mg/Kg	21.8	J	7.1	J	37.8 J
Beryllium	mg/Kg	0.44	J	0.22	J	0.44 J
Cadmium	mg/Kg	0.18	J	0.13	J	0.67 J
Calcium	mg/Kg	27600	=	655	=	29500 =
Chromium, Total	mg/Kg	21	J	5.4	J	26 J
Cobalt	mg/Kg	2.6	J	1.8	J	2.3 J
Copper	mg/Kg	22.9	J	2.5	J	1080 J
Iron	mg/Kg	12300	=	2670	=	10300 =
Lead	mg/Kg	25.9	J	3.8	J	184 J
Magnesium	mg/Kg	1530	=	292	=	1710 =
Manganese	mg/Kg	118	=	11.9	=	101 =
Nickel	mg/Kg	8	=	1.4	J	16.7 =
Potassium	mg/Kg	674	J	112	J	516 J
Selenium	mg/Kg	0.38	J	0.51	J	0.55 J
Silver	mg/Kg	0.14	U	0.14	U	0.56 J
Sodium	mg/Kg	767	=	240	J	557 =
Thallium	mg/Kg	0.39	U	0.41	U	0.42 U
Vanadium	mg/Kg	22.5	=	5.1	=	22.2 =
Zinc	mg/Kg	57.9	J	14	J	279 J
Mercury	mg/Kg	0.19	=	0.04	=	0.3 =

<b>StationID</b>	G633SB012		
<b>SampleID</b>	633SB01202 (3-5ft)		
<b>DateCollected</b>	7/29/1999		
<b>DateExtracted</b>	9/23/1999		
<b>DateAnalyzed</b>	9/27/1999		
<b>SDGNumber</b>	39715		
<b>Parameter</b>	<b>Units</b>		
Total Organic Carbon	mg/Kg	2100	=



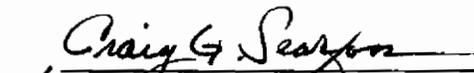
**HEARTLAND**  
ENVIRONMENTAL SERVICES, INC.

**Data Validation Report**

SDG#: 39679  
Date: October 22, 1999  
Client Name: Ensafe  
Project/Site Name: Charleston Zone G  
Date Sampled: July 27, 1999  
Number of Samples: 15 Non-Aqueous Sample(s) with 0 MS/MSD(s)  
1 Aqueous Sample(s) with 0 MS/MSD(s)  
Laboratory: Southwest Laboratory of Oklahoma, Inc.  
Validation Guidance: National Functional Guidelines for Organic and Inorganic Data,  
February, 1994  
QA/QC Level: DQO Level III  
Method(s) Utilized: SW846 Third Edition  
Analytical Fractions: Pesticides, PCBs, SPLP PCBs, Metals, SPLP Metals and Total  
Organic Carbons

Analytical data in this report were screened to determine usability of results and also to determine contractual compliance relative to these requirements and deliverables. This screening assumes analytical results are correct as reported and merely provides an interpretation of the reported quality control results. A minimum of 10% of all laboratory calculations have been verified as part of this validation. All instrument output, i.e. spectra, chromatograms, etc., for each sample have been carefully reviewed. The end-user is urged to review the Specific Findings and associated Data Qualifications presented in this report. Annotated Form 1s or spreadsheets for all samples reviewed are included after the Data Assessment Narratives. Form 1s for MS/MSD samples or spreadsheets are not annotated.

The release of this Data Validation Report is authorized by the following signature:

  
for Paul B. Humburg, President

10-26-99  
Date

SDG# 39679

**Samples and Fractions Reviewed**

Sample Identifications

Analytical Fractions

ENSAFE ID	MATRIX	PEST	PCB	SP-PCB	MET	SP-MET	TOC						
633SB01301	SOIL	X			X								
633SB01302	SOIL	X			X								
633SB01401	SOIL	X			X								
633SB01402	SOIL	X			X								
633SB01801	SOIL	X			X								
633SB01802	SOIL	X			X								
633SB01901	SOIL	X			X								
633SB01902	SOIL	X			X								
633SB02001	SOIL	X			X								
633SB02002	SOIL	X			X								
706SB01101	SOIL	X			X								
706SB01102	SOIL	X			X								
706SB01201	SOIL	X			X								
706SB01202	SOIL	X			X								
706SB01302	SOIL		X		X	X	X						
706SB01302	WATER			X									
Total Billable Samples (Water/Soil)		0	14	0	1	1	0	0	15	0	1	0	1

PEST= Pesticides  
 PCB= PCBs  
 SP-PCB= SPLP PCBs  
 MET= Metals  
 SP-MET= SPLP Metals  
 TOC= Total Organic Carbons

---

## DATA ASSESSMENT NARRATIVES

---

## DATA ASSESSMENT NARRATIVE

### PESTICIDE/PCBs

#### General

The organic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, surrogate and matrix spike recoveries, GC performance, calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the U.S. EPA SW846, Method 8081/8082; the National Functional Guidelines for Organic Data Review, February 1994, where applicable and DQO Level III. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualifications table.

#### SDG # 39679

A validation was performed on the Pesticide/PCB Data from SDG 39679. The data was evaluated based on the following parameters.

- \* • Data Completeness
- \* • Holding Times
- Calibrations
- \* • GC Performance
- \* • Blanks
- Surrogate Recoveries
- \* • Matrix Spike/Matrix Spike Duplicate
- \* • Field Duplicates
- Compound Identification /Quantitation

---

\* - All criteria were met for this parameter

#### Calibrations

The aroclor fraction exhibited a non compliant average %D (17.86%) for AR1260 in AR1660L316K analyzed on 8/9/99 at 13:06. Qualify the positive AR1260 result in sample 633SB01802DL as estimated (J).

Data Assessment Narrative  
Page 2 8081/82

**Calibrations - continued**

The pesticide fraction continuing calibration PEM6K analyzed on 8/12/99 at 16:37 exhibited a non compliant %D (>50% <90%). For the samples listed below, qualify the non detect methoxychlor results as estimated (UJ).

633SB02001	methoxychlor (62.4%)
633SB02002	
633SB01301	
633SB01302	
633SB01401	
706SB01101	
706SB01102	
706SB01201	
706SB01202	
633SB01801	
633SB01802	
633SB01901	
633SB01902	

The pesticide fraction continuing calibration INDAL36H analyzed on 8/12/99 at 17:03 on RTX-PEST exhibited a non compliant %D (> 15% <50%). For the sample listed below, qualify the positive result as estimated (J).

633SB0101DL	4,4'-DDE (17.0%)
-------------	------------------

The pesticide fraction continuing calibration INDAL36I analyzed on 8/12/99 at 02:58 on RTX-PEST exhibited non-compliant %Ds (>15% <50%). For the samples and compounds listed below, qualify the positive results as estimated (J).

633SB02002	4,4'-DDD (21.6%)
706SB01202	
633SB01801	

**Data Assessment Narrative**  
**Page 3 8081/82**

**Calibrations - continued**

The pesticide fraction continuing calibration INDAL36I analyzed on 8/12/99 at 02:58 on RTX-PEST exhibited non compliant %Ds (> 15% < 50%). For the samples and compounds listed below, qualify the positive results as estimated (J).

633SB02002	4,4'-DDE (24.4%)
633SB01302	
706SB01101	
706SB01102	
706SB01201	
706SB01202	
633SB01801	
633SB01802	
633SB01901	

The pesticide fraction continuing calibration INDAL36I analyzed on 8/12/99 at 02:58 on RTX-PEST exhibited non compliant %Ds (> 15% < 50%). For the samples and compounds listed below, qualify the positive results as estimated (J).

633SB01801	$\alpha$ -chlordane (17.3%)
633SB02002	$\gamma$ -chlordane (16.9%)
706SB01201	

The pesticide fraction continuing calibration PEM6P analyzed on 8/19/99 at 08:01 on RTX-PEST exhibited non compliant %Ds (> 15% < 50%). For the samples and compounds listed below, qualify the positive results as estimated (J).

633SB01402	methoxychlor (26.0%)
------------	----------------------

Data Assessment Narrative  
Page 4 8081/82

**Surrogate Recoveries**

Two samples in the 8081 analysis exhibited elevated surrogate recoveries (> QA limit). Five samples exhibited surrogate recoveries less than QA limit. For the samples with recoveries greater than the QA/QC limit, qualify all positive single component pesticides as estimated (J). For the samples with recoveries less than the QA/QC limit, qualify all positive and non detect single component pesticides as estimated (J/UJ).

<u>Sample ID</u>	<u>TCX1</u>	<u>TCX2</u>	<u>DCB1</u>	<u>DCB2</u>
706SB01102			182%	
706SB01201			324%	
633SB01401		36%		
706SB01202	11%	10%	22%	13%
633SB01801				50%
633SB01802				40%
633SB01902				38%

Six samples in the 8082 analysis exhibited elevated surrogate recoveries (> QA limit). Qualify all positive pesticide and aroclor results associated with the samples listed below as estimated (J).

<u>Sample ID</u>	<u>TCX1</u>	<u>TCX2</u>	<u>DCB1</u>	<u>DCB2</u>
706-S-B011-01			157%	131%
706-S-B011-02			141%	153%
706-S-B012-01			152%	136%
706-S-B012-02		137%		202%

---

**Compound Identification/Quantitation**

Many samples were diluted in the 8081 analysis. However, only sample 633SB01401 required a dilution due to a compound exceeding the linear range of the calibration. Report the 4,4'-DDE result in favor of the original result. Do not report the other dilution results.

Data Assessment Narrative

Page 5 8081/82

Compound Identification/Quantitation - continued

Several samples exhibited column quantitation %Ds greater than 40%. The following guidelines were used to qualify the data:

1. No qualifications are required for positive sample results which exhibited column quantitation differences <40%. The "P" flag is removed from the result.
2. The positive sample result which exhibited a column quantitation difference >40%, but ≤100% is qualified as estimated, J.
3. The positive single component pesticide sample result which exhibited a column quantitation difference >100% and is <10X the respective compound CRQL, is qualified as non-detect, U. (All multi-component results are exempt from this rule.)
4. The positive single component pesticide sample result which exhibited a column quantitation difference >100% and >10X the respective compound CRQL, is qualified as presumptively present at an estimated concentration, NJ. (All multi-component results are exempt from this rule.)
5. The positive multi-component pesticide sample result which exhibited a column quantitation difference >100% and <10X the respective multi-component CRQL is qualified as presumptively present at an estimated concentration, NJ.

The following samples and compounds have been qualified for high column quantitation %Ds.

Sample ID	Compound	%D	Lab HESI		
			Qual.	Qual.	Ref. #
706SB01101	4,4'-DDT	39.8	P		1
706SB01201	heptachlor epoxide	184	P	U	3
	4,4'-DDE	26.6	P		1
	endosulfan sulfate	84.8	P	J	2
	4,4'-DDT	202	P	NJ	4
	α-chlordane	86.8	P	J	2
	γ-chlordane	54.0	P	J	2
706SB01202	4,4'-DDD	26.8	P		1
633SB01801	α-chlordane	62.0	P	J	2
633SB01802	endosulfan sulfate	347	P	U	4
	γ-chlordane	356	P	U	4
633SB01901	γ-chlordane	183	P	U	4
633SB01902	γ-chlordane	110	P	U	4
633SB02002	α-chlordane	162	P	U	4
	γ-chlordane	35.9	P		1
633SB01302	heptachlor	999	P	U	4

Data Assessment Narrative  
Page 6 8081/82

Compound Identification/Quantitation - continued

<u>Sample ID</u>	<u>Compound</u>	<u>%D</u>	<u>Qual.</u>	<u>Lab Qual.</u>	<u>HESI Ref. #</u>
633SB01401	4,4'-DDT	29.8	P		1
706SB01202	AR1260	336	NJ	P	5
633SB02002	AR1260	202	NJ	P	5

## GLOSSARY OF DATA QUALIFIERS

### QUALIFICATION CODES

U = Not detected

J = Estimated value

UJ = Reported quantitation limit is qualified as estimated

R = Result is rejected and unusable

D = result value is based on dilution analysis

### METHOD BLANK QUALIFICATION CODES

CRQL = The sample result for the blank contaminant is less than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is rejected and the CRQL for that analyte is reported.

U = The sample result for the blank contaminant is greater than the sample CRQL and is less than 10X the method blank value. The sample result for the blank contaminant is qualified as non detected at the analyte value reported.

No Action = The sample result for the blank contaminant is greater than the sample CRQL and is greater than 10X the method blank value. The sample result for the blank contaminant is not qualified with any blank qualifiers.

---

The specific findings will be noted in numerical form on the Form Is in this data validation report. These specific finding footnotes will reflect the conclusions found in the data validation process that resulted in the qualification of the data.

## SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
633SB01802DL	AR1260	+	J
633SB02001	methoxychlor	-	UJ
633SB02002			
633SB01301			
633SB01302			
633SB01401			
706SB01101			
706SB01102			
706SB01201			
706SB01202			
633SB01801			
633SB01802			
633SB01901			
633SB01902			
633SB0101DL	4,4'-DDE	+	J
633SB02002	4,4'-DDD	+	J
706SB01202			
633SB01801			
633SB02002	4,4'-DDE	+	J
633SB01302			
706SB01101			
706SB01102			
706SB01201			
706SB01202			
633SB01801			
633SB01802			
633SB01901			
633SB01801			
633SB02002			
706SB01201			

\* DL denotes the Form I qualifier supplied by the laboratory  
 QL denotes the qualifier used by the data validation firm  
 + in the DL column denotes a positive result  
 - in the DL column denotes a non detect result

## SUMMARY OF DATA QUALIFICATIONS

<u>SAMPLE ID</u>	<u>ANALYTE ID</u>	<u>DL</u>	<u>QL</u>
633SB01402	methoxychlor	+	J
706SB01102 706SB01201	all single component pesticides	+	J
633SB01401 706SB01202 633SB01801 633SB01802 633SB01902	all single component pesticides	+/-	J/UJ
706-S-B011-01 706-S-B011-02 706-S-B012-01 706-S-B012-02	all aroclors	+	J
633SB01401DL	all compounds except 4,4'-DDE	+/-	DNR
All	All P < 40%	+P	
All	All P > 40% But ≤ 100%	+P	J
All	single component pests All P > 100% And < 10X CRQL	+P	U
All	single component pests All P > 100% And > 10X CRQL	+P	NJ
All	aroclors All P > 100% And > 10X CRQL	+P	NJ

\* DL denotes the Form I qualifier supplied by the laboratory  
 QL denotes the qualifier used by the data validation firm  
 + in the DL column denotes a positive result  
 - in the DL column denotes a non detect result

## DATA ASSESSMENT NARRATIVE METALS AND TOC

### General

The inorganic findings offered in this screening report assumes that all analytical results are correct as reported and is based upon the examination of the reported holding times, blank analysis results, matrix spike and LCS recoveries, matrix duplicates and calibration results. This report was prepared in compliance relative to the analytical and deliverable requirements specified in the SW 846 Methods for Appendix IX metals; the Functional Guidelines for Inorganic Data Validation, February 1994, and DQO Level III requirements. All comments made within this report should be considered when examining the analytical results. Please refer the specific findings found in each category to the Summary of Data Qualification table.

### SDGs # 39679

A validation was performed on the Metals Data from SDG 39679. The data was evaluated based on the following parameters.

- \* ● Data Completeness
- \* ● Holding Times
- \* ● Calibrations
- Blanks
- \* ● Interferences
- Matrix Spike Recovery
- Matrix Duplicates
- \* ● Field Duplicates
- \* ● Laboratory Control Samples
- Serial Dilutions

\* - All criteria were met for this parameter.

### Preparation and Field Blanks

The preparation and calibration blanks exhibited contamination for the following elements.

<u>Elements</u>	<u>Conc.</u>	<u>Samples affected</u>
Antimony	0.39 mg/kg	all soil samples below 1.95 mg/kg
Copper	0.34 mg/kg	no impact
Zinc	0.43 mg/kg	no impact
Tin	2.57 mg/kg	all soil samples below 12.9 mg/kg

The USEPA requires that all sample values below five times the preparation or calibration blank contamination be qualified as non-detect, "U".

### Matrix Spike Recovery results

The matrix spike recovery for soils for Lead (26%) was below 30%. All positive results are qualified as estimated, "J" and all non-detect results are rejected, "UR".

The matrix spike recoveries for soils for Antimony (42%) and Barium (73%) were below the lower control limits (>30% but <75%). All positive and non-detect results are qualified as estimated, "J" or "UJ".

### Matrix Duplicate results

The duplicate RPD for soils for Copper (40%) was greater than 20%. All positive results are qualified as estimated, "J". The RPD for soils for Zinc (29%) was not greater than 35% and no qualification is necessary.

### Serial Dilution results

The serial dilution results for soils for Chromium, Potassium and Zinc were greater than 10%. All positive results are qualified as estimated, "J".

All sample results left with a "B" qualifier after all other qualifications, will be qualified with a "J" qualifier in place of the "B". Value is below the CRDL but greater than the IDL.

## SUMMARY OF DATA QUALIFICATIONS

Sample ID	Analyte	DL	QL
all soil samples below 1.95 mg/kg	Sb.	+	U
all soil samples below 12.9 mg/kg	Sn.		
all soil samples	Pb.	+	J
		U	UR
all soil samples	Sb and Ba.	+/U	J/UJ
all soil samples	Cu.	+	J
all soil samples	Cr, K and Zn.	+	J
all "B" results	all analytes	B	J





SOUTHWEST LABORATORY OF OKLAHOMA  
1700 West Albany, Suite A/ Broken Arrow, OK 74012  
918-251-2858

SDG NARRATIVE

CLIENT: ENSAFE  
PROJECT: ZONE G, RELEASE 118  
SDG NO: 39679  
FRACTION: PCBs

15 soil samples were extracted by SW846 method 3550 and analyzed for PCBs by SW846 method 8082.

No major problems occurred during the analyses of these samples. Sample 633SB01802 required dilution to bring PCBs within calibration range.

Blanks: No corrective action required.

Surrogates: DCB recoveries exceeded control limits in several samples, no corrective action was required.

Laboratory Control Spikes: No corrective action required.

Matrix Spikes: No corrective action required.



Drew Cowan  
GC Supervisor  
Dc

August 12, 1999

SOUTHWEST LABORATORY OF OKLAHOMA  
1700 West Albany, Suite A/ Broken Arrow, OK 74012  
918-251-2858

SDG NARRATIVE

CLIENT: ENSAFE  
PROJECT: ZONE G, RELEASE 118  
SDG NO: 39679  
FRACTION: PCBs

15 soil samples were extracted by SW846 method 3550 and analyzed for PCBs by SW846 method 8082.

No major problems occurred during the analyses of these samples. Sample 633SB01802 required dilution to bring PCBs within calibration range.

Blanks: No corrective action required.

Surrogates: DCB recoveries exceeded control limits in several samples, no corrective action was required.

Laboratory Control Spikes: No corrective action required.

Matrix Spikes: No corrective action required.



Drew Cowan  
GC Supervisor  
Dc

August 12, 1999

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

	Pesticide
Test Code	GC800
Method	SW846 8081A
Matrix	Water-Soil
Initial Calibration	5 point calibration, %RSD=20%
Continuing Calibration	Single point calibration, %D = 15%
Instrument/analysis date	HP_14/ JAN98 - WATERS
Instrument/analysis date	HP_03/ APR98 - SOILS

COMPOUND	CAS NUMBER	PQL's		MDL's	
		Water	Soil	Water	Soil
		ug/L	ug/Kg	ug/L	ug/Kg
alpha-BHC	319-84-6	0.04	1.3	0.0009	0.068
beta-BHC	319-85-7	0.04	1.3	0.0026	0.12
delta-BHC	319-86-8	0.04	1.3	0.0029	0.20
gamma-BHC(Lindane)	58-89-9	0.04	1.3	0.0009	0.07
Heptachlor	76-44-8	0.04	1.3	0.0018	0.19
Aldrin	309-00-2	0.04	1.3	0.0011	0.18
Heptachlor epoxide	1024-57-3	0.04	1.3	0.0017	0.099
Endosulfan I	959-98-8	0.04	1.3	0.0027	0.10
Endosulfan II	3321-65-9	0.08	2.5	0.0028	0.22
Dieldrin	60-57-1	0.08	2.5	0.0019	0.059
4,4'-DDE	72-55-9	0.08	2.5	0.0030	0.14
Endrin	72-20-8	0.08	2.5	0.0030	0.12
4,4'-DDD	72-54-8	0.08	2.5	0.0036	0.10
Endosulfan sulfate	1031-07-8	0.08	2.5	0.0036	0.18
4,4'-DDT	50-29-3	0.08	2.5	0.0026	0.16
Methoxychlor	72-43-5	0.08	12.5	0.0200	0.30
Endrin ketone	53494-70-5	0.38	2.5	0.0029	0.20
Endrin aldehyde	7421-36-3	0.08	2.5	0.0051	0.16
alpha-Chlordane	5103-71-9	0.04	1.3	0.0023	0.21
gamma-Chlordane	5103-74-2	0.04	1.3	0.0027	0.27
Toxaphene	8001-35-2	2.5	83	0.0110	36

MiDL = 3.14 ( for 99 percent confidence; from the "Student's t Value" table) times the standard deviation of seven replicates of a spiked sample matrix analyzed using the pertinent calibration. Reference: Federal Register, July 1982.

PQL = (practical quantitation limit) based on the product of the MDL and a multiplier ranging from 5 to 10.

**SOUTHWEST LABORATORY OF OKLAHOMA, INC.**

**Test Code** PCB's as AROCLORS  
 GC601  
**Method** SW846 8082  
**Matrix** Water-Soil  
**Extract Volume** 1000mL -30g  
**Initial Calibration** 5 point calibration, %RSD=20%  
**Continuing Calibration** Single point calibration, %D = 15%  
**Instrument/analysis date** HP\_03 - 3/9/99 (WATERS)  
**Instrument/analysis date** HP\_03 - 3/13/99 (SOILS)

COMPOUND	CAS NUMBE	CRQL's		MDL's	
		WATER	SOIL	WATER	SOIL
		ug/L	ug/Kg	ug/L	ug/Kg
Aroclor-1016	12674-11-2	1	33	0.050	8.5
Aroclor-1221	11104-28-2	1	33	0.025	7.6
Aroclor-1232	11141-16-5	1	33	0.081	11.0
Aroclor-1242	53469-21-9	1	33	0.075	7.3
Aroclor-1248	12672-29-6	1	33	0.048	3.2
Aroclor-1254	11097-69-1	1	33	0.040	7.6
Aroclor-1260	11096-82-5	1	33	0.046	6.6

MDL = 3.14 (for 99 percent confidence; from the "Student's t Value" table) times the standard deviation of seven replicates of a spiked sample matrix analyzed using pertinent calibration. Reference: Federal Register, July 1982.

PQL = (practical quantitation limit) based on the product of the MDL and a multiplier range from 2 to 10.



800-588-7882

MEMPHIS, TENNESSEE

STONTS; CINCINNATI, OH; DALLAS, TX; JACKSON, TN; KNOXVILLE, TN; MEMPHIS, TN; NASHVILLE, TN; NORFOLK, VA; PADUCAH, KY; PENSACOLA, FL; RALEIGH, NC; COLOGNE, GERMANY

# CHAIN OF CUSTODY RECORD

Amended COC 8/2/99 Revised 7/30/99  
CW

PAGE 1 OF 2  
PROJECT/JOB NO: 200X00100 2000  
COC NO: 792  
PO NO: 4  
REL NO: 118  
LAB NAME: Southwest Lab

CLIENT: E-SAFE - Zone G  
LOCATION: NAVBASE Charleston  
ANALYSTS: (SIGNATURE) PR Hardy

PROJECT MANAGER: Craig Smith  
TELE/FAX NO. (850) 434-2230 p1  
(850) 434-7328 fax

ANALYSIS REQUIRED					REMARKS
NO. OF CONTAINERS	PET	PCB	Metals	SPL PCB/METALS	

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION		NO. OF CONTAINERS	PET	PCB	Metals	SPL PCB/METALS	TOC	REMARKS
					TEMP.	CHEMICAL							
CG 706SB01302	7/27/99	0937	Soil	902 Jar	40	—	2	X	X	X	X		
CG 706SB01101		1000					2	X	X				
CG 706SB01102		1120					2	X	X				
CG 706SB01201		1140					2	X	X				
CG 706SB01202		1150					2	X	X				
CG 633SB01801		1215					2	X	X				
CG 633SB01802		1235					2	X	X				
CG 633SB01901		1435					2	X	X				
CG 633SB01902		1450					2	X	X				
CG 633SB02001		1500					2	X	X				
CG 633SB02002		1505					2	X	X				
CG 633SB01301		1515					2	X	X				
CG 633SB01302		1530					2	X	X				
CG 633SB01401		1545					2	X	X				
CG 633SB01402	7/27/99	1605	Soil	902 Jar	40	—	2	X	X				

RELINQUISHER: <u>PR Hardy</u>	DATE: <u>7/27/99</u>	RECEIVER: _____	DATE: _____	RELINQUISHER: _____	DATE: _____	RECEIVER: _____	DATE: _____
PRINTED: _____	TIME: <u>1800</u>	PRINTED: _____	TIME: _____	PRINTED: _____	TIME: _____	PRINTED: _____	TIME: _____
COMPANY: <u>E-SAFE</u>		COMPANY: _____		COMPANY: _____		COMPANY: _____	

METHOD OF SHIPMENT: FedEx  
 SHIPMENT NO.: 42118170076  
 AND RESULTS: E-SAFE - Charlie Veno  
 COMMENTS: DOO Level III + TICs

SOUTHWEST LABORATORY OF OKLAHOMA  
1700 West Albany, Suite A/ Broken Arrow, OK 74012  
918-251-2858

SDG NARRATIVE

CLIENT: ENSAFE  
PROJECT: ZONE G, RELEASE 118  
EPISODE: 39679  
FRACTION: Pesticides

14 soil samples were extracted by SW846 method 3550 and analyzed for pesticides by SW846 method 8081.

