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RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT  
ADDENDUM AREA OF CONCERN 551 AND 552