The matrix of these soil samples caused problems with their analysis by causing interference peaks in the sample chromatograms and degrading instrument performance. It should be noted that when multi-responding compounds or large numbers of "interference" peaks are present in a sample, false positives of single response compounds are common. Since ECD detection is not a definitive means of detection, single-response analytes in the presence of interference will be reported, per the method, if a peak is within a target analyte's retention time window on both columns, then it is reported as that target analyte). This alleviates the possibility that false negative results will be reported. However, this may lead to false positives. The end data user should be aware of the limitations of the method and take appropriate care.

When analyzed undiluted the soil samples in this SDG caused breakdown of pesticides in the calibration verification standards following their injection (making the data non-compliant according to method 8000/8081A). The calibration verification standards analyzed before these samples met method 8000/8081A continuing calibration criteria. When diluted the samples met acceptance criteria. A non-compliant undiluted analysis and a compliant dilution analysis was performed for these samples. Forms for the undiluted and the dilution data have been submitted.

Blanks: No corrective action required.

Surrogates: There were several sample recoveries outside of control limits, no corrective action was taken.

Laboratory Control Spike: 2 out of 20 RPDs and 1 out of 40 recoveries exceeded control limits, no corrective action was required.

Matrix Spikes:

No corrective action required.



Drew Cowan  
GC Supervisor  
Dc

August 27, 1999



**SOUTHWEST LABORATORY OF OKLAHOMA, INC.**  
**AMERICAN ANALYTICAL & TECHNICAL SERVICES, INC.**

1700 West Albany / Broken Arrow, Oklahoma 74012 / Office (918) 251-2858 / Fax (918) 251-2599

**SDG NARRATIVE**

**CONTRACT: ENSAFE**  
**CASE: 39679**  
**SDG: 39679A**

**DATE: 8/24/99**  
**SOW NO.: SW846**  
**EPISODE NO.: 39679**

**INORGANIC METAL FRACTION:**

Fourteen soil samples were submitted for ICP and Hg analysis. No major problems occurred during the digestion or analyses of these samples. The sample's analyses were completed according to the following:

<b><u>SWL SOP #</u></b>	<b><u>Method SOP is based</u></b>
SWL-IN-205	SW846 3010A, 3050A, 6010B
SWL-IN-207	SW846 7470A & 7471A

**Initial and Continuing Calibration Checks:** No problems.

**Initial and Continuing Calibration Blanks:** The following elements showed low level concentrations below the Contract Required Detection Limit in the Calibration Blanks: Sb, As, Hg // No action required.

**Linearity near the CRDL (CRA & CRI):** The CRI standard was outside of our in-house warning limits of 70 - 130%R for the following elements: Hg // No action required.

**Preparation Blanks:** The following elements showed low level concentrations below the Contract Required Detection Limit in the Preparation Blank: Sb, Cu, Zn, Sn // No action required.

**Lab Control Spikes:** No problems.

**Matrix Spike (and MSD):** The following elements were outside the control limits of 75-125% recovery: Sb, Ba // All associated samples were flagged with a "N" on Form I's. No action required.

**Duplicate (LCSD and MSD):** The following elements were outside the control limits of 0-20% RPD: Cu, Zn // All associated samples were flagged with a "\*" on Form I's. No action required.

**Serial Dilution (ICP):** The soil serial dilution was outside the control limits of 10% for the following elements: Cr, K, Zn // All associated samples were flagged with an "E" on Form I's. No action required.

**SW846 MDLs:** The IDL column on the Form 10s contain our MDLs rather than IDLs and the CRDL column on the Form 10s contain our PQLS rather than CRDLs. MDLs are done on an annual basis (SWOK SOP states between November and February) instead of requiring the quarterly change needed for IDLs.

Sincerely,

Susan S. Turner for ...  
Deborah J. Inman  
Inorganic Program Manager

17175



800-588-7962

MEMPHIS, TENNESSEE

ALSO: CINCINNATI, OH; DALLAS, TX; JACKSON, TN; KNOXVILLE, TN;  
NASHVILLE, TN; NORFOLK, VA; PADUCAH, KY; PENSACOLA, FL;  
RALEIGH, NC; COLOGNE, GERMANY

### CHAIN OF CUSTODY RECORD

Amended COC 8/2/99 Revised 7/30/99  
CFU

PAGE 1 OF 2

PROJECT/JOB NO: 290X00103 (100)

COC NO: 792

PO NO: 4

REL NO: 118

LAB NAME: Southwest Labs

IT ENSAFE - Zone G  
TION NAVBASE Charleston  
LERS: (SIGNATURE) PB Hardy

PROJECT MANAGER Craig Smith  
TELE/FAX NO. (850) 434-3230 ol  
(850) 434-7329 fax

ANALYSIS REQUIRED					REMARKS
NO. OF CONTAINERS	pest	PCB	metals	SPR PCB/III (total)	
				TOC	

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION		NO. OF CONTAINERS	pest	PCB	metals	SPR PCB/III (total)	TOC	REMARKS
					TEMP.	CHEMICAL							
7065B01302	7/27/99	0037	soil	902 Jar	40	—	2	X	X	X	X		
7065B01101		1000				—	2	X	X				
7065B01102		1120				—	2	X	X				
7065B01201		1140				—	2	X	X				
7065B01202		1150				—	2	X	X				
6335B01801		1215				—	2	X	X				
6335B01802		1235				—	2	X	X				
6335B01901		1435				—	2	X	X				
6335B01902		1450				—	2	X	X				
6335B02001		1500				—	2	X	X				
6335B02002		1505				—	2	X	X				
6335B01301		1515				—	2	X	X				
6335B01302		1530				—	2	X	X				
6335B01401		1545				—	2	X	X				
6335B01402	7/27/99	1605	soil	902 Jar	40	—	2	X	X				

RELINQUISHER: PB Hardy	DATE: 7/27/99	RECEIVER:	DATE:	RECEIVER:	DATE:
PRINTED:	TIME: 1800	PRINTED:	TIME:	PRINTED:	TIME:
COMPANY: ENSAFE		COMPANY:		COMPANY:	

MODE OF SHIPMENT: FedEx  
 SHIPMENT NO: 49118179976  
 COMMENTS: DOQ, Level III + TICs  
 RESULTS: ENSAFE - Charlie Verroy



# **HEARTLAND**

**ENVIRONMENTAL SERVICES, INC.**

## **MULTI-MEDIA GC ANALYSIS**

**CASE/SDG NUMBER:** EN032  
**LABORATORY:** LAUCKS  
**CLIENT:** ENSAFE  
**PROJECT:** CHARLESTON ZONE G  
**REVIEWER:** JACQUELINE A. CLEVELAND  
**DATE:** January 20, 2000  
**QA/QC LEVEL:** DQO III

---

**STATEMENT OF WORK:** SW-846 METHOD 8082  
**ANALYSIS MODIFICATIONS:** NONE  
**NUMBER OF SAMPLES:** 1  
**SAMPLE MATRIX:** SOIL  
**NUMBER OF MS/MSDs:** 1

**MULTI-MEDIA GC ANALYSIS  
HOLDING TIMES**

	<u>Water</u>	<u>Soil</u>	<u>Analysis</u>
CLP:	7 days from sampling	14 days from sampling	40 days from VTSR
SW846:	7 days from sampling	14 days from sampling	40 days from VTSR
Region I:	7 days from sampling	7 days from sampling	40 days from VTSR
Region II:	7 days from sampling	7 days from sampling	40 days from VTSR
Region III:	7 days from sampling	7 days from sampling	40 days from VTSR
NYSDEC:	5 days from VTSR	5 days from VTSR	40 days from VTSR

DA - The number of days that the holding time was exceeded.

- DA  $\leq$  5: Qualify all positive results as estimated (J).  
 DA  $>$  5  $\leq$  15: Qualify all positive results as estimated (J) and all non detects as estimated (UJ).  
 DA  $>$  15: Qualify all positive results as estimated (J) and reject (R) all non detects.

**All associated samples met holding time requirements for extraction and/or analysis. No qualifications are required.**

S- 12/14/99, E- 12/20/99, A- 12/23/99

# LAUCKS TESTING LABORATORIES

940 S. Harney  
Seattle, WA 98108

To: Ensafe  
Laboratory No. :9912330  
SDG No. : EN032  
Date of Report: January 11, 2000

## SAMPLE RECEIPT, IDENTIFICATION, AND GENERAL COMMENTS:

### Sample Receipt and Identification:

The samples submitted under the laboratory number(s) indicated above were identified and analyzed as tabulated below. The samples were collected and received on the dates noted on the enclosed chain-of-custody copies, Attachment A.

<u>Client Sample Identification</u>	<u>Laucks Sample Identification</u>	<u>Testing Analytical Request</u>
011M000401	9912330-01	MET/TOC
011M000301	9912330-02	MET/TOC
011SB01102	9912330-03	MET/TOC
706SB01801	9912330-04	MET/TOC
706SB01802	9912330-05	MET/TOC
706SB01401	9912330-06	MET/TOC
706SB01402	9912330-07	MET/TOC
706SB01501	9912330-08	MET/TOC
706SB01601	9912330-09	MET/TOC
706SB01602	9912330-10	MET/TOC
706SB01701	9912330-11	MET/TOC
706SB01901	9912330-12	MET/TOC
706SB01902	9912330-13	MET/TOC
706SB02001	9912330-14	MET/TOC
706SB02002	9912330-15	MET/TOC
633SB02101	9912330-16	PCB
011M000401 SPLP	9912330-17	SPLP
011M000301 SPLP	9912330-18	SPLP
011SB01102 SPLP	9912330-19	SPLP
706SB01801 SPLP	9912330-20	SPLP
706SB01802 SPLP	9912330-21	SPLP
706SB01401 SPLP	9912330-22	SPLP
706SB01402 SPLP	9912330-23	SPLP
706SB01501 SPLP	9912330-24	SPLP
706SB01601 SPLP	9912330-25	SPLP
706SB01602 SPLP	9912330-26	SPLP
706SB01701 SPLP	9912330-27	SPLP
706SB01901 SPLP	9912330-28	SPLP

**LAUCKS TESTING LABORATORIES**

940 S. Harney  
Seattle, WA 98108

706SB01902 SPLP	9912330-29	SPLP
706SB02001 SPLP	9912330-30	SPLP
706SB02002 SPLP	9912330-31	SPLP

Analytical Request Key:

PCB =	Polychlorinated Biphenyls (8082)
MET =	TAL Metals + Tin (6010B/7000)
SPLP =	SPLP Metals (1312), TAL Metals + Tin (6010B/7000)
TOC =	Total Organic Carbon (9060)

Sample Receipt Comments:

Several samples received were measured at temperatures which exceeded the temperature control limits of  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ . Approval to run the samples with high temperatures was given by Charlie Vernoy on 12/16/1999. The original COC was revised to update sample IDs by Julie Shaffer. The revised COC was used as the original in this data package. See the sample receipt logs for documentation.

Sample Identification on Forms:

When completing forms created through the CLP software, every attempt is made to use both your sample IDs as well as the laboratory sample IDs. The forms have varied default sizes to their sample identification fields, and are not amenable to alteration or editing. When it is not possible to use your complete sample ID because of field length limitations, Laucks will usually do one of two things: 1) use as much of your ID as will fit, beginning from the RIGHT hand side of the sample ID number; or 2) select some sub-set of your sample identifier if it is clearly a discrete number. In addition, all forms will contain our sample IDs, which can be cross-referenced from the table above.

---

**SPECIFIC REMARKS ON ORGANIC ANALYSES:**

Holding Time Compliance:

Following the Contract Laboratory Program (CLP) model, Laucks calculates holding time compliance for organic determinations based on the first injection and/or analysis of an extract or sample. Subsequent analyses (for instance, for the purpose of dilution) are not tabulated.

PCBs:

The holding time to extraction is 7 days in water and 14 days in soil calculated from the date of collection. In either case, the holding time from extraction to analysis is 40 days. All samples were extracted and analyzed within holding time.

**LAUCKS TESTING LABORATORIES**

940 S. Harney  
Seattle, WA 98108

**PCB Fraction:**

There were no out of control events associated with this sample.

**GENERAL REMARKS ON INORGANIC ANALYSES:**

The following comments describe general analysis conditions. For remarks specific to the samples reported in this case, see "SPECIFIC REMARKS ON INORGANIC ANALYSES."

**ICP Metals:**

On the first timed and dated page of each ICP run, the data to be reported or rejected will be tabulated for that run.

**Mercury:**

Laucks purchases a 1000 mg/L Hg stock solution from Inorganic Ventures. The 1.0 mg/L working standard is made by diluting 100  $\mu$ L to 100 mL with 2% HNO<sub>3</sub>. The calibration curve is made by placing 0, 20, 50, 100, 200, 500 and 1000  $\mu$ L of the working standard in BOD bottles and diluting up to 100 mL. The standard curve is equivalent to 0, 0.2, 0.5, 1.0, 2.0, 5.0 and 10.0  $\mu$ g/L.

**SPECIFIC REMARKS ON INORGANIC ANALYSES:**

**Holding Time Compliance:**

---

Laucks calculates holding time compliance for inorganic determinations using the date on which reportable data were acquired.

**Metals:**

The holding time for metals is six months from the date of collection, excepting mercury, which is 28 days. All analyses were performed within holding time.

**Miscellaneous:**

The following analytes do not have a Contract Laboratory Program holding time. The holding times tabulated below derive from the relevant EPA methods and are applicable when the sample was appropriately preserved and/or cooled. All samples submitted followed the preservation guidelines unless explicitly noted otherwise.

**LAUCKS TESTING LABORATORIES**

940 S. Harney  
Seattle, WA 98108

<u>Analyte</u>	<u>Holding Time</u>	<u>Violations</u>
TOC	28 days	None

**ICP Metals(Soil):**

The matrix spike sample percent recoveries of antimony was outside of the established control limits of 75-125% for sample 011M000401. No further corrective action was required. All relevant data have been flagged with an "N" on Forms I and V.

The duplicate sample relative percent difference of manganese was outside the control limits of  $\pm 20\%$  for sample 011M000401. No further corrective action was required. All relevant data have been flagged with an "\*" on Forms I and VI.

**Mercury:**

No comments.

**Metals (SPLP):**

Zinc was present in the SPLP blank. No further corrective action was required per client data quality objectives.

The duplicate sample relative percent differences of aluminum and iron were outside the control limits of  $\pm 20\%$  for sample 706SB02002. No further corrective action was required. All relevant data have been flagged with an "\*" on Forms I and VI.

The serial dilution for potassium did not agree within 10% of the original determination after correction for dilution for sample 011M000301. No further corrective action was required. All relevant data have been flagged with an "E" on the applicable Forms I and IX.

---

**Total Organic Carbon:**

No comments.



HEARTLAND ESI GC

HESI97.1

MULTI-MEDIA GC ANALYSIS  
SAMPLE RESULT VERIFICATION

1. Were the sample results reported within the calibration range (YES/NO)? YES
2. Was the percent moisture reported for all soil samples (YES/NO/NA)? YES
3. Was the data reported on a dry weight basis (YES/NO/NA)? YES
4. Did the GC chromatograms exhibit interferences, off scale peaks or elevated baseline (YES/NO)? LEVEL III - NO CHROMATOGRAMS OR RAW DATA
5. Did the data contain elevated detection limits that could not be verified (YES/NO)? NO
6. Were any computational or transcription errors found (YES/NO)? NO

Specific Comments:

---

Reviewer

*Angeline Cleveland*

Date: 1/20/00

From: "Julie Shaffer" <jshaffer@ensafe.com>  
To: LAUCKS.TESTLAB(JennaG)  
Date: 12/15/99 6:16am  
Subject: Revised Zone G COCs

I will be faxing over some revised COC from Zone G from 12/13/99 and 12/14/99.  
Please make the following changes:

12/13/99 COC

Do NOT analyze the PESTICIDE for samples 120SB01001, 120SB01002, 120SB01101,  
and 120SB01102

12/14/99 COC

Sample Id Changes: 011M0002 Please Change to 011M000401 and 011M0003 Please  
Change to 011M000301.

Do NOT analyze the TOC for samples 011SB00601, 011SB00602, 011SB00701, AND  
011SB00702.

Add TOC to the analyze on samples 011M000401 and 011M000301.

-----  
If you have any problems or questions, Please contact Charlie or me. thanks,  
julie

EnSafe Inc.  
Environmental & Management Consultants



FAX

935 Houston Northcutt Boulevard, Suite 113  
Mt. Pleasant, South Carolina 29464

Phone (843) 884-0029

Fax (843) 856-0107

To:  
Jenna G - Lauchs

From:  
Julie Shaffer

Date:  
12/15/99

Fax to Number:

Number of Pages: 3

Remarks:

Jenna - Here are some revised COC from Zone G 12/13/99-12/14/99.

Revisions made on 12/13/99 COC:

① Do NOT analyze the Pesticide Fraction for 120SB01001, 120SB01002, 120SB01101, and 120SB01102.

Revisions made on 12/14/99 COC:

① Sample ID changes: change change to  
~~011M0002~~ → 011M000401  
~~011M0003~~ → 011M000301

② Add TOC to 011M000401 and 011M000301

③ Do NOT analyze the TOC for samples 011SB00601, 011SB00602, 011SB00701 and 011SB00702.

Please look for an email regarding these changes also. If you have any questions please let us know.

*Julie*

# ENSAFÉ

800-588-7882  
MEMPHIS, TENNESSEE  
CHARLESTON, SC; CINCINNATI, OH; DALLAS, TX; JACKSON, TN; KNOXVILLE, TN  
LANCASTER, PA; NASHVILLE, TN; NORFOLK, VA; PADUCAH, KY; PENSACOLA, FL  
ALEXANDRIA, COLO.; COVINGTON, LA

## CHAIN OF CUSTODY RECORD

Amended COC 12/15/99 *[Signature]*

PAGE 1 OF 1 7.2  
PROJECT/JOB NO: 2907-001-08-420-1  
COC NO: \_\_\_\_\_  
PO NO: 1840  
REL NO: 38  
LAB NAME: Lancus

CLIENT Navy Clean CNC PROJECT MANAGER T. Hancock  
LOCATION Zone G / SWM 11 TELE/FAX NO. (843) 884-0029  
SAMPLERS: (SIGNATURE) *[Signature]*

ANALYSIS REQUIRED				REMARKS
NO. OF CONTAINERS	Metals	TOC	SPLP Metals	

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION		NO. OF CONTAINERS	Metals	TOC	SPLP Metals	REMARKS
					TEMP.	CHEMICAL					
NBCG/0115B00601	12/14/99	1301	S	Glass 8oz	Ice	None	2	✓	✗	✓	* Destroy TOC
NBCG/0115B00602	"	1310	S	"	"	"	2	✓	✗	✓	* Destroy TOC
NBCG/0115B00701	"	1308	S	"	"	"	2	✓	✗	✓	* Destroy TOC
NBCG/0115B00702	"	1316	S	"	"	"	2	✓	✗	✓	* Destroy TOC
NBCG/0115B00801	"	1327	S	"	"	"	3	✓	✓	✓	offset to SB001
NBCG/0115B00802	"	1335	S	"	"	"	3	✓	✓	✓	
NBCG/0115B00901	"	1335	S	"	"	"	3	✓	✓	✓	offset to SB003
NBCG/0115B00902	"	1340	S	"	"	"	3	✓	✓	✓	
NBCG/0115B01001	"	1350	S	"	"	"	3	✓	✓	✓	near SB005
NBCG/0115B01101	"	1357	S	"	"	"	3	✓	✓	✓	near SB004
NBCG/011M000401	"	1415	S	"	"	"	2	✓	✓	✓	* Added TOC
NBCG/011M000301	"	1420	S	"	"	"	2	✓	✓	✓	* Added TOC
NBCG/0115B01102	"	1403	S	"	"	"	3	✓	✓	✓	

RELINQUISHER: <i>[Signature]</i>	DATE: 12/14/99	RECEIVER: _____	DATE: _____	RELINQUISHER: _____	DATE: _____	RECEIVER: _____	DATE: _____
PRINTED: Fred Erdmann	TITLE: _____	PRINTED: _____	TITLE: _____	PRINTED: _____	TITLE: _____	PRINTED: _____	TITLE: _____
COMPANY: ENSAFE	505	COMPANY: _____	COMPANY: _____	COMPANY: _____	COMPANY: _____	COMPANY: _____	COMPANY: _____

METHOD SHIPMENT: Fed Exp  
SHIPMENT: 814795922658  
SEND RESULTS TO: Charles Verney

COMMENTS: \* TOC not needed for samples 0115B00601 + 00612, and 0115B00701 + 00702  
\* Add TOC to samples 011M000401 + 011M000301

DEC-15-1999 09:40 EN SAFE, INC.

**LAUCKS TESTING LABORATORIES**

940 S. Harney  
Seattle, WA 98108

To: Ensafe  
Laboratory No. :9912330  
SDG No. : EN032  
Date of Report: January 11, 2000

**SAMPLE RECEIPT, IDENTIFICATION, AND GENERAL COMMENTS:**

**Sample Receipt and Identification:**

The samples submitted under the laboratory number(s) indicated above were identified and analyzed as tabulated below. The samples were collected and received on the dates noted on the enclosed chain-of-custody copies, Attachment A.

<u>Client Sample Identification</u>	<u>Laucks Sample Identification</u>	<u>Testing Analytical Request</u>
011M000401	9912330-01	MET/TOC
011M000301	9912330-02	MET/TOC
011SB01102	9912330-03	MET/TOC
706SB01801	9912330-04	MET/TOC
706SB01802	9912330-05	MET/TOC
706SB01401	9912330-06	MET/TOC
706SB01402	9912330-07	MET/TOC
706SB01501	9912330-08	MET/TOC
706SB01601	9912330-09	MET/TOC
706SB01602	9912330-10	MET/TOC
706SB01701	9912330-11	MET/TOC
706SB01901	9912330-12	MET/TOC
706SB01902	9912330-13	MET/TOC
706SB02001	9912330-14	MET/TOC
706SB02002	9912330-15	MET/TOC
633SB02101	9912330-16	PCB
011M000401 SPLP	9912330-17	SPLP
011M000301 SPLP	9912330-18	SPLP
011SB01102 SPLP	9912330-19	SPLP
706SB01801 SPLP	9912330-20	SPLP
706SB01802 SPLP	9912330-21	SPLP
706SB01401 SPLP	9912330-22	SPLP
706SB01402 SPLP	9912330-23	SPLP
706SB01501 SPLP	9912330-24	SPLP
706SB01601 SPLP	9912330-25	SPLP
706SB01602 SPLP	9912330-26	SPLP
706SB01701 SPLP	9912330-27	SPLP
706SB01901 SPLP	9912330-28	SPLP

## LAUCKS TESTING LABORATORIES

940 S. Harney  
Seattle, WA 98108

706SB01902 SPLP	9912330-29	SPLP
706SB02001 SPLP	9912330-30	SPLP
706SB02002 SPLP	9912330-31	SPLP

### Analytical Request Key:

PCB =	Polychlorinated Biphenyls (8082)
MET =	TAL Metals + Tin (6010B/7000)
SPLP =	SPLP Metals (1312), TAL Metals + Tin (6010B/7000)
TOC =	Total Organic Carbon (9060)

### Sample Receipt Comments:

Several samples received were measured at temperatures which exceeded the temperature control limits of  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ . Approval to run the samples with high temperatures was given by Charlie Vermoy on 12/16/1999. The original COC was revised to update sample IDs by Julie Shaffer. The revised COC was used as the original in this data package. See the sample receipt logs for documentation.

### Sample Identification on Forms:

When completing forms created through the CLP software, every attempt is made to use both your sample IDs as well as the laboratory sample IDs. The forms have varied default sizes to their sample identification fields, and are not amenable to alteration or editing. When it is not possible to use your complete sample ID because of field length limitations, Laucks will usually do one of two things: 1) use as much of your ID as will fit, beginning from the RIGHT hand side of the sample ID number, or 2) select some sub-set of your sample identifier if it is clearly a discrete number. In addition, all forms will contain our sample IDs, which can be cross-referenced from the table above.

### **SPECIFIC REMARKS ON ORGANIC ANALYSES:**

#### Holding Time Compliance:

Following the Contract Laboratory Program (CLP) model, Laucks calculates holding time compliance for organic determinations based on the first injection and/or analysis of an extract or sample. Subsequent analyses (for instance, for the purpose of dilution) are not tabulated.

#### PCBs:

The holding time to extraction is 7 days in water and 14 days in soil calculated from the date of collection. In either case, the holding time from extraction to analysis is 40 days. All samples were extracted and analyzed within holding time.

**LAUCKS TESTING LABORATORIES**

940 S. Harney  
Seattle, WA 98108

PCB Fraction:

There were no out of control events associated with this sample.

**GENERAL REMARKS ON INORGANIC ANALYSES:**

The following comments describe general analysis conditions. For remarks specific to the samples reported in this case, see "SPECIFIC REMARKS ON INORGANIC ANALYSES."

ICP Metals:

On the first timed and dated page of each ICP run, the data to be reported or rejected will be tabulated for that run.

Mercury:

Laucks purchases a 1000 mg/L Hg stock solution from Inorganic Ventures. The 1.0 mg/L working standard is made by diluting 100  $\mu$ L to 100 mL with 2% HNO<sub>3</sub>. The calibration curve is made by placing 0, 20, 50, 100, 200, 500 and 1000  $\mu$ L of the working standard in BOD bottles and diluting up to 100 mL. The standard curve is equivalent to 0, 0.2, 0.5, 1.0, 2.0, 5.0 and 10.0  $\mu$ g/L.

**SPECIFIC REMARKS ON INORGANIC ANALYSES:**

Holding Time Compliance:

Laucks calculates holding time compliance for inorganic determinations using the date on which reportable data were acquired.

Metals:

The holding time for metals is six months from the date of collection, excepting mercury, which is 28 days. All analyses were performed within holding time.

Miscellaneous:

The following analytes do not have a Contract Laboratory Program holding time. The holding times tabulated below derive from the relevant EPA methods and are applicable when the sample was appropriately preserved and/or cooled. All samples submitted followed the preservation guidelines unless explicitly noted otherwise.

**LAUCKS TESTING LABORATORIES**

940 S. Hamey  
Seattle, WA 98108

<u>Analyte</u>	<u>Holding Time</u>	<u>Violations</u>
TOC	28 days	None

**ICP Metals(Soil):**

The matrix spike sample percent recoveries of antimony was outside of the established control limits of 75-125% for sample 011M000401. No further corrective action was required. All relevant data have been flagged with an "N" on Forms I and V.

The duplicate sample relative percent difference of manganese was outside the control limits of  $\pm 20\%$  for sample 011M000401. No further corrective action was required. All relevant data have been flagged with an "\*\*\*" on Forms I and VI.

**Mercury:**

No comments.

**Metals (SPLP):**

Zinc was present in the SPLP blank. No further corrective action was required per client data quality objectives.

The duplicate sample relative percent differences of aluminum and iron were outside the control limits of  $\pm 20\%$  for sample 706SB02002. No further corrective action was required. All relevant data have been flagged with an "\*\*\*" on Forms I and VI.

The serial dilution for potassium did not agree within 10% of the original determination after correction for dilution for sample 011M000301. No further corrective action was required. All relevant data have been flagged with an "E" on the applicable Forms I and IX.

**Total Organic Carbon:**

No comments.

## LAUCKS TESTING LABORATORIES

940 S. Harney  
Seattle, WA 98108

### ABBREVIATIONS

Several abbreviations can appear in our reports. The most commonly employed abbreviations are as follows:

- U The analyte of interest was not detected to the limit of detection indicated.
- SDL Sample Detection Limit. The SDL can vary from sample to sample, depending on sample size, matrix interferences, moisture content and other sample-specific conditions.
- PQL Practical Quantitation Limit. The limit is drawn from the test method and usually represents the SDL multiplied by a matrix-specific factor.
- DB Dry Basis. The value reported has been back-calculated to normalize for the moisture content of the sample.
- AR As-Received. The value has not been normalized for moisture.

### ORGANIC ANALYSES:

- B When used in relation to organics fractions, the "B" flag indicates the analyte of interest was detected in the method blank associated with the sample, as well as in the sample itself. The "B" flag is applied without regard to the relative concentrations detected in the blank and sample.
- J The analyte of interest was detected below the routine reporting limit. This value should be regarded as an estimate.
- T The flagged values represent the SUM of two co-eluting compounds. The SUM of these two values is shown as though it were a result for each of them. The two figures should not be added together.
- E The flagged value was reported from an analysis which exceeded the linear range of the instrument. See additional comments for further discussion of the circumstances. Values so flagged should be considered estimates.
- D The value reported derives from analysis of a diluted sample of sample extract.
- P When a dual column GC technique is employed, this flag indicates that test results from the two columns differ by more than 25%. Generally, we report the higher value.
- C The flagged analyte has been confirmed by GC/MS analysis. The value reported may be derived from either the initial or confirmatory (GC/MS) analysis. See specific report comments for details.
- CRQL Client Requested Quantitation Limit, usually the limit of detection specified at your request. Might also be referred to as Contract Required Quantitation Limit.

## LAUCKS TESTING LABORATORIES

940 S. Harney  
Seattle, WA 98108

### INORGANIC ANALYSES:

- B The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL). If the analyte was analyzed for but not detected, a "U" shall be entered.
- E The reported value is estimated because of the presence of interference. An explanatory note shall be included under Comments on the Cover Page (if the problem applies to all samples) or on the specific Form I-IN (if it is an isolated problem).
- M Duplicate injection precision not met.
- N Spiked sample recovery not within control limits.
- 
- S The reported value was determined by the Method of Standard Additions (MSA)
- W Post-digestion spike for Furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50 % of spike absorbance.
- \* Duplicate analysis not within control limits.
- + Correlation coefficient for the MSA is less than 0.995.

Entering "S", "W" or "+" is mutually exclusive. No combination of these qualifiers can appear in the same field for an analyte.

CRDL Client Requested Detection Limit, usually the limit of detection specified at your request. Might also be referred to as Contract required Detection Limit.

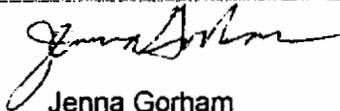
**LAUCKS TESTING LABORATORIES**

940 S. Harney  
Seattle, WA 98108

RELEASE OF DATA

"I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on diskette has been authorized by the Laboratory Manager or his designee, as verified by the following signature."

Respectfully submitted,



Jenna Gorham  
Project Manager

11 Jan 2000  
(DATE)



Mike Nelson  
Technical Director

11 Jan 2000  
(DATE)

**HOW TO CONTACT US:**

All Laucks Testing Laboratories staff members can be reached at the same telephone and facsimile numbers: (206) 767-5060 by phone, (206) 767-5063 by FAX.

**REQUESTS FOR DUPLICATE COPIES:**

This packet has been checked for accuracy. All pages are present and in sequential order. Please see Attachment B for a detailed record.

In the event that duplicate data copies are needed, Laucks will accommodate your request at a fee of twenty-five cents (\$0.25) per copy, plus shipping. If the data are in storage, there will also be a fee for retrieval.

# ENSAFE

800-388-7983  
MEMPHIS, TENNESSEE  
CHARLESTON, SC; CINCINNATI, OH; DALLAS, TX; JACKSON, TN; JORDANVILLE, TN  
LANCASTER, PA; NASHVILLE, TN; NORTON, VA; PRICHARD, KY; PENSACOLA, FL  
WELLSVILLE, COLOGNE, GERMANY

## CHAIN OF CUSTODY RECORD

Amended COC 12/15/99 *[Signature]*

PAGE 1 OF 1 08 11  
PROJECT/JOB NO: 2907-001-08-420-1  
COC NO: \_\_\_\_\_  
PO NO: 1840  
REL NO: 38  
LAB NAME: LAUNCH

CLIENT Navy Clean CNC PROJECT MANAGER T. Haverkost  
LOCATION Zone G / SWM4 11 TELE/FAX NO. (843) 884-0029  
SAMPLERS: (SIGNATURE) *[Signature]*

NO. OF CONTAINERS	Meths	TOC	SPLP Meths	ANALYSIS REQUIRED				REMARKS
				TEMP.	CHEMICAL			
2	✓	✓	✓					* Destroy TOC
2	✓	✓	✓					* Destroy TOC
2	✓	✓	✓					* Destroy TOC
2	✓	✓	✓					* Destroy TOC
3	✓	✓	✓					offset to SB001
3	✓	✓	✓					
3	✓	✓	✓					offset to SB003
3	✓	✓	✓					near SB005
3	✓	✓	✓					near SB004
2	✓	✓	✓					* Added TOC
2	✓	✓	✓					* Added TOC
3	✓	✓	✓					

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION													
					TEMP.	CHEMICAL												
NBCG/0115B00601	12/14/99	1301	S	Glass 8oz	Ice	None	2	✓	✓	✓								
NBCG/0115B00602	"	1310	S	"	"	"	2	✓	✓	✓								
NBCG/0115B00701	"	1308	S	"	"	"	2	✓	✓	✓								
NBCG/0115B00702	"	1316	S	"	"	"	2	✓	✓	✓								
NBCG/0115B00801	"	1327	S	"	"	"	3	✓	✓	✓								
NBCG/0115B00802	"	1335	S	"	"	"	3	✓	✓	✓								
NBCG/0115B00901	"	1335	S	"	"	"	3	✓	✓	✓								
NBCG/0115B00902	"	1340	S	"	"	"	3	✓	✓	✓								
NBCG/0115B01001	"	1350	S	"	"	"	3	✓	✓	✓								
NBCG/0115B01101	"	1357	S	"	"	"	3	✓	✓	✓								
1 NBCG/011M00040	"	1415	S	"	"	"	2	✓	✓	✓								
2 NBCG/011M00030	"	1420	S	"	"	"	2	✓	✓	✓								
3 NBCG/0115B01102	"	1403	S	"	"	"	3	✓	✓	✓								

TOTAL P. 03

RELINQUISHER: <i>[Signature]</i>	DATE: <u>12/14/99</u>	RECEIVER: <i>[Signature]</i>	DATE: <u>12/15/99</u>
PRINTED: Fred Erdmann	TIME: _____	PRINTED: Charles Christensen	TIME: _____
COMPANY: ENSAFE	505	COMPANY: LAUNCH	0545

METHOD OF SHIPMENT: Fed Exp  
SHIPMENT: 814795922658  
SEND RESULTS TO: Charles Veeney

COMMENTS: \* TOC not needed for samples 0115B00601 + 0062, and 0115B00701 + 00702  
\* Add TOC to samples 011M000401 + 011M000301

DEC-15-1999 09:40 EN SAFE, INC. PMS RDB 0101 F. 00003



800-588-7962  
 MEMPHIS, TENNESSEE  
 CHARLESTON, SC; CINCINNATI, OH; DALLAS, TX; JACKSON, TN; KNOXVILLE, TN;  
 WESTER, PA; NASHVILLE, TN; NORFOLK, VA; PADUCAH, KY; PENSACOLA, FL;  
 RALEIGH, NC; COLOGNE, GERMANY

# CHAIN OF CUSTODY RECORD

9912330 EN032

PROJECT/JOB NO: 2907-001-0874-20-00  
 COC NO: 0  
 PO NO: 1840  
 REL NO: 38  
 LAB NAME: Launch

CLIENT: Navy Clean CNC  
 LOCATION: Zone G/AOC 706  
 SAMPLERS: (SIGNATURE) *[Signature]*

PROJECT MANAGER: T. Haverkort  
 TELE/FAX NO: (843) 884-0529

FIELD SAMPLE NUMBER	DATE	TIME	SAMPLE TYPE	TYPE/SIZE OF CONTAINER	PRESERVATION		NO. OF CONTAINERS	ANALYSIS REQUIRED				REMARKS
					TEMP.	CHEMICAL		Metals	SPLP Metals	TOC		
BCG/7065B01801	12/14/99	0832	S	Glass 8 oz	ICR	None	3	✓	✓	✓		
BCG/7065B01802	"	0838	"	"	"	"	3	✓	✓	✓		
BCG/7065B01401	"	0830	"	"	"	"	3	✓	✓	✓		
BCG/7065B01402	"	0841	"	"	"	"	3	✓	✓	✓		
BCG/7065B01501	"	0912	"	"	"	"	3	✓	✓	✓		offset to SB005
BCG/7065B01601	"	0916	"	"	"	"	3	✓	✓	✓		offset to SB009
BCG/7065B01602	"	0921	"	"	"	"	3	✓	✓	✓		
BCG/7065B01701	"	0945	"	"	"	"	3	✓	✓	✓		offset to SB006
BCG/7065B01901	"	0954	"	"	"	"	3	✓	✓	✓		offset to SB004
BCG/7065B01902	"	1003	"	"	"	"	3	✓	✓	✓		
BCG/7065B02001	"	1021	"	"	"	"	3	✓	✓	✓		offset to SB003
BCG/7065B02002	"	1028	"	"	"	"	3	✓	✓	✓		

APPROVED: <i>[Signature]</i> PRINTED: Fred Erdmann COMPANY: Enviro	DATE: 12/14/99 TIME: 1505	RECEIVER: <i>[Signature]</i> PRINTED: Charles Christensen COMPANY: Launch	DATE: 12/14/99 TIME: 1545	RELINQUISHER: _____ PRINTED: _____ COMPANY: _____	DATE: _____ TIME: _____	RECEIVER: _____ PRINTED: _____ COMPANY: _____	DATE: _____ TIME: _____
--	------------------------------	---	------------------------------	---	----------------------------	---	----------------------------

METHOD OF SHIPMENT: Fed Exp  
 SHIPMENT NO: 814795922658  
 SEND RESULT: Charles Verney

COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_







PROJECT NUMBER  
158814.ZG

WELL NUMBER  
G633GW001

SHEET 1 OF 1

## WELL COMPLETION DIAGRAM

PROJECT : AOC 633, Zone E, Charleston Naval Complex

LOCATION : Charleston, South Carolina

DRILLING CONTRACTOR : Prosonic Corporation License # 1435

NORTHING

DRILLING METHOD AND EQUIPMENT USED : Hollow Stem Augering (4.25-inch diameter)

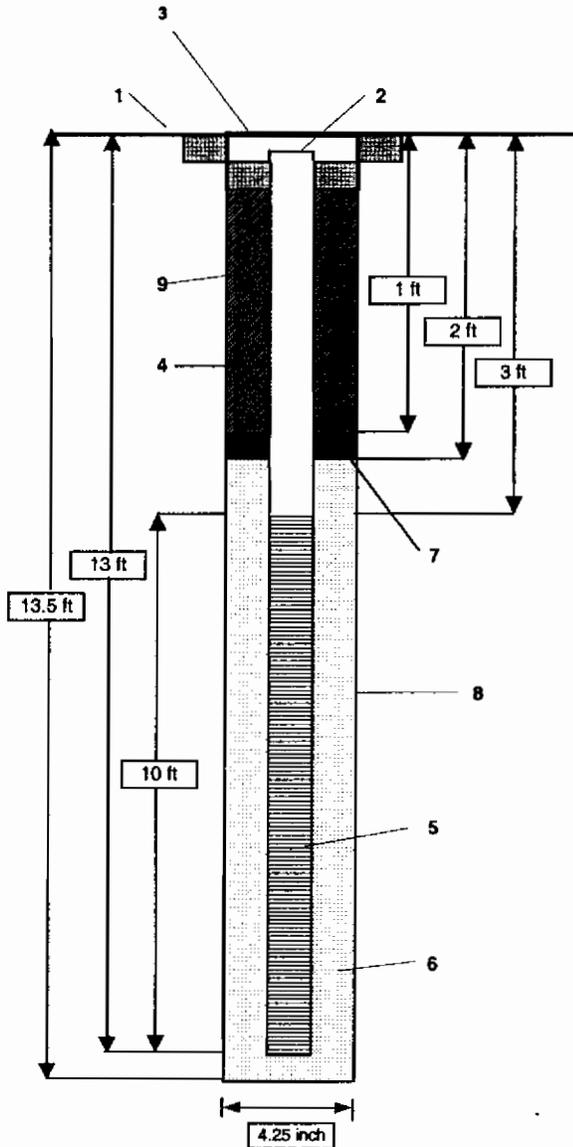
EASTING

WATER LEVELS : not measured

START : 9/17/2002

END: 9/17/2002

LOGGER : D. Gates/NVR



1- Ground elevation at well	not measured
2- Top of casing elevation	
3- Protective cover type	8-inch dia. flush mount manhole vault
a) concrete pad dimensions	2 ft x 2 ft
4- Dia./type of well casing	2-inch inside diameter schedule 40 PVC
5- Type/slot size of screen	0.010-inch dia. machine slotted PVC
6- Type filter pack	20/30 Sieve Size Silica Sand (5 bags)
7- Type of seal	3/8-inch bentonite chips, Baroid
8- Borehole diameter	4.25"
9- Grout	Type I Portland Cement

Note: Diagram not to scale.



PROJECT NUMBER  
158814.ZG

DPT NUMBER  
G633GW001

page 1 of 1

**DPT SOIL SAMPLE LOG**

PROJECT : Charleston Naval Complex (AOC 633)      LOCATION : Charleston, SC      NORTHING: [REDACTED]  
 ELEVATION : not measured      DRILLING CONTRACTOR : Prosonic      License # 1435      EASTING: [REDACTED]  
 DRILLING METHOD AND EQUIPMENT USED :      Direct-Push Sampling, 4 - ft screen  
 START : 9/17/2002      END: 9/17/2002      LOGGER : D. Gates/NVR

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SOIL DESCRIPTION	COMMENTS
		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	TESTS, INSTRUMENTATION ABANDONMENT METHOD
	0-1'	gravel	
5	1-6'	SAND: brown, fine-medium grained, well sorted (backfilled from excavation), moist, soft, saturated at 6'	
10	6-14'	SAND: black, fine grained with appreciable silt content, saturated	product laden
15			Boring ended at 14'
20			
25			
30			



PROJECT NUMBER  
158814.ZG

WELL NUMBER  
G633GW002

SHEET 1 OF 1

## WELL COMPLETION DIAGRAM

PROJECT : AOC 633, Zone E, Charleston Naval Complex

LOCATION : Charleston, South Carolina

DRILLING CONTRACTOR : Prosonic Corporation License # 1435

NORTHING: [REDACTED]

DRILLING METHOD AND EQUIPMENT USED : Hollow Stem Augering (4.25-inch diameter)

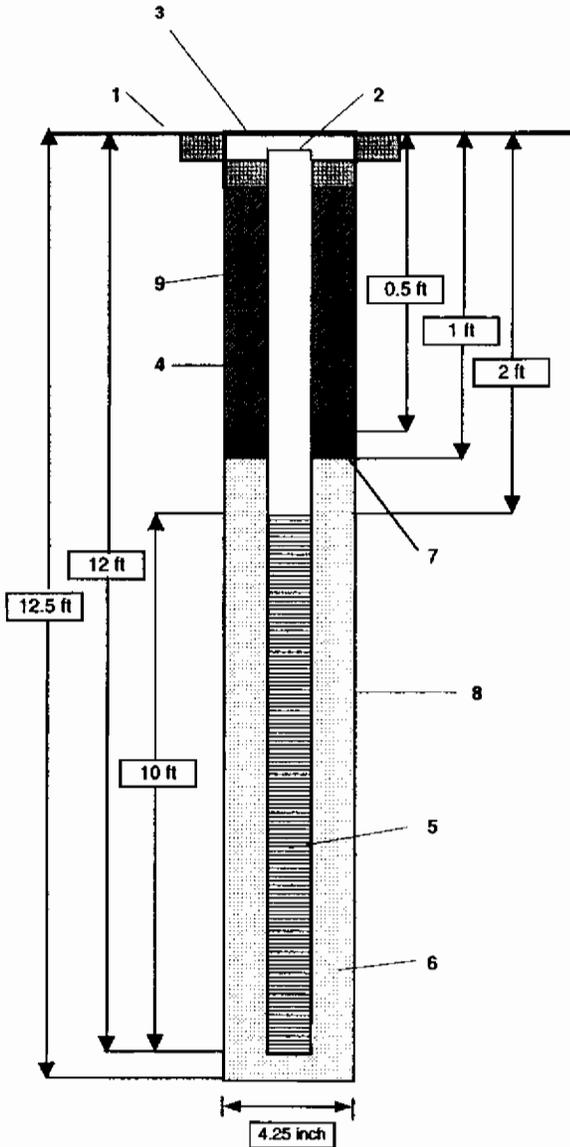
EASTING: [REDACTED]

WATER LEVELS : not measured

START : 9/17/2002

END: 9/17/2002

LOGGER : D. Gates/NVR



1- Ground elevation at well	not measured
2- Top of casing elevation	[REDACTED]
3- Protective cover type	8-ich dia. flush mount manhole vault
a) concrete pad dimensions	2 ft x 2 ft
4- Dia./type of well casing	2-inch inside diameter schedule 40 PVC
5- Type/slot size of screen	0.010-inch dia. machine slotted PVC
6- Type filter pack	20/30 Sieve Size Silica Sand (5 bags)
7- Type of seal	3/8-inch bentonite chips, Baroid
8- Borehole diameter	4.25"
9- Grout	Type I Portland Cement

Note: Diagram not to scale.



<b>PROJECT NUMBER</b> 158814.ZG	<b>DPT NUMBER</b> G633GW002
page 1 of 1	
DPT SOIL SAMPLE LOG	

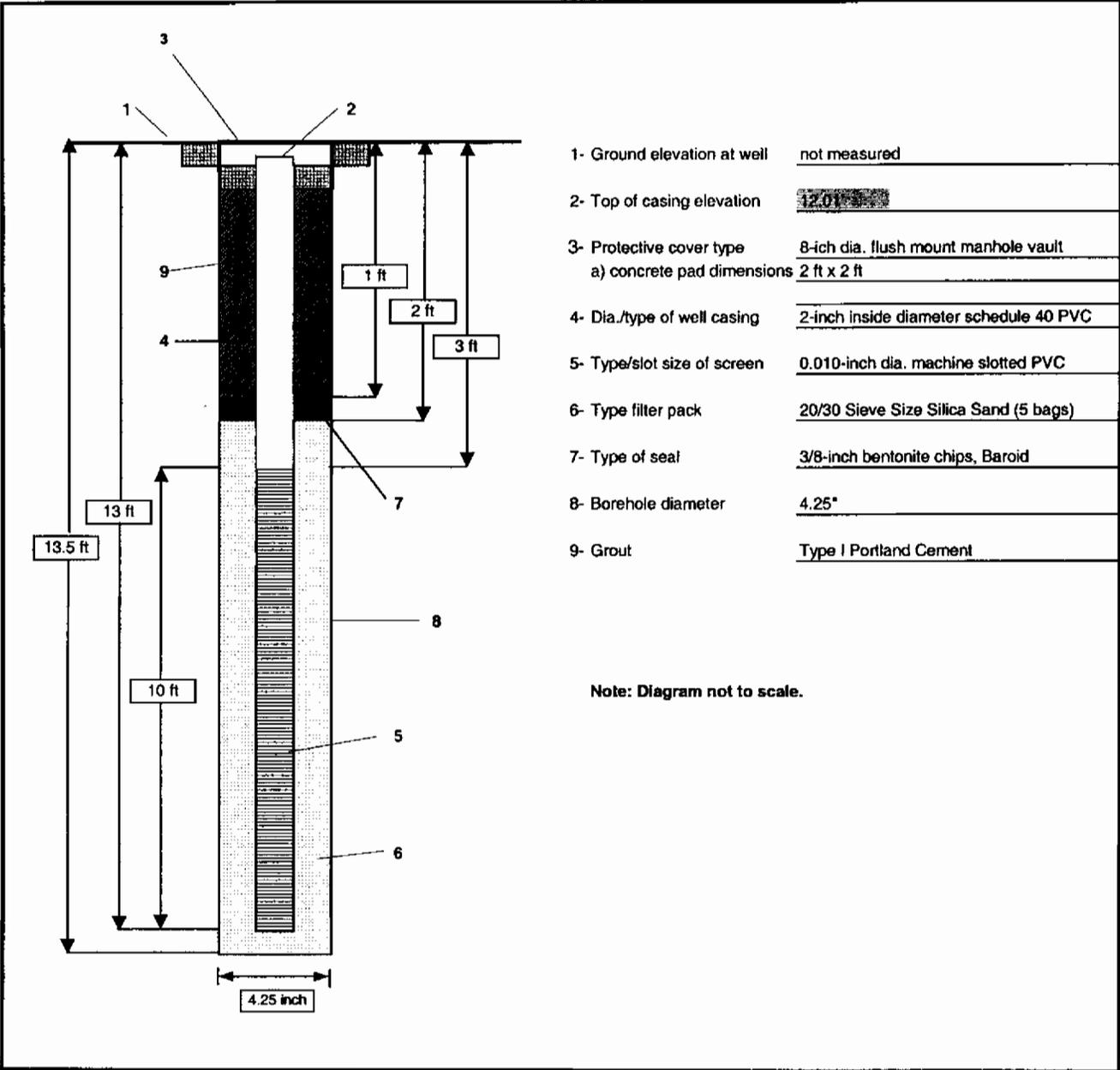
**PROJECT :** Charleston Naval Complex (AOC 633)      **LOCATION :** Charleston, SC      **NORTHING:** ██████████  
**ELEVATION :** not measured      **DRILLING CONTRACTOR :** Prosonic      License # 1435      **EASTING:** ██████████  
**DRILLING METHOD AND EQUIPMENT USED :** Direct-Push Sampling, 4 - ft screen  
**START :** 9/17/2002      **END:** 9/17/2002      **LOGGER :** D. Gates/NVR

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SOIL DESCRIPTION	COMMENTS
		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	TESTS, INSTRUMENTATION ABANDONMENT METHOD
	0-3'	surface: grass <b>SAND:</b> dark brown, fine to medium grained, slightly silty, saturated at 2.5'	
5	3-7'	<b>SANDY CLAY:</b> black, fine grained with silt, sticky, damp	
10	7-13'	<b>SANDY CLAY:</b> black, fine grained with silt, sticky, damp, saturated at 7'	product laden
			Boring ended at 13'
15			
20			
25			
30			



PROJECT NUMBER <b>158814.ZG</b>	WELL NUMBER <b>G633GW003</b>	SHEET 1 OF 1
<b>WELL COMPLETION DIAGRAM</b>		

PROJECT : AOC 633, Zone E, Charleston Naval Complex	LOCATION : Charleston, South Carolina
DRILLING CONTRACTOR : Prosonic Corporation License # 1435	NORTHING : ██████████
DRILLING METHOD AND EQUIPMENT USED : Hollow Stem Augering (4.25-inch diameter)	EASTING : ██████████
WATER LEVELS : not measured	START : 9/17/2002    END: 9/17/2002    LOGGER : D. Gates/NVR



1- Ground elevation at well	not measured
2- Top of casing elevation	12.01
3- Protective cover type a) concrete pad dimensions	8-inch dia. flush mount manhole vault 2 ft x 2 ft
4- Dia./type of well casing	2-inch inside diameter schedule 40 PVC
5- Type/slot size of screen	0.010-inch dia. machine slotted PVC
6- Type filter pack	20/30 Sieve Size Silica Sand (5 bags)
7- Type of seal	3/8-inch bentonite chips, Baroid
8- Borehole diameter	4.25"
9- Grout	Type I Portland Cement

**Note: Diagram not to scale.**



<b>PROJECT NUMBER</b> 158814.ZG	<b>DPT NUMBER</b> G633GW003
page 1 of 1	
<b>DPT SOIL SAMPLE LOG</b>	

**PROJECT :** Charleston Naval Complex (AOC 633)      **LOCATION :** Charleston, SC      **NORTHING:** ██████████  
**ELEVATION :** not measured      **DRILLING CONTRACTOR :** Prosonic      License # 1435      **EASTING:** ██████████  
**DRILLING METHOD AND EQUIPMENT USED :** Direct-Push Sampling, 4 - ft screen  
**START :** 9/17/2002      **END:** 9/17/2002      **LOGGER :** D. Gates/NVR

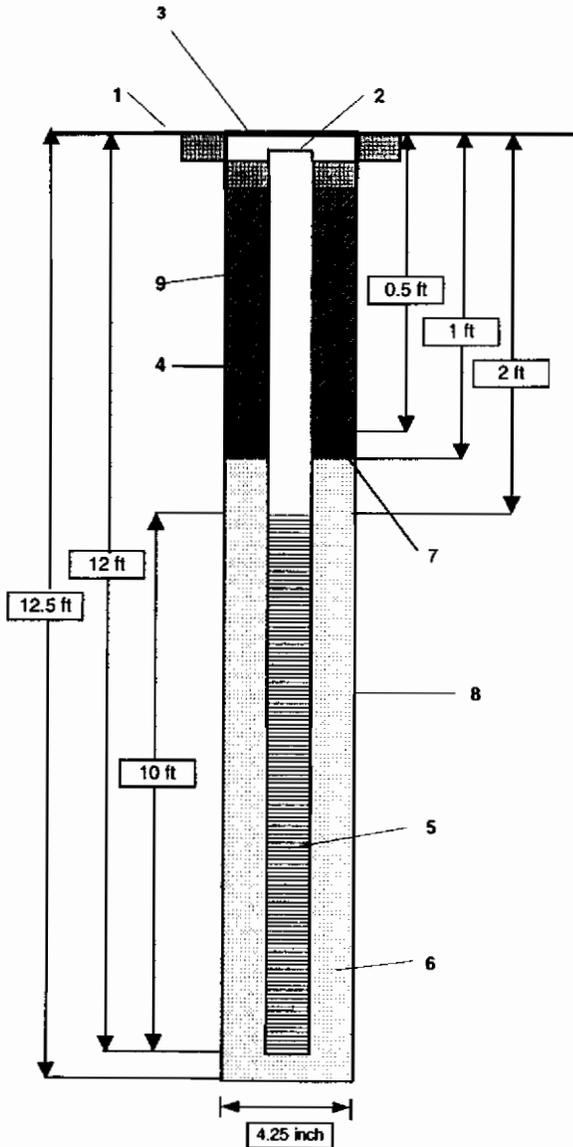
DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SOIL DESCRIPTION	COMMENTS
		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	TESTS, INSTRUMENTATION ABANDONMENT METHOD
	0-3'	surface: grass  <b>SAND:</b> dark brown, fine to medium grained, slightly silty,	
5			saturated at 5'
10	3-13'	<b>SANDY CLAY:</b> black, fine grained with silt, saturated, sticky	
			Boring ended at 13'
15			
20			
25			
30			



PROJECT NUMBER 158814.ZG	WELL NUMBER G633GW004	SHEET 1 OF 1
-----------------------------	--------------------------	--------------

## WELL COMPLETION DIAGRAM

PROJECT : AOC 633, Zone E, Charleston Naval Complex	LOCATION : Charleston, South Carolina
DRILLING CONTRACTOR : Prosonic Corporation License # 1435	NORTHING : [REDACTED]
DRILLING METHOD AND EQUIPMENT USED : Hollow Stem Augering (4.25-inch diameter)	EASTING : [REDACTED]
WATER LEVELS : not measured	START : 9/17/2002      END: 9/17/2002      LOGGER : D. Gates/NVR



1- Ground elevation at well	not measured
2- Top of casing elevation	120.0
3- Protective cover type	8-ich dia. flush mount manhole vault
a) concrete pad dimensions	2 ft x 2 ft
4- Dia./type of well casing	2-inch inside diameter schedule 40 PVC
5- Type/slot size of screen	0.010-inch dia. machine slotted PVC
6- Type filter pack	20/30 Sieve Size Silica Sand (5 bags)
7- Type of seal	3/8-inch bentonite chips, Baroid
8- Borehole diameter	4.25"
9- Grout	Type I Portland Cement

Note: Diagram not to scale.



PROJECT NUMBER  
158814.ZG

DPT NUMBER  
G633GW004

page 1 of 1

### DPT SOIL SAMPLE LOG

PROJECT : Charleston Naval Complex (AOC 633)      LOCATION : Charleston, SC      NORTHING: [REDACTED]  
ELEVATION : not measured      DRILLING CONTRACTOR : Prosonic      License # 1435      EASTING: [REDACTED]  
DRILLING METHOD AND EQUIPMENT USED :      Direct-Push Sampling, 4 - ft screen  
START : 9/18/2002      END: 9/18/2002      LOGGER : D. Gates/NVR

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SOIL DESCRIPTION	COMMENTS
		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	TESTS, INSTRUMENTATION ABANDONMENT METHOD
	0-3'	surface: grass SAND: brownish black, fine to medium grained, some silt, moist at 2', wet at 3'	
5	3-5'	CLAY: black/gray, slightly sandy, moist	
10	5-13'	SAND: black, clayey silty, saturated, sticky	
15			Boring ended at 13'
20			
25			
30			

StationID	G633GW002	G633GW003	G633GW004	G633GW004
SampleID	633GW002M7	633GW003M7	633GW004M7	633HW004M7
DateCollected	10/2/2002	10/2/2002	10/2/2002	10/2/2002
DateExtracted	10/10/2002	10/10/2002	10/11/2002	10/11/2002
DateAnalyzed	10/10/2002	10/10/2002	10/11/2002	10/11/2002
SDGNumber	68148	68148	68148	68148

Parameter	Units	G633GW002		G633GW003		G633GW004		G633GW004	
Chloromethane	ug/L	10	U	10	U	100	U	100	U
Vinyl chloride	ug/L	10	UJ	10	U	100	U	100	U
Bromomethane	ug/L	10	U	10	U	100	U	100	U
Chloroethane	ug/L	10	U	10	U	100	U	100	U
1,1-Dichloroethene	ug/L	5	U	5	U	50	U	50	U
Acetone	ug/L	5.4	J	2.4	J	100	U	100	U
Carbon Disulfide	ug/L	5	UJ	5	UJ	50	UJ	50	UJ
Methylene Chloride	ug/L	5	U	5	U	50	U	50	U
trans-1,2-Dichloroethene	ug/L	5	U	5	U	50	U	50	U
1,1-Dichloroethane	ug/L	5	U	5	U	50	U	50	U
Vinyl acetate	ug/L	10	U	10	U	100	U	100	U
Methyl ethyl ketone (2-Butanone)	ug/L	10	U	10	U	100	U	100	U
cis-1,2-Dichloroethylene	ug/L	5	U	5	U	50	U	50	U
1,2-Dichloroethene (total)	ug/L	5	U	5	U	50	U	50	U
Chloroform	ug/L	5	U	5	U	50	U	50	U
1,1,1-Trichloroethane	ug/L	5	U	5	U	50	U	50	U
Carbon Tetrachloride	ug/L	5	U	5	U	50	U	50	U
1,2-Dichloroethane	ug/L	5	U	5	U	50	U	50	U
Benzene	ug/L	5	U	5	U	23.8	J	24	J
Trichloroethylene (TCE)	ug/L	5	U	5	U	50	U	50	U
1,2-Dichloropropane	ug/L	5	U	5	U	50	U	50	U
Bromodichloromethane	ug/L	5	U	5	U	50	U	50	U
2-Chloroethyl vinyl ether	ug/L	10	R	10	U	100	U	100	U
cis-1,3-Dichloropropene	ug/L	5	U	5	U	50	U	50	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/L	10	U	10	U	100	U	100	U
Toluene	ug/L	5	U	5	U	17.1	J	16.9	J
trans-1,3-Dichloropropene	ug/L	5	UJ	5	UJ	50	U	50	U
1,1,2-Trichloroethane	ug/L	5	U	5	U	50	U	50	U
2-Hexanone	ug/L	10	U	10	U	100	U	100	U
Tetrachloroethylene (PCE)	ug/L	5	U	5	U	50	U	50	U

Analytical Data Summary

02/28/2003 3:15 PM

StationID	G633GW002		G633GW003		G633GW004		G633GW004		
SampleID	633GW002M7		633GW003M7		633GW004M7		633HW004M7		
DateCollected	10/2/2002		10/2/2002		10/2/2002		10/2/2002		
DateExtracted	10/10/2002		10/10/2002		10/11/2002		10/11/2002		
DateAnalyzed	10/10/2002		10/10/2002		10/11/2002		10/11/2002		
SDGNumber	68148		68148		68148		68148		
Parameter	Units								
Dibromochloromethane	ug/L	5	U	5	U	50	U	50	U
Chlorobenzene	ug/L	5	U	5	U	50	U	50	U
Ethylbenzene	ug/L	5	U	5	U	16.3	J	17.4	J
m+p Xylene	ug/L	5	U	5	U	18.1	J	18.6	J
o-Xylene	ug/L	5	U	5	U	12.6	J	13.9	J
Xylenes, Total	ug/L	5	U	5	U	30.6	J	32.6	J
Styrene	ug/L	5	U	5	U	50	U	50	U
Bromoform	ug/L	5	U	5	U	50	U	50	U
1,1,2,2-Tetrachloroethane	ug/L	5	U	5	U	50	U	50	U
1,3-Dichlorobenzene	ug/L	5	U	5	U	50	U	50	U
1,4-Dichlorobenzene	ug/L	5	U	5	U	50	U	50	U
1,2-Dichlorobenzene	ug/L	5	U	5	U	50	U	50	U
1,2,4-Trichlorobenzene	ug/L	5	UJ	5	UJ	50	UJ	50	UJ
1,2,3-Trichlorobenzene	ug/L	5	UJ	5	UJ	50	UJ	50	UJ

StationID	G633GW002	G633GW003	G633GW004	G633GW004
SampleID	633GW002M7	633GW003M7	633GW004M7	633GW004M7DL
DateCollected	10/2/2002	10/2/2002	10/2/2002	10/2/2002
DateExtracted	10/4/2002	10/4/2002	10/4/2002	10/4/2002
DateAnalyzed	10/4/2002	10/7/2002	10/4/2002	10/8/2002
SDGNumber	68148	68148	68148	68148

Parameter	Units	G633GW002		G633GW003		G633GW004		G633GW004	
Phenol	ug/L	9.7	U	10.2	U	10	U	400	R
bis(2-Chloroethyl) ether (2-Chloroethyl Ether)	ug/L	9.7	U	10.2	U	10	U	400	R
2-Chlorophenol	ug/L	9.7	U	10.2	U	10	U	400	R
Benzyl alcohol	ug/L	9.7	U	10.2	U	10	U	400	R
Bis(2-Chloroisopropyl)Ether	ug/L	9.7	U	10.2	U	10	U	400	R
2-Methylphenol (o-Cresol)	ug/L	9.7	U	10.2	U	10	U	400	R
N-Nitrosodi-n-propylamine	ug/L	9.7	U	10.2	U	10	U	400	R
3-Methylphenol/4-Methylphenol (mp-Cresol)	ug/L	9.7	U	10.2	U	16	=	400	R
Hexachloroethane	ug/L	9.7	U	10.2	U	10	U	400	R
Nitrobenzene	ug/L	9.7	U	10.2	U	10	U	400	R
Isophorone	ug/L	9.7	U	10.2	U	10	U	400	R
2-Nitrophenol	ug/L	9.7	U	10.2	U	10	U	400	R
2,4-Dimethylphenol	ug/L	9.7	U	10.2	U	106	=	400	R
bis(2-Chloroethoxy) Methane	ug/L	9.7	U	10.2	U	10	U	400	R
2,4-Dichlorophenol	ug/L	9.7	U	10.2	U	10	U	400	R
Benzoic acid	ug/L	48.5	UJ	51	UJ	50	UJ	2000	R
Naphthalene	ug/L	9.7	U	10.2	U	1060	R	2510	=
4-Chloroaniline	ug/L	9.7	U	10.2	U	10	U	400	R
Hexachlorobutadiene	ug/L	9.7	U	10.2	U	10	U	400	R
4-Chloro-3-methylphenol	ug/L	9.7	U	10.2	U	10	U	400	R
2-Methylnaphthalene	ug/L	9.7	U	10.2	U	339	R	401	=
Hexachlorocyclopentadiene	ug/L	9.7	U	10.2	UJ	10	U	400	R
2,4,6-Trichlorophenol	ug/L	9.7	U	10.2	U	10	U	400	R
2,4,5-Trichlorophenol	ug/L	48.5	U	51	U	50	U	2000	R
2-Chloronaphthalene	ug/L	9.7	U	10.2	U	10	U	400	R
2-Nitroaniline	ug/L	48.5	U	51	U	50	U	2000	R
3-Nitroaniline	ug/L	48.5	U	51	U	50	U	2000	R
Dimethyl Phthalate	ug/L	9.7	U	10.2	U	10	U	400	R
2,6-Dinitrotoluene	ug/L	9.7	U	10.2	U	10	U	400	R
Acenaphthylene	ug/L	9.7	U	10.2	U	10	U	400	R

Analytical Data Summary

02/28/2003 3:15 PM

	StationID	G633GW004		G633GW004	
	SampleID	633HW004M7		633HW004M7DL	
	DateCollected	10/2/2002		10/2/2002	
	DateExtracted	10/4/2002		10/4/2002	
	DateAnalyzed	10/4/2002		10/8/2002	
	SDGNumber	68148		68148	
Parameter	Units				
Phenol	ug/L	9.8	U	390	R
bis(2-Chloroethyl) ether (2-Chloroethyl Ether)	ug/L	9.8	U	390	R
2-Chlorophenol	ug/L	9.8	U	390	R
Benzyl alcohol	ug/L	9.8	U	390	R
Bis(2-Chloroisopropyl)Ether	ug/L	9.8	U	390	R
2-Methylphenol (o-Cresol)	ug/L	9.8	U	390	R
N-Nitrosodi-n-propylamine	ug/L	9.8	U	390	R
3-Methylphenol/4-Methylphenol (mp-Cresol)	ug/L	15.9	=	390	R
Hexachloroethane	ug/L	9.8	U	390	R
Nitrobenzene	ug/L	42.3	=	390	R
Isophorone	ug/L	9.8	U	390	R
2-Nitrophenol	ug/L	9.8	U	390	R
2,4-Dimethylphenol	ug/L	124	J	390	R
bis(2-Chloroethoxy) Methane	ug/L	9.8	U	390	R
2,4-Dichlorophenol	ug/L	9.8	U	390	R
Benzoic acid	ug/L	48.8	UJ	1950	R
Naphthalene	ug/L	1150	R	2900	=
4-Chloroaniline	ug/L	9.8	U	390	R
Hexachlorobutadiene	ug/L	9.8	U	390	R
4-Chloro-3-methylphenol	ug/L	9.8	U	390	R
2-Methylnaphthalene	ug/L	375	R	460	=
Hexachlorocyclopentadiene	ug/L	9.8	U	390	R
2,4,6-Trichlorophenol	ug/L	9.8	U	390	R
2,4,5-Trichlorophenol	ug/L	48.8	U	1950	R
2-Chloronaphthalene	ug/L	9.8	U	390	R
2-Nitroaniline	ug/L	48.8	U	1950	R
3-Nitroaniline	ug/L	48.8	U	1950	R
Dimethyl Phthalate	ug/L	9.8	U	390	R
2,6-Dinitrotoluene	ug/L	9.8	U	390	R
Acenaphthylene	ug/L	9.8	U	390	R

StationID	G633GW002		G633GW003		G633GW004		G633GW004		
SampleID	633GW002M7		633GW003M7		633GW004M7		633GW004M7DL		
DateCollected	10/2/2002		10/2/2002		10/2/2002		10/2/2002		
DateExtracted	10/4/2002		10/4/2002		10/4/2002		10/4/2002		
DateAnalyzed	10/4/2002		10/7/2002		10/4/2002		10/8/2002		
SDGNumber	68148		68148		68148		68148		
Parameter	Units								
Acenaphthene	ug/L	9.7	U	10.2	U	323	R	469	=
2,4-Dinitrophenol	ug/L	48.5	U	51	U	50	U	2000	R
Dibenzofuran	ug/L	9.7	U	10.2	U	177	R	239	J
2,4-Dinitrotoluene	ug/L	9.7	U	10.2	U	10	U	400	R
Diethyl Phthalate	ug/L	9.7	U	10.2	U	10	U	400	R
4-Nitrophenol	ug/L	48.5	U	51	U	50	U	2000	R
Fluorene	ug/L	9.7	U	10.2	U	146	R	186	J
4-Chlorophenyl Phenyl Ether	ug/L	9.7	U	10.2	U	10	U	400	R
4,6-Dinitro-2-methylphenol	ug/L	48.5	R	51	R	50	R	2000	R
4-Nitroaniline	ug/L	48.5	UJ	51	U	50	UJ	2000	R
Diphenylamine	ug/L	9.7	U	10.2	U	10	U	400	R
4-Bromophenyl Phenyl Ether	ug/L	9.7	U	10.2	U	10	U	400	R
Hexachlorobenzene	ug/L	9.7	U	10.2	U	10	U	400	R
Pentachlorophenol	ug/L	48.5	U	51	U	50	U	2000	R
Phenanthrene	ug/L	9.7	U	10.2	U	156	R	206	J
Anthracene	ug/L	9.7	U	10.2	U	15.7	=	400	R
Di-n-butyl Phthalate	ug/L	9.7	U	10.2	U	10	U	400	R
Fluoranthene	ug/L	9.7	U	10.2	U	25.3	=	29.9	R
Pyrene	ug/L	9.7	U	10.2	U	16.4	J	400	R
Benzyl Butyl Phthalate	ug/L	9.7	U	10.2	U	10	U	400	R
Benzo(a)Anthracene	ug/L	9.7	U	10.2	U	10	U	400	R
3,3'-Dichlorobenzidine	ug/L	19.4	UJ	20.4	U	20	UJ	800	R
Chrysene	ug/L	9.7	U	10.2	U	10	U	400	R
bis(2-Ethylhexyl) Phthalate	ug/L	9.7	U	10.2	U	10	U	400	R
Di-n-octylphthalate	ug/L	9.7	U	10.2	U	10	U	400	R
Benzo(b)Fluoranthene	ug/L	9.7	U	10.2	U	0.77	J	400	R
Benzo(k)Fluoranthene	ug/L	9.7	U	10.2	U	10	U	400	R
Benzo(a)Pyrene	ug/L	0.97	U	1	U	0.56	J	40	R
Indeno(1,2,3-c,d)pyrene	ug/L	9.7	U	10.2	UJ	10	U	400	R
Dibenz(a,h)anthracene	ug/L	9.7	U	10.2	UJ	10	U	400	R

Analytical Data Summary

02/28/2003 3:15 PM

StationID	G633GW004	G633GW004
SampleID	633HW004M7	633HW004M7DL
DateCollected	10/2/2002	10/2/2002
DateExtracted	10/4/2002	10/4/2002
DateAnalyzed	10/4/2002	10/8/2002
SDGNumber	68148	68148

Parameter	Units				
Acenaphthene	ug/L	357	R	577	=
2,4-Dinitrophenol	ug/L	48.8	U	1950	R
Dibenzofuran	ug/L	208	R	304	J
2,4-Dinitrotoluene	ug/L	9.8	U	390	R
Diethyl Phthalate	ug/L	9.8	U	390	R
4-Nitrophenol	ug/L	48.8	U	1950	R
Fluorene	ug/L	172	R	239	J
4-Chlorophenyl Phenyl Ether	ug/L	9.8	U	390	R
4,6-Dinitro-2-methylphenol	ug/L	48.8	R	1950	R
4-Nitroaniline	ug/L	48.8	UJ	1950	R
Diphenylamine	ug/L	9.8	U	390	R
4-Bromophenyl Phenyl Ether	ug/L	9.8	U	390	R
Hexachlorobenzene	ug/L	9.8	U	390	R
Pentachlorophenol	ug/L	48.8	U	1950	R
Phenanthrene	ug/L	186	R	258	J
Anthracene	ug/L	18.4	=	22.4	R
Di-n-butyl Phthalate	ug/L	9.8	U	390	R
Fluoranthene	ug/L	23.8	=	34.8	R
Pyrene	ug/L	17.2	J	390	R
Benzyl Butyl Phthalate	ug/L	9.8	U	390	R
Benzo(a)Anthracene	ug/L	9.8	U	390	R
3,3'-Dichlorobenzidine	ug/L	19.5	UJ	780	R
Chrysene	ug/L	9.8	U	390	R
bis(2-Ethylhexyl) Phthalate	ug/L	9.8	U	390	R
Di-n-octylphthalate	ug/L	9.8	U	390	R
Benzo(b)Fluoranthene	ug/L	0.8	J	390	R
Benzo(k)Fluoranthene	ug/L	9.8	U	390	R
Benzo(a)Pyrene	ug/L	0.98	U	39	R
Indeno(1,2,3-c,d)pyrene	ug/L	9.8	U	390	R
Dibenz(a,h)anthracene	ug/L	9.8	U	390	R

Analytical Data Summary

02/28/2006 3:15 PM

<b>StationID</b>	G633GW002	G633GW003	G633GW004	G633GW004
<b>SampleID</b>	633GW002M7	633GW003M7	633GW004M7	633GW004M7DL
<b>DateCollected</b>	10/2/2002	10/2/2002	10/2/2002	10/2/2002
<b>DateExtracted</b>	10/4/2002	10/4/2002	10/4/2002	10/4/2002
<b>DateAnalyzed</b>	10/4/2002	10/7/2002	10/4/2002	10/8/2002
<b>SDGNumber</b>	68148	68148	68148	68148

**Parameter**

**Units**

Benzo(g,h,i)Perylene	ug/L	9.7	U	10.2	UJ	10	U	400	R
Carbazole	ug/L	9.7	U	10.2	U	66.4	=	106	R

Analytical Data Summary

02/28/2003 3:15 PM

Parameter	Units	StationID		SampleID	
		G633GW004		G633GW004	
		633HW004M7		633HW004M7DL	
		10/2/2002		10/2/2002	
		10/4/2002		10/4/2002	
		10/4/2002		10/8/2002	
		68148		68148	
Benzo(g,h,i)Perylene	ug/L	9.8	U	390	R
Carbazole	ug/L	99	=	150	R

StationID	G633GW002		G633GW003		G633GW004		G633GW004	
SampleID	633GW002M7		633GW003M7		633GW004M7		633HW004M7	
DateCollected	10/2/2002		10/2/2002		10/2/2002		10/2/2002	
DateExtracted	10/3/2002		10/3/2002		10/3/2002		10/3/2002	
DateAnalyzed	10/4/2002		10/4/2002		10/4/2002		10/4/2002	
SDGNumber	68148		68148		68148		68148	
Parameter	Units							
PCB-1016 (Arochlor 1016)	1	U	1	U	5	U	10	U
PCB-1221 (Arochlor 1221)	1	U	1	U	5	U	10	U
PCB-1232 (Arochlor 1232)	1	U	1	U	5	U	10	U
PCB-1242 (Arochlor 1242)	1	U	1	U	5	U	10	U
PCB-1248 (Arochlor 1248)	1	U	1	U	5	U	10	U
PCB-1254 (Arochlor 1254)	2	U	2	U	10	U	20	U
PCB-1260 (Arochlor 1260)	2	U	2	U	10	U	20	U

Analytical Data Summary

02/28/2003 3:15 PM

StationID	G633GW002	G633GW002	G633GW003	G633GW003	
SampleID	633GW002M7	633GW002M7	633GW003M7	633GW003M7	
DateCollected	10/2/2002	10/2/2002	10/2/2002	10/2/2002	
DateExtracted	10/3/2002	10/4/2002	10/3/2002	10/4/2002	
DateAnalyzed	10/4/2002	10/10/2002	10/4/2002	10/10/2002	
SDGNumber	68148	68148	68148	68148	
Parameter	Units				
Aluminum	ug/L	261	U	7840	=
Antimony	ug/L	4.79	U	4.79	U
Arsenic	ug/L	17.9	=	26	=
Barium	ug/L	102	J	100	J
Beryllium	ug/L	0.185	U	0.377	U
Cadmium	ug/L	0.676	U	0.499	U
Calcium	ug/L	178000	=	165000	=
Chromium, Total	ug/L	0.832	U	9.4	U
Cobalt	ug/L	0.581	U	0.581	U
Copper	ug/L	11	J	8.41	J
Iron	ug/L	3190	=	13600	=
Lead	ug/L	1.24	U	13.1	U
Magnesium	ug/L	409000	=	422000	=
Manganese	ug/L	794	=	1490	=
Nickel	ug/L	0.837	U	0.837	U
Potassium	ug/L	194000	J	188000	J
Selenium	ug/L	2.67	U	2.67	U
Silver	ug/L	1.15	U	1.15	U
Sodium	ug/L	4810000	J	4700000	J
Thallium	ug/L	10.9	U	5.82	U
Vanadium	ug/L	18.8	J	25.1	J
Zinc	ug/L	77.2	=	52.3	=
Mercury	ug/L	0.064	U	0.064	U

StationID	G633GW004		G633GW004		G633GW004		G633GW004		
SampleID	633GW004M7		633GW004M7		633HW004M7		633HW004M7		
DateCollected	10/2/2002		10/2/2002		10/2/2002		10/2/2002		
DateExtracted	10/3/2002		10/4/2002		10/3/2002		10/4/2002		
DateAnalyzed	10/4/2002		10/10/2002		10/4/2002		10/10/2002		
SDGNumber	68148		68148		68148		68148		
Parameter	Units								
Aluminum	ug/L		249	U			247	U	
Antimony	ug/L		4.79	U			4.79	U	
Arsenic	ug/L		6.37	J			8.53	J	
Barium	ug/L		94.2	J			93.9	J	
Beryllium	ug/L		0.185	U			0.185	U	
Cadmium	ug/L		0.248	U			0.21	U	
Calcium	ug/L		185000	=			186000	=	
Chromium, Total	ug/L		0.966	U			0.979	U	
Cobalt	ug/L		0.581	U			0.581	U	
Copper	ug/L		1.8	U			2.27	U	
Iron	ug/L		2020	=			2010	=	
Lead	ug/L		1.24	U			1.27	U	
Magnesium	ug/L		334000	=			338000	=	
Manganese	ug/L		633	=			638	=	
Nickel	ug/L		0.837	U			0.837	U	
Potassium	ug/L		139000	J			134000	J	
Selenium	ug/L		2.67	U			2.67	U	
Silver	ug/L		1.15	U			1.15	U	
Sodium	ug/L		3550000	J			3410000	J	
Thallium	ug/L		4.99	U			5.04	U	
Vanadium	ug/L		4.69	U			4.48	U	
Zinc	ug/L		1.26	U			1.26	U	
Mercury	ug/L	0.064	U			0.064	U		

Analytical Data Summary

02/28/2003 3:20 PM

**StationID** G633GW001  
**SampleID** 633GW001N1  
**DateCollected** 1/24/2003  
**DateExtracted** 1/30/2003  
**DateAnalyzed** 1/30/2003  
**SDGNumber** CNC162

Parameter	Units		
m-Xylene	ug/l	5	U
Chloromethane	ug/l	10	U
Vinyl chloride	ug/l	10	U
Bromomethane	ug/l	10	U
Chloroethane	ug/l	10	U
1,1-Dichloroethene	ug/l	5	U
Acetone	ug/l	10	U
Carbon Disulfide	ug/l	5	U
Methylene Chloride	ug/l	5	U
trans-1,2-Dichloroethene	ug/l	5	U
1,1-Dichloroethane	ug/l	5	U
Vinyl acetate	ug/l	10	U
Methyl ethyl ketone (2-Butanone)	ug/l	10	U
cis-1,2-Dichloroethylene	ug/l	5	U
1,2-Dichloroethene (total)	ug/l	5	U
Chloroform	ug/l	5	U
1,1,1-Trichloroethane	ug/l	5	U
Carbon Tetrachloride	ug/l	5	U
1,2-Dichloroethane	ug/l	5	U
Benzene	ug/l	5	U
Trichloroethylene (TCE)	ug/l	5	U
1,2-Dichloropropane	ug/l	5	U
Bromodichloromethane	ug/l	5	U
2-Chloroethyl vinyl ether	ug/l	10	UJ
cis-1,3-Dichloropropene	ug/l	5	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/l	10	U
Toluene	ug/l	0.63	J
trans-1,3-Dichloropropene	ug/l	5	U
1,1,2-Trichloroethane	ug/l	5	U
2-Hexanone	ug/l	10	U

**StationID** G633GW001  
**SampleID** 633GW001N1  
**DateCollected** 1/24/2003  
**DateExtracted** 1/30/2003  
**DateAnalyzed** 1/30/2003  
**SDGNumber** CNC162

Parameter	Units		
Tetrachloroethylene (PCE)	ug/l	5	U
Dibromochloromethane	ug/l	5	U
Chlorobenzene	ug/l	1.8	J
Ethylbenzene	ug/l	5	U
o-Xylene	ug/l	5	U
Xylenes, Total	ug/l	5	U
Styrene	ug/l	5	U
Bromoform	ug/l	5	U
1,1,2,2-Tetrachloroethane	ug/l	5	U
1,3-Dichlorobenzene	ug/l	5.5	=
1,4-Dichlorobenzene	ug/l	23	=
1,2-Dichlorobenzene	ug/l	5	U
1,2,4-Trichlorobenzene	ug/l	5	U
1,2,3-Trichlorobenzene	ug/l	5	U

## Analytical Data Summary

02/28/2003 3:20 PM

StationID	G633GW001
SampleID	633GW001N1
DateCollected	1/24/2003
DateExtracted	1/28/2003
DateAnalyzed	1/30/2003
SDGNumber	CNC162

Parameter	Units		
N-Nitrosodiphenylamine	ug/l	10	U
Phenol	ug/l	10	U
bis(2-Chloroethyl) ether (2-Chloroethyl Ether)	ug/l	10	U
2-Chlorophenol	ug/l	10	U
Benzyl alcohol	ug/l	10	U
Bis(2-Chloroisopropyl)Ether	ug/l	10	U
2-Methylphenol (o-Cresol)	ug/l	10	U
N-Nitrosodi-n-propylamine	ug/l	10	U
3-Methylphenol/4-Methylphenol (mp-Cresol)	ug/l	10	U
Hexachloroethane	ug/l	10	U
Nitrobenzene	ug/l	10	U
Isophorone	ug/l	10	U
2-Nitrophenol	ug/l	10	U
2,4-Dimethylphenol	ug/l	10	U
bis(2-Chloroethoxy) Methane	ug/l	10	U
2,4-Dichlorophenol	ug/l	10	U
Benzoic acid	ug/l	50	U
Naphthalene	ug/l	10	U
4-Chloroaniline	ug/l	10	U
Hexachlorobutadiene	ug/l	10	U
4-Chloro-3-methylphenol	ug/l	10	U
2-Methylnaphthalene	ug/l	10	U
Hexachlorocyclopentadiene	ug/l	10	U
2,4,6-Trichlorophenol	ug/l	10	U
2,4,5-Trichlorophenol	ug/l	50	U
2-Chloronaphthalene	ug/l	10	U
2-Nitroaniline	ug/l	50	U
3-Nitroaniline	ug/l	50	U
Dimethyl Phthalate	ug/l	10	U
2,6-Dinitrotoluene	ug/l	10	U

**StationID** G633GW001  
**SampleID** 633GW001N1  
**DateCollected** 1/24/2003  
**DateExtracted** 1/28/2003  
**DateAnalyzed** 1/30/2003  
**SDGNumber** CNC162

Parameter	Units		
Acenaphthylene	ug/l	10	U
Acenaphthene	ug/l	10	U
2,4-Dinitrophenol	ug/l	50	U
Dibenzofuran	ug/l	10	U
2,4-Dinitrotoluene	ug/l	10	U
Diethyl Phthalate	ug/l	10	U
4-Nitrophenol	ug/l	50	U
Fluorene	ug/l	10	U
4-Chlorophenyl Phenyl Ether	ug/l	10	U
4,6-Dinitro-2-methylphenol	ug/l	50	U
4-Nitroaniline	ug/l	50	U
4-Bromophenyl Phenyl Ether	ug/l	10	U
Hexachlorobenzene	ug/l	10	U
Pentachlorophenol	ug/l	50	U
Phenanthrene	ug/l	10	U
Anthracene	ug/l	10	U
Di-n-butyl Phthalate	ug/l	10	U
Fluoranthene	ug/l	10	U
Pyrene	ug/l	10	U
Benzyl Butyl Phthalate	ug/l	10	U
Benzo(a)Anthracene	ug/l	10	U
3,3'-Dichlorobenzidine	ug/l	20	U
Chrysene	ug/l	10	U
bis(2-Ethylhexyl) Phthalate	ug/l	1.6	J
Di-n-octylphthalate	ug/l	10	U
Benzo(b)Fluoranthene	ug/l	10	U
Benzo(k)Fluoranthene	ug/l	10	U
Benzo(a)Pyrene	ug/l	10	U
Indeno(1,2,3-c,d)pyrene	ug/l	10	U
Dibenz(a,h)anthracene	ug/l	10	U

Analytical Data Summary

02/28/2003 3:20 PM

StationID	G633GW001
SampleID	633GW001N1
DateCollected	1/24/2003
DateExtracted	1/28/2003
DateAnalyzed	1/30/2003
SDGNumber	CNC162

Parameter	Units		
Benzo(g,h,i)Perylene	ug/l	10	U
Carbazole	ug/l	10	U

<b>StationID</b>	G633GW001
<b>SampleID</b>	633GW001N1
<b>DateCollected</b>	1/24/2003
<b>DateExtracted</b>	1/28/2003
<b>DateAnalyzed</b>	1/30/2003
<b>SDGNumber</b>	CNC162

<b>Parameter</b>	<b>Units</b>		
PCB-1016 (Arochlor 1016)	ug/l	1	UJ
PCB-1221 (Arochlor 1221)	ug/l	1	UJ
PCB-1232 (Arochlor 1232)	ug/l	1	UJ
PCB-1242 (Arochlor 1242)	ug/l	1	UJ
PCB-1248 (Arochlor 1248)	ug/l	1	UJ
PCB-1254 (Arochlor 1254)	ug/l	2	UJ
PCB-1260 (Arochlor 1260)	ug/l	1.8	J

Analytical Data Summary

02/28/2003 3:20 PM

StationID	G633GW001	G633GW001	
SampleID	633GW001N1	633GW001N1	
DateCollected	1/24/2003	1/24/2003	
DateExtracted	1/28/2003	1/30/2003	
DateAnalyzed	1/31/2003	1/31/2003	
SDGNumber	CNC162	CNC162	
Parameter	Units		
Arsenic	mg/l		0.011 U
Barium	mg/l		0.059 J
Cadmium	mg/l		0.00068 J
Chromium, Total	mg/l		0.00085 U
Lead	mg/l		0.00075 U
Selenium	mg/l		0.0021 U
Silver	mg/l		0.00095 U
Mercury	mg/l	0.000072 UJ	

Analytical Data Summary

02/28/2003 3:20 PM

<b>StationID</b>	G633GW001	G633GW001
<b>SampleID</b>	633GW001N1	633GW001N1
<b>DateCollected</b>	1/24/2003	1/24/2003
<b>DateExtracted</b>	1/28/2003	1/30/2003
<b>DateAnalyzed</b>	1/31/2003	1/31/2003
<b>SDGNumber</b>	CNC162	CNC162

<b>Parameter</b>	<b>Units</b>				
Arsenic, Dissolved	mg/l			0.011	U
Barium, Dissolved	mg/l			0.058	J
Cadmium, Dissolved	mg/l			0.00067	J
Chromium, Dissolved	mg/l			0.00085	U
Lead, Dissolved	mg/l			0.00075	U
Mercury, Dissolved	mg/l	0.000076	J		
Selenium, Dissolved	mg/l			0.0023	U
Silver, Dissolved	mg/l			0.00095	U

Analytical Data Summary

02/28/2003 3:22 PM

**StationID** G633ZA001  
**SampleID** 633ZA001M8  
**DateCollected** 10/30/2002  
**DateExtracted** 11/05/2002  
**DateAnalyzed** 11/05/2002  
**SDGNumber** CNC149

Parameter	Units		
m-Xylene	ug/kg	10000	U
Chloromethane	ug/kg	20000	U
Vinyl chloride	ug/kg	20000	U
Bromomethane	ug/kg	20000	U
Chloroethane	ug/kg	20000	U
1,1-Dichloroethene	ug/kg	10000	U
Acetone	ug/kg	20000	U
Carbon Disulfide	ug/kg	10000	U
Methylene Chloride	ug/kg	10000	U
trans-1,2-Dichloroethene	ug/kg	10000	U
1,1-Dichloroethane	ug/kg	10000	U
Vinyl acetate	ug/kg	20000	UJ
Methyl ethyl ketone (2-Butanone)	ug/kg	20000	U
cis-1,2-Dichloroethylene	ug/kg	10000	U
1,2-Dichloroethene (total)	ug/kg	10000	U
Chloroform	ug/kg	10000	U
1,1,1-Trichloroethane	ug/kg	10000	U
Carbon Tetrachloride	ug/kg	10000	U
1,2-Dichloroethane	ug/kg	10000	U
Benzene	ug/kg	10000	U
Trichloroethylene (TCE)	ug/kg	10000	U
1,2-Dichloropropane	ug/kg	10000	U
Bromodichloromethane	ug/kg	10000	U
2-Chloroethyl vinyl ether	ug/kg	20000	UJ
cis-1,3-Dichloropropene	ug/kg	10000	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/kg	20000	U
Toluene	ug/kg	10000	U
trans-1,3-Dichloropropene	ug/kg	10000	U
1,1,2-Trichloroethane	ug/kg	10000	U
2-Hexanone	ug/kg	20000	U

**StationID** G633ZA001  
**SampleID** 633ZA001M8  
**DateCollected** 10/30/2002  
**DateExtracted** 11/05/2002  
**DateAnalyzed** 11/05/2002  
**SDGNumber** CNC149

Parameter	Units		
Tetrachloroethylene (PCE)	ug/kg	10000	U
Dibromochloromethane	ug/kg	10000	U
Chlorobenzene	ug/kg	2400	J
Ethylbenzene	ug/kg	10000	U
o-Xylene	ug/kg	10000	U
Xylenes, Total	ug/kg	10000	U
Styrene	ug/kg	10000	U
Bromoform	ug/kg	10000	U
1,1,2,2-Tetrachloroethane	ug/kg	10000	U
1,3-Dichlorobenzene	ug/kg	25000	=
1,4-Dichlorobenzene	ug/kg	100000	=
1,2-Dichlorobenzene	ug/kg	3300	J
1,2,4-Trichlorobenzene	ug/kg	1300	J
1,2,3-Trichlorobenzene	ug/kg	10000	U

<b>StationID</b>	G633ZA001
<b>SampleID</b>	633ZA001M8
<b>DateCollected</b>	10/30/2002
<b>DateExtracted</b>	11/05/2002
<b>DateAnalyzed</b>	11/06/2002
<b>SDGNumber</b>	CNC149

<b>Parameter</b>	<b>Units</b>		
140 Solvent	mg/kg	300000	U
90 Solvent	mg/kg	300000	U
Diesel Components	mg/kg	1000000	=
HiSol 10	mg/kg	300000	U
HiSol 15	mg/kg	300000	U
Kerosene	mg/kg	300000	U
Kwik Dri	mg/kg	300000	U
Mineral Spirits	mg/kg	300000	U
V M & P Naphtha	mg/kg	300000	U

StationID	G633ZA001
SampleID	633ZA001M8
DateCollected	10/30/2002
DateExtracted	11/05/2002
DateAnalyzed	11/11/2002
SDGNumber	CNC149

Parameter	Units		
4-Methylphenol (p-Cresol)	ug/kg	99000	U
N-Nitrosodiphenylamine	ug/kg	99000	U
Phenol	ug/kg	99000	U
bis(2-Chloroethyl) ether (2-Chloroethyl Ether)	ug/kg	99000	U
2-Chlorophenol	ug/kg	99000	U
Benzyl alcohol	ug/kg	99000	U
Bis(2-Chloroisopropyl)Ether	ug/kg	99000	U
2-Methylphenol (o-Cresol)	ug/kg	99000	U
N-Nitrosodi-n-propylamine	ug/kg	99000	U
Hexachloroethane	ug/kg	99000	U
Nitrobenzene	ug/kg	99000	U
Isophorone	ug/kg	99000	U
2-Nitrophenol	ug/kg	99000	U
2,4-Dimethylphenol	ug/kg	99000	U
bis(2-Chloroethoxy) Methane	ug/kg	99000	U
2,4-Dichlorophenol	ug/kg	99000	U
Benzoic acid	ug/kg	480000	U
Naphthalene	ug/kg	99000	U
4-Chloroaniline	ug/kg	99000	U
Hexachlorobutadiene	ug/kg	99000	U
4-Chloro-3-methylphenol	ug/kg	99000	U
2-Methylnaphthalene	ug/kg	99000	U
Hexachlorocyclopentadiene	ug/kg	99000	U
2,4,6-Trichlorophenol	ug/kg	99000	U
2,4,5-Trichlorophenol	ug/kg	480000	U
2-Chloronaphthalene	ug/kg	99000	U
2-Nitroaniline	ug/kg	480000	U
3-Nitroaniline	ug/kg	480000	U
Dimethyl Phthalate	ug/kg	99000	U
2,6-Dinitrotoluene	ug/kg	99000	U

Analytical Data Summary

02/28/2003 3:22 PM

StationID G633ZA001  
 SampleID 633ZA001M8  
 DateCollected 10/30/2002  
 DateExtracted 11/05/2002  
 DateAnalyzed 11/11/2002  
 SDGNumber CNC149

Parameter	Units		
Acenaphthylene	ug/kg	99000	U
Acenaphthene	ug/kg	99000	U
2,4-Dinitrophenol	ug/kg	480000	U
Dibenzofuran	ug/kg	99000	U
2,4-Dinitrotoluene	ug/kg	99000	U
Diethyl Phthalate	ug/kg	99000	U
4-Nitrophenol	ug/kg	480000	U
Fluorene	ug/kg	99000	U
4-Chlorophenyl Phenyl Ether	ug/kg	99000	U
4,6-Dinitro-2-methylphenol	ug/kg	480000	U
4-Nitroaniline	ug/kg	480000	U
4-Bromophenyl Phenyl Ether	ug/kg	99000	U
Hexachlorobenzene	ug/kg	99000	U
Pentachlorophenol	ug/kg	480000	U
Phenanthrene	ug/kg	99000	U
Anthracene	ug/kg	99000	U
Di-n-butyl Phthalate	ug/kg	99000	U
Fluoranthene	ug/kg	99000	U
Pyrene	ug/kg	99000	U
Benzyl Butyl Phthalate	ug/kg	99000	U
Benzo(a)Anthracene	ug/kg	99000	U
3,3'-Dichlorobenzidine	ug/kg	200000	U
Chrysene	ug/kg	99000	U
bis(2-Ethylhexyl) Phthalate	ug/kg	68000	J
Di-n-octylphthalate	ug/kg	99000	U
Benzo(b)Fluoranthene	ug/kg	99000	U
Benzo(k)Fluoranthene	ug/kg	99000	U
Benzo(a)Pyrene	ug/kg	99000	U
Indeno(1,2,3-c,d)pyrene	ug/kg	99000	U
Dibenz(a,h)anthracene	ug/kg	99000	U

**StationID** G633ZA001  
**SampleID** 633ZA001M8  
**DateCollected** 10/30/2002  
**DateExtracted** 11/05/2002  
**DateAnalyzed** 11/11/2002  
**SDGNumber** CNC149

Parameter	Units		
Benzo(g,h,i)Perylene	ug/kg	99000	U
Carbazole	ug/kg	99000	U

Analytical Data Summary

02/28/2003 3:22 PM

**StationID** G633ZA001  
**SampleID** 633ZA001M8  
**DateCollected** 10/30/2002  
**DateExtracted** 11/05/2002  
**DateAnalyzed** 11/07/2002  
**SDGNumber** CNC149

Parameter	Units		
PCB-1016 (Arochlor 1016)	mg/kg	200	UJ
PCB-1221 (Arochlor 1221)	mg/kg	400	U
PCB-1232 (Arochlor 1232)	mg/kg	200	U
PCB-1242 (Arochlor 1242)	mg/kg	200	U
PCB-1248 (Arochlor 1248)	mg/kg	200	U
PCB-1254 (Arochlor 1254)	mg/kg	200	U
PCB-1260 (Arochlor 1260)	mg/kg	3500	=

## Data Validation Summary - Charleston Naval Complex - Zone G, AOC 633 Ground Water

TO: William Elliott/CH2M HILL/GNA

FROM: Amy Juchem/CH2M HILL/GNA  
Herb Kelly/CH2M HILL/GNA

DATE: January 13, 2003

The purpose of this memorandum is to present the results of the data validation process for the samples collected in Zone G, AOC 633. The samples were collected on October 2 and October 30, 2002.

The specific samples and analytical fractions reviewed are summarized below in [REDACTED].

The Quality Control areas that were reviewed and the resulting findings are documented within each subsection that follows. This data was validated for compliance with the analytical method requirements. This process also included a review of the data to assess the accuracy, precision, and completeness based upon procedures described in the guidance documents such as the Environmental Protection Agency (EPA) *National Functional Guidelines for Inorganic Data Review (EPA 2002)* and *National Functional Guidelines for Organic Data Review (EPA 1999)*. Quality assurance/quality control (QA/QC) summary forms and data reports were reviewed.

Samples were submitted to General Engineering Laboratories, Inc., in Charleston, South Carolina, for the following analyses: SW-846 8260 Volatile Organic Compounds (VOC), SW-846 8270 Semivolatile Organic Compounds (SVOC), and Metals following SW-846 6010/7000 Series methodology.

Samples were submitted to Severn Trent Services, STL Savannah Laboratories, Inc., in Savannah, Georgia for the following analyses: SW-846 8260 Volatile Organic Compounds (VOC), SW-846 8270 Semivolatile Organic Compounds (SVOC), and SW846 8100 Fuel Fingerprinting.

Sample results that were not within the acceptance limits were appended with a qualifying flag, which consisted of a single- or double-letter code that indicated a possible problem with the data. The qualifying flags originated during the data review and validation processes. These also include the secondary, or the two-digit "sub-qualifier" flags. The secondary qualifiers provide the reasoning behind the assignment of a qualifier flag to the data. The secondary qualifiers are presented and defined below.

**Attachment I** lists the changes in data qualifiers, due to the validation process.

The following primary flags were used to qualify the data:

- [=] Detected. The analyte was analyzed for and detected at the concentration shown.
- [J] Estimated. The analyte was present but the reported value may not be accurate or precise.
- [U] Undetected. The analyte was analyzed for but not detected above the method detection limit.
- [UJ] Detection limit estimated. The analyte was analyzed for but qualified as not detected; the result is estimated.
- [R] Rejected. The data is not useable.

### Secondary Data Validation Qualifiers

<u>Code</u>	<u>Definition</u>
2S	Second Source
2C	Second Column Confirmation
BL	Blank
BD	Blank Spike/Blank Spike Duplicate or (LCS/LCSD) Precision
BS	Blank Spike/LCS
CC	Continuing Calibration Verification
DL	Dilution
FD	Field Duplicate
HT	Holding Time
IB	In-Between (metals – B's → J's )
IC	Initial Calibration
IS	Internal Standard
LD	Lab Duplicate
LR	Concentration exceeded Linear Range
MD	MS/MSD or LCS/LCSD Precision
MS	Matrix Spike/Matrix Spike Duplicate
OT	Other (see DV worksheet)
PD	Pesticide Degradation
PS	Post Spike
RE	Re-extraction/Re-analysis
SD	Serial Dilution
SS	Spiked Surrogate
TD	Total vs. Dissolved
TN	Tune

Table 1 - Chemical Analytical Methods – Field and Quality Control Samples

Sample ID	Method	Location	Well ID	Depth	Filter	Date	SW330E	SW330G	SW330H	SW330I	SW330J	SW330K
68148	FIELDQC	633TW001M7	68148001	WQ	TB	10/02/02	X					
68148	FIELDQC	633EW001M7	68148002	WQ	EB	10/02/02	X	X	X		X	X
68148	G633GW002	633GW002M7	68148003	WG	N	10/02/02	X	X	X		X	X
68148	G633GW003	633GW003M7	68148004	WG	N	10/02/02	X	X	X		X	X
68148	G633GW004	633GW004M7	68148005	WG	N	10/02/02	X	X	X		X	X
68148	G633GW004	633GW004M7DL	68148005	WG	LR	DL	10/02/02		X			
68148	G633GW004	633HW004M7	68148006	WG	FD	10/02/02	X	X	X		X	X
68148	G633GW004	633HW004M7DL	68148006	WG	LR	DL	10/02/02		X			
68148	G633GW002	633GW002M7MS	1200310733	WG	MS	10/02/02					X	
68148	G633GW002	633GW002M7SD	1200310734	WG	SD	10/02/02					X	
68148	G633GW002	633GW002M7MS	1200313872	WG	MS	10/02/02	X					
68148	G633GW002	633GW002M7SD	1200313874	WG	SD	10/02/02	X					
68148	LABQC	1200309909	1200309909	WQ	LB							X
68148	LABQC	1200309912	1200309912	WQ	BS							X
68148	LABQC	1200310461	1200310461	WQ	LB				X			
68148	LABQC	1200310462	1200310462	WQ	BS				X			
68148	LABQC	1200310731	1200310731	WQ	LB						X	
68148	LABQC	1200310735	1200310735	WQ	BS						X	
68148	LABQC	1200311149	1200311149	WQ	LB			X				
68148	LABQC	1200311150	1200311150	WQ	BS			X				
68148	LABQC	1200313870	1200313870	WQ	LB		X					

ID	Sample Type	Sample ID	Reference ID	Matrix	Sample Type Code	LR Type	Analysis Date	VOC	SVOC	PCBs	Other	Notes
68148	LABQC	1200313875	1200313875	WQ	BS			X				
68148	LABQC	1200315262	1200315262	WQ	LB			X				
68148	LABQC	1200315263	1200315263	WQ	LB			X				
68148	LABQC	1200315264	1200315264	WQ	BS			X				
68148	LABQC	1200315265	1200315265	WQ	BS			X				
CNC149	G633ZA001	633ZA001M8	S247868*1	LO	N		10/30/02	X	X	X	X	
CNC149	LABQC	478682LB	S247868*2	LO	LB			X	X	X	X	
CNC149	LABQC	478683BS	S247868*3	LO	BS			X		X		

**MATRIX CODE**

WG - Groundwater  
 WQ - Water QC Samples  
 LO - Organic Liquid

**SAMPLE TYPE CODE**

BS - Blank Spike  
 EB - Equipment Blank  
 TB - Trip Blank  
 FD - Field Duplicate  
 N - Native Sample  
 LB - Laboratory Blank  
 LR - Laboratory Replicate  
 MS - Matrix Spike  
 SD - Matrix Spike duplicate

**LR TYPE CODE**

DL - Dilution

**ANALYSIS CODE**

VOC - Volatile Organic Compounds  
 SVOC - Semi-Volatile Organic Compounds  
 PCBs - Polychlorinated Biphenyls

## Organic Parameters

### Quality Control Review

The following list represents the QA/QC measures that were reviewed during the data quality evaluation procedure for organic data.

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Method blanks, equipment blanks, and trip blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Surrogate Recoveries** – Surrogate Compounds are added to each sample and the recoveries are used to monitor lab performance and possible matrix interference.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", either laboratory reagent water or Ottawa sand, in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **Field Duplicate Samples** – These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **GC/MS Tuning** – The mass spectrum of the tuning compound is evaluated for method compliance. The criteria are established to verify the proper mass assignment and mass resolution.
- **Initial Calibration** – The initial calibration ensures that the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest.
- **Continuing Calibration** – The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds.
- **Confirmation** – If GCMS methodology is not initially used for analysis, SW-846 method 8000 requires confirmation when the composition of samples is not well characterized. Therefore, even when the identification has been confirmed on a dissimilar column or detector, the agreement of the quantitative results on both columns is evaluated. For Pesticide and PCB analyses covered in this report, confirmation was performed using a dissimilar analytical column. The laboratory analyzed samples with a gas chromatograph (GC) utilizing simultaneous primary and confirmation data acquisition. Per SW-86 method 8000, 40% RPD criteria was used as the acceptance limit.

- **Internal Standards** – The internal standards (retention time and response) are evaluated for method compliance. The internal standards are used in quantitation of the target parameters and monitor the instrument sensitivity and response for stability during each analysis.

## Volatile Organic Compounds (VOC) Analyses

The QA/QC parameters for VOC analyses for all of the samples were within acceptable control limits, except as noted below:

### Recoveries - Surrogate, MS/MSD and LCS

All Surrogate, Matrix Spike (MS), Matrix Spike Duplicate (MSD), and Laboratory Control Sample (LCS) recoveries were within acceptable quality control limits, except as noted in **Table 2** below.

**TABLE 2**  
Surrogate, MS/MSD, and LCS Recoveries Out of QC Limits: VOC  
Charleston Naval Complex, Zone G, AOC 633, Charleston, SC

68148	633GW002M7 MS/MSD	Vinyl chloride	67.8* / 69.6*	70-130	633GW002M7	Detects-J, non- detects-UJ
		Carbon disulfide	67.6* / 68.4*	70-130		
		2-Chloroethyl vinyl ether	0* / 0*	70-130	633GW002M7	Detects-J, non- detects-R
CNC149	478683BS (LCS)	Vinyl acetate	68*	70-130	CNC149 – All	Detects-J, non- detects-UJ
* - out of control limits						

## Initial and Continuing Calibration Criteria

All initial calibration criteria and continuing calibration criteria were met, except as listed in **Table 3**.

**TABLE 3**

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: VOC  
Charleston Naval Complex, Zone G, AOC 633, Charleston, SC

VOA1-ICAL-09/04/02, 1559	1,2,4-Trichlorobenzene	R <sup>2</sup> =0.989	68148 - All
	1,2,3-Trichlorobenzene	R <sup>2</sup> =0.986	
VOA1-CCAL-10/09/02, 0904	Chloromethane	22.7% high	633TW001M7, 633EW001M7
	Bromomethane	25.5% high	
	Acetone	21.6% low	
	Trans-1,3-Dichloropropylene	20.7% low	
VOA1-CCAL-10/10/02, 0834	Carbon disulfide	22.2% low	633GW002M7, 633GW003M7
	Trans-1,3-Dichloropropylene	20.1% low	
VOA1-CCAL-10/11/02, 0915	Bromomethane	23.0% high	633GW004M7, 633HW004M7
	Carbon disulfide	21.7% low	
MSA5973-CCAL-11/05/02, 0739	Chloromethane	24.3% high	633ZA001M8
	Chloroethane	25.5% high	
	Vinyl acetate	30.3% low	
	2-Chloroethyl vinyl ether	45.9% low	

Flags were applied to the compounds in the associated samples in the following manner:

- When the percent Relative Standard Deviation (%RSD) or correlation coefficient (R<sup>2</sup>) was out in the initial calibration, all associated samples were qualified. Detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.
- When the percent difference (%D) was low in the continuing calibration standards, detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.
- When the percent difference (%D) was high in the continuing calibration standards, detected compounds were flagged "J", as estimated. Non-detected compounds were not flagged.

## Semivolatile Organic Compounds (SVOC) Analyses

The QA/QC parameters for the SVOC analyses for all of the samples were within acceptable control limits, except as noted below.

### Blanks

The SVOC target parameters detected in blank samples are listed in **Table 4**.

**TABLE 4**  
Blank Contamination: SVOC  
Charleston Naval Complex, Zone G, AOC 633, Charleston, SC

Sample ID	Location	Parameter	Unit	Reporting Limit	Control Limit
CNC149	478682LB	S247868*2	LB	Benzo(g,h,i)perylene	14000 µg/Kg, 70000 µg/Kg

If a target parameter determined to be a common contaminant was reported in a field sample, and the concentration was below the level determined to be due to blank contamination, the following actions were taken:

- If the concentration was above the reporting limit, the numeric result was unchanged, but it was flagged "U", as undetected.
- If the concentration was below the reporting limit, the numeric result was changed to the value of the reporting limit, and it was flagged "U", as undetected.

No results were qualified due to blank contamination.

### Field Duplicate Samples

All Field Duplicate Samples were within acceptable quality control limits, except as noted in **Table 5** below. According to EPA *National Functional Guidelines*, no flags are applied due to Field Duplicate precision.

**TABLE 5**  
Field Duplicate RPDs Out of QC Limits: SVOC  
Charleston Naval Complex, Zone G, AOC 633, Charleston, SC

Sample ID	Location	Parameter	Field Result	Control Limit	Reporting Limit
68148	633GW004M7 / 633HW004M7	Nitrobenzene	Non-detect	42.3 ug/L	200*
		Carbazole	66.4ug/L	99.0 ug/L	39.4*
		Acenaphthene	469 ug/L	577 ug/L	20.6*

\* - out of control limits

## Initial and Continuing Calibration Criteria

All initial calibration criteria and continuing calibration criteria were met, except as listed in Table 6.

**TABLE 6**

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: SVOC  
Charleston Naval Complex, Zone G, AOC 633, Charleston, SC

MSD5-ICAL-09/28/02, 1706	2-Methyl-4,6-dinitrophenol	RRF=0.0046	68148 - All
MSD5-CCAL-10/04/02, 1101	Benzoic acid	22.7% low	633EW001M7, 633GW002M7, 633GW004M7, 633HW004M7
	2-Methyl-4,6-dinitrophenol	35.6% low RRF=0.0029	
MSD5-CCAL-10/04/02, 1101	Pyrene	26.8% high	633EW001M7, 633GW002M7, 633GW004M7, 633HW004M7
	Butylbenzylphthalate	24.5% high	
	p-Nitroaniline	21.9% low	
	3,3'-Dichlorobenzidine	20.2% low	
MSD5-10/07/02, 1143	Benzoic acid	27.4% low	633GW003M7
	Hexachlorocyclopentadiene	42.4% low	
	2-Methyl-4,6-dinitrophenol	46.7% low RRF=0.0024	
	Indeno(1,2,3-cd)pyrene	29.2% low	
	Dibenzo(a,h)anthracene	29.6% low	
	Benzo(g,h,i)perylene	27.7% low	
MSD5-CCAL-10/08/02, 1116	Benzoic acid	23.3% low	633GW004M7DL, 633HW004M7DL
	Hexachlorocyclopentadiene	43.9% low	
	2,4-Dinitrophenol	21.9% low	
	2-Methyl-4,6-dinitrophenol	RRF=0.004	
MSG5973-CCAL-11/11/02, 0816	2,4-Dinitrophenol	21.1% high	633ZA001M8

Flags were applied to the compounds in the associated samples in the following manner:

- When the percent difference (%D) was low in the continuing calibration standards, detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.

- When the percent difference (%D) was high in the continuing calibration standards, detected compounds were flagged "J", as estimated. Non-detected compounds were not flagged.
- When the Relative Response Factor (RRF) was low in the initial or continuing calibration, detected compounds were flagged "J", and non-detected compounds were flagged "UJ", as estimated.
- In extreme cases where the RRF or %RSD was significantly low or there was no response, detected compounds were flagged "J", as estimated, and non-detected compounds were qualified "R", as rejected.

## Polychlorinated Biphenyls (PCBs) Analyses

The QA/QC parameters for the PCB analyses for all of the samples were within acceptable control limits, except as noted below:

### Initial and Continuing Calibration Criteria

All initial and continuing calibration criteria were met except as noted in [REDACTED].

TABLE 7

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: PCBs  
Charleston Naval Complex, Zone G, AOC 633, Charleston, SC

SGRECD1#1-CCAL- 11/07/02, 1326	Aroclor-1016	18.8% low	633ZA001M8
	Aroclor-1260	22.7% low	
SGRECD1#1-CCAL- 11/07/02, 2234	Aroclor-1016	20.8% low	633ZA001M8
	Aroclor-1260	19.4% low	

Flags were applied to the compounds in the associated samples in the following manner:

- When the percent difference (%D) was low in the continuing calibration standards, detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.

## Fuel Fingerprinting by GC/FID Analyses

The QA/QC parameters for the Fuel Fingerprinting analyses for all of the samples were within acceptable control limits.

## Inorganic Parameters

### Quality Control Review

The following list represents the QA/QC measures that are typically reviewed during the data quality evaluation procedure for inorganic parameters.

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Sample preparation, initial calibration blanks/continuing calibration blanks, and equipment blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", in which target parameters have been added prior to digestion/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Field Duplicate Samples** – These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **Pre/Post Digestion Spike (MS/MSD)** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **ICP Interference Check Sample** – This sample verifies the lab's interelement and background correction factors.
- **Initial Calibration Verification** – This parameter ensures that the instrument is capable of producing acceptable quantitative data for the target analyte list to be measured.
- **Continuing Calibration Verification** – This one-point, mid-range parameter establishes that the initial calibration is still valid by checking the performance of the instrument on a continual basis.
- **ICP Serial Dilution** – The serial dilution of samples quantitated by ICP determines whether or not significant physical or chemical interferences exist due to the sample matrix.

## Metals Analyses

The QA/QC parameters for the Metals analyses for all of the samples were within acceptable control limits, except as noted below.

### Blanks

The Metals target parameters detected in blank samples are listed in **Table 8**.

**TABLE 8**

Blank Contamination: Metals  
Charleston Naval Complex, Zone G, AOC 633, Charleston, SC

68148	CCB		CCB	Aluminum	144	ug/L	720 ug/L
68148	CCB		CCB	Antimony	6.66	ug/L	33.3 ug/L
68148	CCB		CCB	Barium	0.679	ug/L	3.395 ug/L
68148	CCB		CCB	Beryllium	0.496	ug/L	2.48 ug/L
68148	CCB		CCB	Cadmium	0.715	ug/L	3.575 ug/L
68148	CCB		CCB	Calcium	195	ug/L	975 ug/L
68148	CCB		CCB	Chromium	1.93	ug/L	9.65 ug/L
68148	CCB		CCB	Cobalt	2.13	ug/L	10.65 ug/L
68148	CCB		CCB	Copper	1.36	ug/L	6.8 ug/L
68148	CCB		CCB	Iron	55.9	ug/L	279.5 ug/L
68148	CCB		CCB	Lead	3.28	ug/L	16.4 ug/L
68148	CCB		CCB	Magnesium	137	ug/L	685 ug/L
68148	CCB		CCB	Manganese	1.81	ug/L	9.05 ug/L
68148	CCB		CCB	Nickel	1.50	ug/L	7.5 ug/L
68148	CCB		CCB	Potassium	71.2	ug/L	356 ug/L
68148	CCB		CCB	Selenium	3.84	ug/L	19.2 ug/L
68148	CCB		CCB	Sodium	41.3	ug/L	206.5 ug/L
68148	CCB		CCB	Thallium	8.49	ug/L	42.45 ug/L
68148	CCB		CCB	Vanadium	1.85	ug/L	9.25 ug/L
68148	1200310731	1200310731	LB	Calcium	24.3	ug/L	121.5 ug/L
68148	1200310731	1200310731	LB	Copper	1.65	ug/L	8.25 ug/L

**TABLE 8**  
 Blank Contamination: Metals  
 Charleston Naval Complex, Zone G, AOC 633, Charleston, SC

68148	1200310731	1200310731	LB	Iron	6.69	ug/L	33.45 ug/L
68148	1200310731	1200310731	LB	Magnesium	10.9	ug/L	54.5 ug/L
68148	1200310731	1200310731	LB	Sodium	43.2	ug/L	216 ug/L
68148	1200310731	1200310731	LB	Zinc	3.31	ug/L	16.55 ug/L
68148	68148002	633EW001M7	EB	Aluminum	10.5	ug/L	52.5 ug/L
68148	68148002	633EW001M7	EB	Barium	0.524	ug/L	2.62 ug/L
68148	68148002	633EW001M7	EB	Cadmium	0.230	ug/L	1.15 ug/L
68148	68148002	633EW001M7	EB	Calcium	18.1	ug/L	90.5 ug/L
68148	68148002	633EW001M7	EB	Chromium	0.545	ug/L	2.725 ug/L
68148	68148002	633EW001M7	EB	Copper	1.670	ug/L	8.35 ug/L
68148	68148002	633EW001M7	EB	Iron	5.230	ug/L	26.15 ug/L
68148	68148002	633EW001M7	EB	Magnesium	6.390	ug/L	31.95 ug/L
68148	68148002	633EW001M7	EB	Sodium	43.8	ug/L	219 ug/L
68148	68148002	633EW001M7	EB	Zinc	2.510	ug/L	12.55 ug/L

If a target parameter was reported in a field sample, and the concentration was below the level determined to be due to blank contamination (5 times the concentration in the associated QC blank samples), it was flagged as "U", not detected. Initial and continuing calibration blanks were also evaluated for possible contamination.

The results qualified due to blank contamination are listed in ~~Appendix B~~.

### Serial Dilution

The serial dilution percent difference (%D) for sodium at 10.1 percent, was outside acceptable QC limits of 10.0 percent in SDG 68148. Detected results were qualified "J", as estimated and non-detected results were qualified "UJ".

## Rejected Data

The majority of rejected data were associated with re-runs and dilutions (there can only be a single valid result per parameter per sample). However, there were selected results qualified as "R", rejected, due to associated QC parameters out of criteria. The rejected data are summarized in **Table 9** below.

**TABLE 9**  
Data Qualification Summary: Rejected Data  
Charleston Naval Complex, Zone G, AOC 633, Charleston, SC

68148	633GW002M7	SVOA	4,6-DINITRO-2-METHYLPHENOL	48.5	U	48.5	R	ug/L	IC,CC
68148	633GW003M7	SVOA	4,6-DINITRO-2-METHYLPHENOL	51	U	51	R	ug/L	IC,CC
68148	633GW004M7	SVOA	4,6-DINITRO-2-METHYLPHENOL	50	U	50	R	ug/L	IC,CC
68148	633HW004M7	SVOA	4,6-DINITRO-2-METHYLPHENOL	48.8	U	48.8	R	ug/L	IC,CC
68148	633GW002M7	VOA	2-Chloroethyl vinyl ether	10	U	10	R	ug/L	MS

## Conclusion

A review of the analytical data submitted regarding the investigation of Zone G, AOC 633 at the Charleston Naval Complex, Charleston, South Carolina by CH2M HILL has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed, and that the analytical results should be considered usable as qualified.

As discussed above, there were specific results that were rejected, in which the data cannot be used. With the exception of this result, the validation review demonstrated that the analytical systems were generally in control and the data can be used in the decision making process.

Attachment 1 - Changed Qualifiers and Results  
 Zone G, AOC 633 Groundwater - Data Validation

Material	Sample ID	Parameter	Lab ID	Sample ID	Lab ID	Unit	Value	Qualifier	Value	Qualifier	Unit	Reasons
METAL	SW6010B	ALUMINUM	68148	633GW002M7	68148003	WG	261	=	261	U	ug/L	BL
METAL	SW6010B	ALUMINUM	68148	633GW004M7	68148005	WG	249	=	249	U	ug/L	BL
METAL	SW6010B	ALUMINUM	68148	633HW004M7	68148006	WG	247	=	247	U	ug/L	BL
METAL	SW6010B	ARSENIC	68148	633GW004M7	68148005	WG	6.37	B	6.37	J	ug/L	IB
METAL	SW6010B	ARSENIC	68148	633HW004M7	68148006	WG	8.53	B	8.53	J	ug/L	IB
METAL	SW6010B	BARIUM	68148	633GW002M7	68148003	WG	102	B	102	J	ug/L	IB
METAL	SW6010B	BARIUM	68148	633GW003M7	68148004	WG	100	B	100	J	ug/L	IB
METAL	SW6010B	BARIUM	68148	633GW004M7	68148005	WG	94.2	B	94.2	J	ug/L	IB
METAL	SW6010B	BARIUM	68148	633HW004M7	68148006	WG	93.9	B	93.9	J	ug/L	IB
METAL	SW6010B	BERYLLIUM	68148	633GW003M7	68148004	WG	0.377	B	0.377	U	ug/L	BL
METAL	SW6010B	CADMIUM	68148	633GW002M7	68148003	WG	0.676	B	0.676	U	ug/L	BL
METAL	SW6010B	CADMIUM	68148	633GW003M7	68148004	WG	0.499	B	0.499	U	ug/L	BL
METAL	SW6010B	CADMIUM	68148	633GW004M7	68148005	WG	0.248	B	0.248	U	ug/L	BL
METAL	SW6010B	CHROMIUM, TOTAL	68148	633GW002M7	68148003	WG	0.832	B	0.832	U	ug/L	BL
METAL	SW6010B	CHROMIUM, TOTAL	68148	633GW003M7	68148004	WG	9.4	B	9.4	U	ug/L	BL
METAL	SW6010B	CHROMIUM, TOTAL	68148	633GW004M7	68148005	WG	0.966	B	0.966	U	ug/L	BL
METAL	SW6010B	CHROMIUM, TOTAL	68148	633HW004M7	68148006	WG	0.979	B	0.979	U	ug/L	BL
METAL	SW6010B	COPPER	68148	633GW002M7	68148003	WG	11	B	11	J	ug/L	IB
METAL	SW6010B	COPPER	68148	633GW003M7	68148004	WG	8.41	B	8.41	J	ug/L	IB
METAL	SW6010B	COPPER	68148	633GW004M7	68148005	WG	1.8	B	1.8	U	ug/L	BL
METAL	SW6010B	COPPER	68148	633HW004M7	68148006	WG	2.27	B	2.27	U	ug/L	BL
METAL	SW6010B	LEAD	68148	633GW003M7	68148004	WG	13.1	=	13.1	U	ug/L	BL
METAL	SW6010B	LEAD	68148	633HW004M7	68148006	WG	1.27	B	1.27	U	ug/L	BL
METAL	SW6010B	POTASSIUM	68148	633GW002M7	68148003	WG	194000	B	194000	J	ug/L	IB
METAL	SW6010B	POTASSIUM	68148	633GW003M7	68148004	WG	188000	B	188000	J	ug/L	IB
METAL	SW6010B	POTASSIUM	68148	633GW004M7	68148005	WG	139000	B	139000	J	ug/L	IB
METAL	SW6010B	POTASSIUM	68148	633HW004M7	68148006	WG	134000	B	134000	J	ug/L	IB
METAL	SW6010B	SODIUM	68148	633GW002M7	68148003	WG	5E+06	E	5E+06	J	ug/L	SD
METAL	SW6010B	SODIUM	68148	633GW003M7	68148004	WG	5E+06	E	5E+06	J	ug/L	SD
METAL	SW6010B	SODIUM	68148	633GW004M7	68148005	WG	4E+06	E	4E+06	J	ug/L	SD

Attachment 1 - Changed Qualifiers and Results  
 Zone G, AOC 633 Ground Water - Data Validation

Parameter Class	Method	Parameter	Site	Sample ID	Sample ID	Unit	Exp. Det.	U	Exp. Result	U	Unit	Reasons
METAL	SW6010B	SODIUM	68148	633HW004M7	68148006	WG	3E+06	E	3E+06	J	ug/L	SD
METAL	SW6010B	THALLIUM	68148	633GW002M7	68148003	WG	10.9	=	10.9	U	ug/L	BL
METAL	SW6010B	THALLIUM	68148	633GW003M7	68148004	WG	5.82	B	5.82	U	ug/L	BL
METAL	SW6010B	THALLIUM	68148	633HW004M7	68148006	WG	5.04	B	5.04	U	ug/L	BL
METAL	SW6010B	VANADIUM	68148	633GW002M7	68148003	WG	18.8	B	18.8	J	ug/L	IB
METAL	SW6010B	VANADIUM	68148	633GW003M7	68148004	WG	25.1	B	25.1	J	ug/L	IB
METAL	SW6010B	VANADIUM	68148	633GW004M7	68148005	WG	4.69	B	4.69	U	ug/L	BL
METAL	SW6010B	VANADIUM	68148	633HW004M7	68148006	WG	4.48	B	4.48	U	ug/L	BL
PCB	SW8082	PCB-1016 (AROCHLOR 1016)	CNC149	633ZA001M8	S247868*1	LO	200	U	200	UJ	mg/kg	CC
SVOA	SW8270C	2,4,5-TRICHLOROPHENOL	68148	633GW004M7DL	68148005	WG	2000	U	2000	R	ug/L	DL
SVOA	SW8270C	2,4,5-TRICHLOROPHENOL	68148	633HW004M7DL	68148006	WG	1950	U	1950	R	ug/L	DL
SVOA	SW8270C	2,4,6-TRICHLOROPHENOL	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	2,4,6-TRICHLOROPHENOL	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	2,4-DICHLOROPHENOL	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	2,4-DICHLOROPHENOL	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	2,4-DIMETHYLPHENOL	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	2,4-DIMETHYLPHENOL	68148	633HW004M7	68148006	WG	124	E	124	J	ug/L	LR
SVOA	SW8270C	2,4-DIMETHYLPHENOL	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	2,4-DINITROPHENOL	68148	633GW004M7DL	68148005	WG	2000	U	2000	R	ug/L	DL
SVOA	SW8270C	2,4-DINITROPHENOL	68148	633HW004M7DL	68148006	WG	1950	U	1950	R	ug/L	DL
SVOA	SW8270C	2,4-DINITROTOLUENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	2,4-DINITROTOLUENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	2,6-DINITROTOLUENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	2,6-DINITROTOLUENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	2-CHLORONAPHTHALENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	2-CHLORONAPHTHALENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	2-CHLOROPHENOL	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	2-CHLOROPHENOL	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	2-METHYLNAPHTHALENE	68148	633GW004M7	68148005	WG	339	E	339	R	ug/L	LR
SVOA	SW8270C	2-METHYLNAPHTHALENE	68148	633HW004M7	68148006	WG	375	E	375	R	ug/L	LR

Attachment 1 - Changed Qualifiers and Results  
 Zone G, AOC 633 Groundwater - Data Validation

Reference ID	Sample ID	Compound Name	Site ID	Sample ID	Lab ID	Unit	Method	Qualifier	Result	Qualifier	Unit	Qualifier
SVOA	SW8270C	2-METHYLPHENOL (o-CRESOL)	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	2-METHYLPHENOL (o-CRESOL)	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	2-NITROANILINE	68148	633GW004M7DL	68148005	WG	2000	U	2000	R	ug/L	DL
SVOA	SW8270C	2-NITROANILINE	68148	633HW004M7DL	68148006	WG	1950	U	1950	R	ug/L	DL
SVOA	SW8270C	2-NITROPHENOL	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	2-NITROPHENOL	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	3,3'-DICHLOROBENZIDINE	68148	633GW002M7	68148003	WG	19.4	U	19.4	UJ	ug/L	CC
SVOA	SW8270C	3,3'-DICHLOROBENZIDINE	68148	633GW004M7	68148005	WG	20	U	20	UJ	ug/L	CC
SVOA	SW8270C	3,3'-DICHLOROBENZIDINE	68148	633GW004M7DL	68148005	WG	800	U	800	R	ug/L	DL
SVOA	SW8270C	3,3'-DICHLOROBENZIDINE	68148	633HW004M7	68148006	WG	19.5	U	19.5	UJ	ug/L	CC
SVOA	SW8270C	3,3'-DICHLOROBENZIDINE	68148	633HW004M7DL	68148006	WG	780	U	780	R	ug/L	DL
SVOA	SW8270C	3-NITROANILINE	68148	633GW004M7DL	68148005	WG	2000	U	2000	R	ug/L	DL
SVOA	SW8270C	3-NITROANILINE	68148	633HW004M7DL	68148006	WG	1950	U	1950	R	ug/L	DL
SVOA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	68148	633GW002M7	68148003	WG	48.5	U	48.5	R	ug/L	CC,IC
SVOA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	68148	633GW003M7	68148004	WG	51	U	51	R	ug/L	IC,CC
SVOA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	68148	633GW004M7	68148005	WG	50	U	50	R	ug/L	IC,CC
SVOA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	68148	633GW004M7DL	68148005	WG	2000	U	2000	R	ug/L	DL
SVOA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	68148	633HW004M7	68148006	WG	48.8	U	48.8	R	ug/L	IC,CC
SVOA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	68148	633HW004M7DL	68148006	WG	1950	U	1950	R	ug/L	DL
SVOA	SW8270C	4-BROMOPHENYL PHENYL ETHER	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	4-BROMOPHENYL PHENYL ETHER	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	4-CHLORO-3-METHYLPHENOL	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	4-CHLORO-3-METHYLPHENOL	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	4-CHLOROANILINE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	4-CHLOROANILINE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	4-CHLOROPHENYL PHENYL ETHER	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	4-CHLOROPHENYL PHENYL ETHER	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	4-NITROANILINE	68148	633GW002M7	68148003	WG	48.5	U	48.5	UJ	ug/L	CC
SVOA	SW8270C	4-NITROANILINE	68148	633GW004M7	68148005	WG	50	U	50	UJ	ug/L	CC
SVOA	SW8270C	4-NITROANILINE	68148	633GW004M7DL	68148005	WG	2000	U	2000	R	ug/L	DL

Attachment 1 - Changed Qualifiers and Results  
 Zone G, AOC 633 Ground Water - Data Validation

Parameter Class	Well ID	Parameter	Site ID	Sample ID	Lab ID	Units	Result	Qual	Limit	Unit	Qual	Reason
SVOA	SW8270C	4-NITROANILINE	68148	633HW004M7	68148006	WG	48.8	U	48.8	UJ	ug/L	CC
SVOA	SW8270C	4-NITROANILINE	68148	633HW004M7DL	68148006	WG	1950	U	1950	R	ug/L	DL
SVOA	SW8270C	4-NITROPHENOL	68148	633GW004M7DL	68148005	WG	2000	U	2000	R	ug/L	DL
SVOA	SW8270C	4-NITROPHENOL	68148	633HW004M7DL	68148006	WG	1950	U	1950	R	ug/L	DL
SVOA	SW8270C	ACENAPHTHENE	68148	633GW004M7	68148005	WG	323	E	323	R	ug/L	LR
SVOA	SW8270C	ACENAPHTHENE	68148	633HW004M7	68148006	WG	357	E	357	R	ug/L	LR
SVOA	SW8270C	ACENAPHTHYLENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	ACENAPHTHYLENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	ANTHRACENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	ANTHRACENE	68148	633HW004M7DL	68148006	WG	22.4	JD	22.4	R	ug/L	DL
SVOA	SW8270C	BENZO(a)ANTHRACENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	BENZO(a)ANTHRACENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	BENZO(a)PYRENE	68148	633GW004M7DL	68148005	WG	40	U	40	R	ug/L	DL
SVOA	SW8270C	BENZO(a)PYRENE	68148	633HW004M7DL	68148006	WG	39	U	39	R	ug/L	DL
SVOA	SW8270C	BENZO(b)FLUORANTHENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	BENZO(b)FLUORANTHENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	BENZO(g,h,i)PERYLENE	68148	633GW003M7	68148004	WG	10.2	U	10.2	UJ	ug/L	CC
SVOA	SW8270C	BENZO(g,h,i)PERYLENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	BENZO(g,h,i)PERYLENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	BENZO(k)FLUORANTHENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	BENZO(k)FLUORANTHENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	Benzoic acid	68148	633GW002M7	68148003	WG	48.5	U	48.5	UJ	ug/L	CC
SVOA	SW8270C	Benzoic acid	68148	633GW003M7	68148004	WG	51	U	51	UJ	ug/L	CC
SVOA	SW8270C	Benzoic acid	68148	633GW004M7	68148005	WG	50	U	50	UJ	ug/L	CC
SVOA	SW8270C	Benzoic acid	68148	633GW004M7DL	68148005	WG	2000	U	2000	R	ug/L	DL
SVOA	SW8270C	Benzoic acid	68148	633HW004M7	68148006	WG	48.8	U	48.8	UJ	ug/L	CC
SVOA	SW8270C	Benzoic acid	68148	633HW004M7DL	68148006	WG	1950	U	1950	R	ug/L	DL
SVOA	SW8270C	Benzyl alcohol	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	Benzyl alcohol	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	BENZYL BUTYL PHTHALATE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL

Attachment 1 - Changed Qualifiers and Results  
 Zone G, AOC 633 Ground Water - Data Validation

Sample ID	Location	Compound Name	Lab ID	Sample ID	Lab ID	Method	Result	Qualifier	Result	Qualifier	Unit	Pass/Fail
SVOA	SW8270C	BENZYL BUTYL PHTHALATE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	bis(2-CHLOROETHOXY) METHANE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	bis(2-CHLOROETHOXY) METHANE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	2-CHLOROETHYL ETHER	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	2-CHLOROETHYL ETHER	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	Bis(2-Chloroisopropyl)Ether	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	Bis(2-Chloroisopropyl)Ether	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	bis(2-ETHYLHEXYL) PHTHALATE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	bis(2-ETHYLHEXYL) PHTHALATE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	CARBAZOLE	68148	633GW004M7DL	68148005	WG	106	JD	106	R	ug/L	DL
SVOA	SW8270C	CARBAZOLE	68148	633HW004M7DL	68148006	WG	150	JD	150	R	ug/L	DL
SVOA	SW8270C	CHRYSENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	CHRYSENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	DIBENZ(a,h)ANTHRACENE	68148	633GW003M7	68148004	WG	10.2	U	10.2	UJ	ug/L	CC
SVOA	SW8270C	DIBENZ(a,h)ANTHRACENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	DIBENZ(a,h)ANTHRACENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	DIBENZOFURAN	68148	633GW004M7	68148005	WG	177	E	177	R	ug/L	LR
SVOA	SW8270C	DIBENZOFURAN	68148	633GW004M7DL	68148005	WG	239	JD	239	J	ug/L	DL
SVOA	SW8270C	DIBENZOFURAN	68148	633HW004M7	68148006	WG	208	E	208	R	ug/L	LR
SVOA	SW8270C	DIBENZOFURAN	68148	633HW004M7DL	68148006	WG	304	JD	304	J	ug/L	DL
SVOA	SW8270C	DIETHYL PHTHALATE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	DIETHYL PHTHALATE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	DIMETHYL PHTHALATE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	DIMETHYL PHTHALATE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	DI-n-BUTYL PHTHALATE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	DI-n-BUTYL PHTHALATE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	DI-n-OCTYLPHTHALATE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	DI-n-OCTYLPHTHALATE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	Diphenylamine	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	Diphenylamine	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL

Attachment 1 - Changed Qualifiers and Results  
 Zone G, AOC 633 Ground Water - Data Validation

Sample ID	Location	Compound	Lab ID	Sample ID	Lab ID	Method	Conc	Unit	Conc	Unit	Qualifier	Result
SVOA	SW8270C	FLUORANTHENE	68148	633GW004M7DL	68148005	WG	29.9	JD	29.9	R	ug/L	DL
SVOA	SW8270C	FLUORANTHENE	68148	633HW004M7DL	68148006	WG	34.8	JD	34.8	R	ug/L	DL
SVOA	SW8270C	FLUORENE	68148	633GW004M7	68148005	WG	146	E	146	R	ug/L	LR
SVOA	SW8270C	FLUORENE	68148	633GW004M7DL	68148005	WG	186	JD	186	J	ug/L	DL
SVOA	SW8270C	FLUORENE	68148	633HW004M7	68148006	WG	172	E	172	R	ug/L	LR
SVOA	SW8270C	FLUORENE	68148	633HW004M7DL	68148006	WG	239	JD	239	J	ug/L	DL
SVOA	SW8270C	HEXACHLOROBENZENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	HEXACHLOROBENZENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	HEXACHLOROBUTADIENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	HEXACHLOROBUTADIENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	HEXACHLOROCYCLOPENTADIENE	68148	633GW003M7	68148004	WG	10.2	U	10.2	UJ	ug/L	CC
SVOA	SW8270C	HEXACHLOROCYCLOPENTADIENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	HEXACHLOROCYCLOPENTADIENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	HEXACHLOROETHANE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	HEXACHLOROETHANE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	INDENO(1,2,3-c,d)PYRENE	68148	633GW003M7	68148004	WG	10.2	U	10.2	UJ	ug/L	CC
SVOA	SW8270C	INDENO(1,2,3-c,d)PYRENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	INDENO(1,2,3-c,d)PYRENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	ISOPHORONE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	ISOPHORONE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	m,p-Cresols	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	m,p-Cresols	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	NAPHTHALENE	68148	633GW004M7	68148005	WG	1060	E	1060	R	ug/L	LR
SVOA	SW8270C	NAPHTHALENE	68148	633HW004M7	68148006	WG	1150	E	1150	R	ug/L	LR
SVOA	SW8270C	NITROBENZENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	NITROBENZENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	N-NITROSODI-n-PROPYLAMINE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	N-NITROSODI-n-PROPYLAMINE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	PENTACHLOROPHENOL	68148	633GW004M7DL	68148005	WG	2000	U	2000	R	ug/L	DL
SVOA	SW8270C	PENTACHLOROPHENOL	68148	633HW004M7DL	68148006	WG	1950	U	1950	R	ug/L	DL

Attachment 1 - Changed Qualifiers and Results  
 Zone G, AOC 633 Groundwater - Data Validation

Sample ID	Method	Compound	Lab ID	Sample ID	Lab ID	Unit	Result	Qualifier	Result	Qualifier	Unit	Reference
SVOA	SW8270C	PHENANTHRENE	68148	633GW004M7	68148005	WG	156	E	156	R	ug/L	LR
SVOA	SW8270C	PHENANTHRENE	68148	633GW004M7DL	68148005	WG	206	JD	206	J	ug/L	DL
SVOA	SW8270C	PHENANTHRENE	68148	633HW004M7	68148006	WG	186	E	186	R	ug/L	LR
SVOA	SW8270C	PHENANTHRENE	68148	633HW004M7DL	68148006	WG	258	JD	258	J	ug/L	DL
SVOA	SW8270C	PHENOL	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	PHENOL	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
SVOA	SW8270C	PYRENE	68148	633GW004M7	68148005	WG	16.4	=	16.4	J	ug/L	CC
SVOA	SW8270C	PYRENE	68148	633GW004M7DL	68148005	WG	400	U	400	R	ug/L	DL
SVOA	SW8270C	PYRENE	68148	633HW004M7	68148006	WG	17.2	=	17.2	J	ug/L	CC
SVOA	SW8270C	PYRENE	68148	633HW004M7DL	68148006	WG	390	U	390	R	ug/L	DL
VOA	SW8260B	1,2,3-Trichlorobenzene	68148	633GW002M7	68148003	WG	5	U	5	UJ	ug/L	IC
VOA	SW8260B	1,2,3-Trichlorobenzene	68148	633GW003M7	68148004	WG	5	U	5	UJ	ug/L	IC
VOA	SW8260B	1,2,3-Trichlorobenzene	68148	633GW004M7	68148005	WG	50	U	50	UJ	ug/L	IC
VOA	SW8260B	1,2,3-Trichlorobenzene	68148	633HW004M7	68148006	WG	50	U	50	UJ	ug/L	IC
VOA	SW8260B	1,2,4-TRICHLORO BENZENE	68148	633GW002M7	68148003	WG	5	U	5	UJ	ug/L	IC
VOA	SW8260B	1,2,4-TRICHLORO BENZENE	68148	633GW003M7	68148004	WG	5	U	5	UJ	ug/L	IC
VOA	SW8260B	1,2,4-TRICHLORO BENZENE	68148	633GW004M7	68148005	WG	50	U	50	UJ	ug/L	IC
VOA	SW8260B	1,2,4-TRICHLORO BENZENE	68148	633HW004M7	68148006	WG	50	U	50	UJ	ug/L	IC
VOA	SW8260B	2-Chloroethyl vinyl ether	68148	633GW002M7	68148003	WG	10	U	10	R	ug/L	MS
VOA	SW8260B	2-Chloroethyl vinyl ether	CNC149	633ZA001M8	S247868*1	LO	20000	U	20000	UJ	ug/kg	CC
VOA	SW8260B	CARBON DISULFIDE	68148	633GW002M7	68148003	WG	5	U	5	UJ	ug/L	CC,MS
VOA	SW8260B	CARBON DISULFIDE	68148	633GW003M7	68148004	WG	5	U	5	UJ	ug/L	CC
VOA	SW8260B	CARBON DISULFIDE	68148	633GW004M7	68148005	WG	50	U	50	UJ	ug/L	CC
VOA	SW8260B	CARBON DISULFIDE	68148	633HW004M7	68148006	WG	50	U	50	UJ	ug/L	CC
VOA	SW8260B	trans-1,3-DICHLOROPROPENE	68148	633GW002M7	68148003	WG	5	U	5	UJ	ug/L	CC
VOA	SW8260B	trans-1,3-DICHLOROPROPENE	68148	633GW003M7	68148004	WG	5	U	5	UJ	ug/L	CC
VOA	SW8260B	Vinyl acetate	CNC149	633ZA001M8	S247868*1	LO	20000	U	20000	UJ	ug/kg	CC,BS
VOA	SW8260B	VINYL CHLORIDE	68148	633GW002M7	68148003	WG	10	U	10	UJ	ug/L	MS

## Data Validation Summary - Charleston Naval Complex - Zone G, AOC 633 Ground Water

TO: William Elliott/CH2M HILL/GNA

FROM: Amy Juchem/CH2M HILL/GNA  
Herb Kelly/CH2M HILL/GNA

DATE: February 18, 2003

The purpose of this memorandum is to present the results of the data validation process for the samples collected in Zone G, AOC 633. The samples were collected on January 24, 2003.

The specific samples and analytical fractions reviewed are summarized below in **Table 1**.

The Quality Control areas that were reviewed and the resulting findings are documented within each subsection that follows. This data was validated for compliance with the analytical method requirements. This process also included a review of the data to assess the accuracy, precision, and completeness based upon procedures described in the guidance documents such as the Environmental Protection Agency (EPA) *National Functional Guidelines for Inorganic Data Review (EPA 2002)* and *National Functional Guidelines for Organic Data Review (EPA 1999)*. Quality assurance/quality control (QA/QC) summary forms and data reports were reviewed.

Samples were submitted to Severn Trent Services, STL Savannah Laboratories, Inc., in Savannah, Georgia for the following analyses: SW-846 8260 Volatile Organic Compounds (VOC), SW-846 8270 Semivolatile Organic Compounds (SVOC), SW-846 8082 Polychlorinated Biphenyls, and Metals following SW-846 6010/7000 Series methodology.

Sample results that were not within the acceptance limits were appended with a qualifying flag, which consisted of a single- or double-letter code that indicated a possible problem with the data. The qualifying flags originated during the data review and validation processes. These also include the secondary, or the two-digit "sub-qualifier" flags. The secondary qualifiers provide the reasoning behind the assignment of a qualifier flag to the data. The secondary qualifiers are presented and defined below.

**Attachment 1** lists the changes in data qualifiers, due to the validation process.

The following primary flags were used to qualify the data:

- [=] Detected. The analyte was analyzed for and detected at the concentration shown.
- [J] Estimated. The analyte was present but the reported value may not be accurate or precise.
- [U] Undetected. The analyte was analyzed for but not detected above the method detection limit.
- [UJ] Detection limit estimated. The analyte was analyzed for but qualified as not detected; the result is estimated.
- [R] Rejected. The data is not useable.

### Secondary Data Validation Qualifiers

<u>Code</u>	<u>Definition</u>
2S	Second Source
2C	Second Column Confirmation
BL	Blank
BD	Blank Spike/Blank Spike Duplicate or (LCS/LCSD) Precision
BS	Blank Spike/LCS
CC	Continuing Calibration Verification
DL	Dilution
FD	Field Duplicate
HT	Holding Time
IB	In-Between (metals – B's → J's )
IC	Initial Calibration
IS	Internal Standard
LD	Lab Duplicate
LR	Concentration exceeded Linear Range
MD	MS/MSD or LCS/LCSD Precision
MS	Matrix Spike/Matrix Spike Duplicate
OT	Other (see DV worksheet)
PD	Pesticide Degradation
PS	Post Spike
RE	Re-extraction/Re-analysis
SD	Serial Dilution
SS	Spiked Surrogate
TD	Total vs. Dissolved
TN	Tune

Table 1 - Chemical Analytical Methods – Field and Quality Control Samples

Site ID	Sample ID	Sample ID	Analysis Code	Matrix	Sample Type	Collection Date	VOC	SVOC	PCB	Total and Dissolved Metals	Total and Dissolved Mercury
							SW8260B	SW8270C	SW8082	SW6010B	SW7470A
CNC162	G633GW001	633GW001N1	S380527*1	WG	N	01/24/03	X	X	X	X	X
CNC162	FIELDQC	633EW001N1	S380527*2	WQ	EB	01/24/03	X	X	X	X	X
CNC162	FIELDQC	633TW001N1	S380527*3	WQ	TB	01/24/03	X				
CNC162	LABQC	805274LB	S380527*4	WQ	LB		X	X	X	X	X
CNC162	LABQC	805275BS	S380527*5	WQ	BS		X	X	X	X	X

**MATRIX CODE**

WG – Groundwater

WQ – Water QC Samples

**SAMPLE TYPE CODE**

BS - Blank Spike

EB - Equipment Blank

TB - Trip Blank

N - Native Sample

LB - Laboratory Blank

**ANALYSIS CODE**

VOC - Volatile Organic Compounds

SVOC - Semi-Volatile Organic Compounds

PCBs – Polychlorinated Biphenyls

## Organic Parameters

### Quality Control Review

The following list represents the QA/QC measures that were reviewed during the data quality evaluation procedure for organic data.

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Method blanks, equipment blanks, and trip blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Surrogate Recoveries** – Surrogate Compounds are added to each sample and the recoveries are used to monitor lab performance and possible matrix interference.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", either laboratory reagent water or Ottawa sand, in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **Field Duplicate Samples** – These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **GC/MS Tuning** – The mass spectrum of the tuning compound is evaluated for method compliance. The criteria are established to verify the proper mass assignment and mass resolution.
- **Initial Calibration** – The initial calibration ensures that the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest.
- **Continuing Calibration** – The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds.
- **Confirmation** – If GCMS methodology is not initially used for analysis, SW-846 method 8000 requires confirmation when the composition of samples is not well characterized. Therefore, even when the identification has been confirmed on a dissimilar column or detector, the agreement of the quantitative results on both columns is evaluated. For Pesticide and PCB analyses covered in this report, confirmation was performed using a dissimilar analytical column. The laboratory analyzed samples with a gas chromatograph (GC) utilizing simultaneous primary and confirmation data acquisition. Per SW-86 method 8000, 40% RPD criteria was used as the acceptance limit.

- **Internal Standards** – The internal standards (retention time and response) are evaluated for method compliance. The internal standards are used in quantitation of the target parameters and monitor the instrument sensitivity and response for stability during each analysis.

## Volatile Organic Compounds (VOC) Analyses

The QA/QC parameters for VOC analyses for all of the samples were within acceptable control limits, except as noted below:

### Blanks

The VOC target parameters detected in blank samples are listed in **Table 2**.

**TABLE 2**

Blank Contamination: VOC

Charleston Naval Complex, Zone G, AOC 633, Charleston, SC

CNC162	633EW001N1	S380527*2	EB	1,3-Dichlorobenzene	0.65	µg/L	3.25 µg/L
CNC162	633EW001N1	S380527*2	EB	1,2-Dichlorobenzene	0.44	µg/L	2.2 µg/L
CNC162	633EW001N1	S380527*2	EB	1,2,4-Trichlorobenzene	1.1	µg/L	5.5 µg/L
CNC162	633EW001N1	S380527*2	EB	1,2,3-Trichlorobenzene	0.87	µg/L	4.35 µg/L
CNC162	633TW001N1	S380527*3	TB	Trichloroethene	0.48	µg/L	2.4 µg/L

If a target parameter determined to be a common contaminant was reported in a field sample, and the concentration was below the level determined to be due to blank contamination, the following actions were taken:

- If the concentration was above the reporting limit, the numeric result was unchanged, but it was flagged "U", as undetected.
- If the concentration was below the reporting limit, the numeric result was changed to the value of the reporting limit, and it was flagged "U", as undetected.

The results qualified due to blank contamination are listed in **Attachment 1**.

### Recoveries - Surrogate, MS/MSD and LCS

All Surrogate, Matrix Spike (MS), Matrix Spike Duplicate (MSD), and Laboratory Control Sample (LCS) recoveries were within acceptable quality control limits, except as noted below.

- 2-Chloroethyl vinyl ether was recovered at 160 percent with control limits of 70-130 percent in the LCS sample in CNC162. Only detected compounds are qualified "J", as estimated. All sample results were non-detects, therefore no flags were applied.

### Initial and Continuing Calibration Criteria

All initial calibration criteria and continuing calibration criteria were met, except as listed in **Table 3**.

**TABLE 3**

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: VOC  
Charleston Naval Complex, Zone G, AOC 633, Charleston, SC

MSO5973-ICAL-01/29/03, 1318	2-Chloroethyl vinyl ether	28.2% RSD	CNC162 - All
MSO5973-CCAL-01/30/03, 1132	2-Chloroethyl vinyl ether	27.6% high	CNC162 - All

Flags were applied to the compounds in the associated samples in the following manner:

- When the percent Relative Standard Deviation (%RSD) or correlation coefficient ( $R^2$ ) was out in the initial calibration, all associated samples were qualified. Detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.
- When the percent difference (%D) was high in the continuing calibration standards, detected compounds were flagged "J", as estimated. Non-detected compounds were not flagged.

### Semivolatile Organic Compounds (SVOC) Analyses

The QA/QC parameters for the SVOC analyses for all of the samples were within acceptable control limits, except as noted below.

### Recoveries - Surrogate, MS/MSD and LCS

All Surrogate, Matrix Spike (MS), Matrix Spike Duplicate (MSD), and Laboratory Control Sample (LCS) recoveries were within acceptable quality control limits, except as noted below.

- 4-Nitrophenol was recovered at 82 percent with control limits of 10-80 percent in the LCS sample in CNC162. Detects only are qualified, "J". All sample results are non-detects. No flags were applied.

## Polychlorinated Biphenyls (PCBs) Analyses

The QA/QC parameters for the PCB analyses for all of the samples were within acceptable control limits, except as noted below:

### Recoveries - Surrogate, MS/MSD and LCS

All Surrogate, Matrix Spike (MS), Matrix Spike Duplicate (MSD), and Laboratory Control Sample (LCS) recoveries and Relative Percent Deviations (RPDs) were within acceptable quality control limits, except as noted below.

- Surrogate Decachlorobiphenyl was recovered at 41 percent with control limits of 60-150 percent in sample 633GW001N1 in CNC162. For all results in this sample, detects were qualified, "J", and non-detects were qualified, "UJ".

### Initial and Continuing Calibration Criteria

All initial and continuing calibration criteria were met except as noted in ~~Table 4~~.

**TABLE 4**

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: PCBs  
Charleston Naval Complex, Zone G, AOC 633, Charleston, SC

SGKECD1-CCAL-01/30/03, 0742	Aroclor-1016	25.2% high	633GW001N1, 633EW001N1
SGKECD1-CCAL-01/30/03, 1457	Aroclor-1016	29.6% high	633GW001N1, 633EW001N1

Flags were applied to the compounds in the associated samples in the following manner:

- When the percent difference (%D) was high in the continuing calibration standards, detected compounds were flagged "J", as estimated. Non-detected compounds were not flagged.

## Inorganic Parameters

### Quality Control Review

The following list represents the QA/QC measures that are typically reviewed during the data quality evaluation procedure for inorganic parameters.

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Sample preparation, initial calibration blanks/continuing calibration blanks, and equipment blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", in which target parameters have been added prior to digestion/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Field Duplicate Samples** – These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **Pre/Post Digestion Spike (MS/MSD)** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **ICP Interference Check Sample** – This sample verifies the lab's interelement and background correction factors.
- **Initial Calibration Verification** – This parameter ensures that the instrument is capable of producing acceptable quantitative data for the target analyte list to be measured.
- **Continuing Calibration Verification** – This one-point, mid-range parameter establishes that the initial calibration is still valid by checking the performance of the instrument on a continual basis.
- **ICP Serial Dilution** – The serial dilution of samples quantitated by ICP determines whether or not significant physical or chemical interferences exist due to the sample matrix.

## Metals Analyses

The QA/QC parameters for the Metals analyses for all of the samples were within acceptable control limits, except as noted below.

### Blanks

The Metals target parameters detected in blank samples are listed in [Table 5](#).

**TABLE 5**

Blank Contamination: Metals

Charleston Naval Complex, Zone G, AOC 633, Charleston, SC

CNC162	CCB		CCB	Arsenic	3.51	ug/L	0.01755 mg/L
CNC162	CCB		CCB	Barium	2.22	ug/L	0.0111 mg/L
CNC162	CCB		CCB	Lead	2.40	ug/L	0.012 mg/L
CNC162	CCB		CCB	Selenium	4.46	ug/L	0.0223 mg/L

If a target parameter was reported in a field sample, and the concentration was below the level determined to be due to blank contamination (5 times the concentration in the associated QC blank samples), it was flagged as "U", not detected. Initial and continuing calibration blanks were also evaluated for possible contamination.

The results qualified due to blank contamination are listed in [Attachment 1](#).

### Recoveries - MS/MSD and LCS

All Matrix Spike (MS), Matrix Spike Duplicate (MSD), and Laboratory Control Sample (LCS) recoveries were within acceptable quality control limits, except as noted below.

- Mercury was recovered at 74 and 78 percent with control limits of 80-120 percent in the MS/MSD set run on sample 633GW001N1 in CNC162. For all samples in the SDG, all detects were qualified, "J", and non-detects were qualified, "UJ".

## Rejected Data

No data were rejected based upon the validation process for this sampling event.

## Conclusion

A review of the analytical data submitted regarding the investigation of Zone G, AOC 633 at the Charleston Naval Complex, Charleston, South Carolina by CH2M HILL has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed, and that the analytical results should be considered usable as qualified.

The analytical data had minor QC concerns as indicated above, however, it did not affect data usability for those specific results. The validation review demonstrated that the analytical systems were generally in control and the data results can be used in the decision making process.

Attachment 1 - Changed Qualifiers and Results  
 Zone G, AOC 633 Ground Water - Data Validation

Class	Monitor	Parameter	Site	Sample	Sample ID	Group	Value	Qualifier	Limit	Unit	Result	
TMET	SW6010B	ARSENIC, Dissolved	CNC162	633GW001N1	S380527*1	WG	0.011	=	0.011	U	mg/l	BL
TMET	SW6010B	BARIUM, Dissolved	CNC162	633GW001N1	S380527*1	WG	0.058	B	0.058	J	mg/l	IB
TMET	SW6010B	CADMIUM, Dissolved	CNC162	633GW001N1	S380527*1	WG	0.00067	B	0.00067	J	mg/l	IB
TMET	SW6010B	SELENIUM, Dissolved	CNC162	633GW001N1	S380527*1	WG	0.0023	B	0.0023	U	mg/l	BL
TMET	SW7470A	MERCURY, Dissolved	CNC162	633GW001N1	S380527*1	WG	0.000076	BN	0.000076	J	mg/l	MS
ETAL	SW6010B	ARSENIC	CNC162	633GW001N1	S380527*1	WG	0.011	=	0.011	U	mg/l	BL
ETAL	SW6010B	BARIUM	CNC162	633GW001N1	S380527*1	WG	0.059	B	0.059	J	mg/l	IB
ETAL	SW6010B	CADMIUM	CNC162	633GW001N1	S380527*1	WG	0.00068	B	0.00068	J	mg/l	IB
ETAL	SW7470A	MERCURY	CNC162	633GW001N1	S380527*1	WG	0.000072	UN	0.000072	UJ	mg/l	MS
CB	SW8082	PCB-1016 (AROCHLOR 1016)	CNC162	633GW001N1	S380527*1	WG	1	U	1	UJ	ug/l	SS
CB	SW8082	PCB-1221 (AROCHLOR 1221)	CNC162	633GW001N1	S380527*1	WG	1	U	1	UJ	ug/l	SS
CB	SW8082	PCB-1232 (AROCHLOR 1232)	CNC162	633GW001N1	S380527*1	WG	1	U	1	UJ	ug/l	SS
CB	SW8082	PCB-1242 (AROCHLOR 1242)	CNC162	633GW001N1	S380527*1	WG	1	U	1	UJ	ug/l	SS
CB	SW8082	PCB-1248 (AROCHLOR 1248)	CNC162	633GW001N1	S380527*1	WG	1	U	1	UJ	ug/l	SS
CB	SW8082	PCB-1254 (AROCHLOR 1254)	CNC162	633GW001N1	S380527*1	WG	2	U	2	UJ	ug/l	SS
CB	SW8082	PCB-1260 (AROCHLOR 1260)	CNC162	633GW001N1	S380527*1	WG	1.8	J	1.8	J	ug/l	SS
DA	SW8260B	1,2-DICHLOROBENZENE	CNC162	633GW001N1	S380527*1	WG	1.1	J	5	U	ug/l	BL
DA	SW8260B	2-Chloroethyl vinyl ether	CNC162	633GW001N1	S380527*1	WG	10	U	10	UJ	ug/l	IC

CH2M HILL Chain of Custody/ Laboratory Analysis Form

COC Tracking #: ZG633-092602-01 page 1 of 2

Laboratory: **STL**  
 Project Name: **Charleston Navy Complex**  
 Project Number: **158814.PM.04**  
 Project Manager: **Tom Beisel**  
 Address: **GNV: 3011 SW Williston Rd., Gainesville, FL 32605**  
**ATL: 115 Perimeter Center Place NE, Suite 700, Atlanta, GA 30346-1278**  
 Send Report To: **see last page of COC**  
 EDD: **CNC format**

# of containers	3 - 40mL vials, HCl	2 - 1L amber	2 - 1L amber	1 - 0.5L HDPE, HNO3						
	VOCs (SW8260B)	SVOCs (SW8270C)	PCBs (SW8082)	Metals (SW8010B/7000)						
8	X	X	X	X						
8	X	X	X	X						
8	X	X	X	X						
8	X	X	X	X						
8	X	X	X	X						
1	X	X	X	X						
	X									

Lab Batch/SDG:

Sample ID	Station ID	Sample Description	Depth		Date & Time Collected	Matrix	# of containers	VOCs (SW8260B)	SVOCs (SW8270C)	PCBs (SW8082)	Metals (SW8010B/7000)								Comments
			Begin	End															
633GW001M7	G633GW001	new well			Did not Receive	WG	8	X	X	X	X								
633GW002M7	G633GW002	new well			10/2/2002 / 1010	WG	8	X	X	X	X								
633GW003M7	G633GW003	new well			10/2/2002 / 1137	WG	8	X	X	X	X								
633GW004M7	G633GW004	new well			10/2/2002 / 1442	WG	8	X	X	X	X								
633HW004M7	G633GW004	new well			10/2/2002 / 1442	WG	8	X	X	X	X								
633EW001M7	G633EW001	EB			10/2/2002 / 1530	WQ	1	X	X	X	X								EB
633TW001M7	G633TW001	TB			Lab Provided	WQ		X											TB

Sampled By: **Darryl Gates** Date/Time AS Noted: \_\_\_\_\_ Relinquished by: *[Signature]* Date/Time **10/2/02 / 1630**

Additional Samplers: **Andrew O'Connor**

Received By Lab: *[Signature]* Date/Time **10/2/02 / 1630** Relinquished by: \_\_\_\_\_ Date/Time \_\_\_\_\_

Received By: \_\_\_\_\_ Date/Time \_\_\_\_\_ Shipped Via: **UPS FedEx Hand Other** Tracking#: \_\_\_\_\_

Remarks: **Fax results to David Lane 352-271-4846 & Herb Kelly** Temperature: \_\_\_\_\_

Receipt Exceptions:



CH2 HILL Chain of Custody/ Laboratory Analysis Form

Laboratory: STL  
 Project Name: Charleston Navy Complex Site Name: Zone G, AOC 633  
 Project Number: 158814.PM.04 TAT: 14 day results  
 Project Manager: Tom Beisel QA Level: level 3  
 Address: GNV: 3011 SW Williston Rd., Gainesville, FL 32605  
ATL: 115 Perimeter Center Place NE, Suite 700, Atlanta, GA 30346-1278  
 Send Report To: see last page of COC EDD: CNC format

Lab Batch/SDG:

Sample ID	Station ID	Sample Description	Depth		Date & Time Collected	Matrix	# of containers	3 - 40mL vials, HCl	2 - 1L amber	2 - 1L amber	1 - 0.5L HDPE, HNO3	1 - 0.5L HPLC METALS (SW6010B/200)							Comments	
			Begin	End																
633GW001N1 ✓	G633GW001	new well			1-24-03/1240	WG	9	X	X	X	X	X								
633EW001N1 /	G633EW001	EB			1-24-03/1255	WQ	9	X	X	X	X	X								EB
633TW001N1 ✓	G633TW001	TB			LAB SUPPLIED	WQ	3	X												TB
																				RCRA
																				* SAMPLES will probably have high levels of petroleum constituents
																				sample complete
																				* ADD FILTERED METALS, 45ml

Sampled By ANDREW O'CONNOR Date/Time 1-24-03

Relinquished by: [Signature] Date/Time 1-24-03/1600

Additional Samplers: D. Wileman

Received By Lab: [Signature] Date/Time

Relinquished by: Date/Time

Received By: [Signature] Date/Time 012503/1111

Shipped Via: UPS FedEx Hand Other Tracking#:

Remarks: Fax results to David Lane 352-271-4846 & Herb Kelly

Temperature:

Receipt Exceptions: Bill Blum + 352-333-7116 5380527

Site: AOC 633  
 Media: Surface Soil  
 Units: mg/kg

Chemical	CASRN	Samples	Detects	NonDetects	FOD	Min Detect	Max Detect	Avg Detect	Mean	Min nondetect	Max nondetect	W-Test	t-Statistic	UCL95 nom	H-statistic	UCL96 log	UCL95 nonparm	UCL95 bootstrap	UTL nom	UTL log	UTL nonparm
Antimony		8	1	7	13%	14.4	14.4	14.4	1.98625	0.155	0.29	NONPARAMETRIC	1.895	5.347022	4.532667	15.12237	0.155	4.611158	12.06856	7.465791	14.4
Chromium, total		8	8	0	100%	4.9	45.5	20.9875	20.9875	0	0	LOGNORMAL	1.895	31.14663	2.858333	57.73055	4.9	29.18157	51.48489	88.70578	45.5

Site: AOC 633  
 Media: Surface Soil  
 Units: mg/kg  
 Chemical: Antimony  
 CASRN:

**STATISTICS**

N	8
Detects	1
FOD	13%
Mean of Detect	14.400
Min of Detect	14.40
Max of Detect	14.40
Best Estimate of Mean (arithmetic)	4.6
Best Estimate of Mean (geometric)	0.4
Nondetects at 1/2 DL	YES

**95% UPPER CONFIDENCE LIMITS FOR MEAN**

UCL95 Normal	5.3	
<i>t</i> -statistic	1.90	
UCL95 Lognormal	15.1	Exceeds Max Detect
<i>H</i> -statistic	4.53	
UCL95 Nonparametric	0.155	
<b>UCL95 Bootstrap</b>	<b>4.611</b>	

**95% UPPER TOLERANCE INTERVAL**

UTL95 Normal	12.06856492
<i>coverage</i>	95%
UTL95 Lognormal	7.465791142
<i>coverage</i>	95%
UTL95 Nonparametric	14.40
<i>coverage</i>	89%

**DISTRIBUTION TESTING**

Population is best described as:	<b>NONPARAMETRIC</b>
$W_{normal}$	0.428
$W_{log}$	0.564
$W_{\alpha=0.05}$	0.818

Notes:

1. If population does not fit normal or lognormal distribution, check Q-Q plots and W-test values. The population may be close enough to one of those distributions to subjectively select a normal or lognormal distribution.
2. For site data, if the selected UCL95 exceeds the Max Detect, the Max Detect should be chosen as the EPC.
3. Lognormal UCL or UTL values calculated for less than 30 samples may be widely inflated.
4. If there is >90% nondetection, it is generally impossible to calculate a UTL or UCL with any level of confidence.

Site: AOC 633  
 Media: Surface Soil  
 Units: mg/kg  
 Chemical: Chromium, total  
 CASRN:

**STATISTICS**

N	8
Detects	8
FOD	100%
Mean of Detect	21.0
Min of Detect	4.90
Max of Detect	45.50
Best Estimate of Mean (arithmetic)	29.2
Best Estimate of Mean (geometric)	15.8
Nondetects at 1/2 DL	YES

**95% UPPER CONFIDENCE LIMITS FOR MEAN**

UCL95 Normal	31.1	
<i>t</i> -statistic	1.90	
UCL95 Lognormal	57.7	Exceeds Max Detect
<i>H</i> -statistic	2.86	
UCL95 Nonparametric	4.9	
UCL95 Bootstrap	29.2	

**95% UPPER TOLERANCE INTERVAL**

UTL95 Normal	51.46488701	
<i>coverage</i>	95%	
UTL95 Lognormal	88.70578277	
<i>coverage</i>	95%	
UTL95 Nonparametric	45.50	
<i>coverage</i>	89%	

**DISTRIBUTION TESTING**

Population is best described as:	<b>LOGNORMAL</b>
$W_{normal}$	0.909
$W_{log}$	0.912
$W_{\alpha = 0.05}$	0.818

Notes:

1. If population does not fit normal or lognormal distribution, check Q-Q plots and W-test values. The population may be close enough to one of those distributions to subjectively select a normal or lognormal distribution.
2. For site data, if the selected UCL95 exceeds the Max Detect, the Max Detect should be chosen as the EPC.
3. Lognormal UCL or UTL values calculated for less than 30 samples may be widely inflated.
4. If there is >90% nondetection, it is generally impossible to calculate a UTL or UCL with any level of confidence.

Responses to SCDHEC Comments  
RFI Report Addendum/CMS Work Plan  
AOC 633, Revision 0  
Charleston Naval Complex  
Dated May 30, 2003

---

**Prepared by Jerry Stamps**

**General**

1. The Department understands that industrial reuse LUCs are to be applied to this site as well as restrictions against the installation of wells and the use of shallow groundwater. No response to this comment is necessary.

**CH2M-Jones Response:**

*Comment noted.*

2. Sections 2.3 and 5.3  
Six sediment samples were collected from the ditch that presumably served for stormwater runoff from AOCs 633, 634, and 706. This ditch apparently leads to an intermittent pond, which is located in Area of Ecological Concern (AEC) IV-1. It is reported that various VOCs, SVOCs, PCBs, and metals exceeded their corresponding Sediment Screening Value (SSV). It is stated that the ecological risk associated with this area will be addressed in the Zone J RFI at a later date. However, since there does not appear to be a direct link between this isolated inland habitat and the surface water bodies associated with Zone J, addressing the ecological risk for this area in the Zone J RFI does not appear to be appropriate. Therefore, additional investigation, as deemed necessary, and the ecological risk assessment must be conducted in association with either AOC 633, 634, or 706.

**CH2M-Jones Response:**

*The potential ecological impacts for the 6 samples noted above to AEC IV-1, Subzone G-1, will be evaluated. A separate submittal for this evaluation will be provided.*

3. Section 3.3, Page 3-3, Lines 11 and 12  
The average PCB concentration remaining in the soil should be presented in this section to demonstrate that the leaching potential for PCBs no longer exists.

**CH2M-Jones Response:**

*The average PCB concentration in soil will be provided as requested above.*

Response to Hydrogeology Comments  
RFI Report Addendum/CMS Work Plan, Revision 0  
Area of Concern 633, Zone G  
Charleston Naval Complex  
Dated May 30, 2003

---

**Prepared by Jo Cherie Overcash**

CH2M Jones and the Navy appreciate the conditional approval of the RFIRA/CMSWP for AOC 633. A few responses to the reviewer's comments are provided below.

1. We agree to conduct appropriate investigations into the nature of the petroleum hydrocarbons detected in groundwater at G633GW004 under RCRA Subtitle I through SCDHEC's UST Program.
  
2. The reviewer noted the following regarding monitor well locations at the site:

Figure 4-2 Potentiometric Surface (without GW001), October 2002

According to the groundwater flow direction, there are no monitoring wells located downgradient of the source area. Monitoring well G633GW001 was installed in the area where LNAPL seeped into the soil excavations (designated source area) while monitoring wells G633GW002 and G633GW003 are sidegradient wells that have not been adversely impacted. Therefore, the Navy must install a minimum of two shallow groundwater monitoring wells near Building 1177 to provide immediate and long term monitoring for AOC 633.

We agree that an additional well should be installed near Building 177 downgradient of the location at which LNAPL is found at AOC 633. The need for two wells is not apparent to CH2M Jones. We propose that an initial downgradient well be first installed at a location acceptable to SCDHEC and, pending the results of groundwater analysis from that well, the need for an additional well would then be determined.

A key reason why one well appears adequate at this time is that the slow groundwater flow rate at the site suggests that significant downgradient migration of contamination is unlikely. Assuming an average hydraulic conductivity of  $10E-04$  and a hydraulic gradient of approximately 0.0067 ft/ft (from Figure 4-2), and assuming an effective porosity of approximately 0.25, a seepage velocity of slightly less than 3 ft/yr is calculated. Given the significant retardation of contaminants such as PCBs and diesel compounds, the contaminant migration rate in groundwater at this site is probably on the order of less than one ft/year.

An initial proposed location of this well will be provided in the CMS report for AOC 633.

3. The reviewer noted the following, with regard to proposed Media Cleanup Standards:

8.2 Remedial Goal Options and Proposed Media Cleanup Standards

The Navy has proposed an inappropriate media cleanup standard (MCS) for LNAPL. While the thickness of the LNAPL on the watertable may be used to determine when to actively remove the LNAPL, thickness of the contaminants cannot be used as a cleanup standard. Each constituent in the LNAPL must meet MCLs or RBC values, whichever is appropriate. On Table 4-9 entitled LNAPL Analytical Results from G633GW001, the Navy identified Aroclor-1260, bis (2-ethylhexyl) phthalate, diesel components, 1,3-dichlorobenzene, and 1,4-dichlorobenzene in the one sample of LNAPL collected during January 2003. In the CMS Report, the Navy must further identify the diesel components and propose acceptable cleanup standard. Even though the individual constituents do not exceed their respective MCLs/RBCs at this time, the Division considers LNAPL a constituent of concern in that its continued presence poses a potential threat to groundwater quality.

As noted above, SCDHEC considers LNAPL a COC. CH2M Jones agrees and for this reason we provided the proposed LNAPL MCS (less than or equal to 0.01 ft measured in the monitoring wells). We suggest that this MCS for LNAPL be retained as it provides a practical end point for active LNAPL recovery methods.

In addition, we agree that MCSs for applicable diesel analytes also be included as COCs and proposed MCSs for these will be provided in the CMS. Because many diesel constituents are not considered toxic and do not have MCLs or RBCs established, we propose that the list of individual diesel constituents to be identified as COCs be those for which the SCDHEC UST program provides target cleanup levels and that those target cleanup levels be used as the proposed MCSs.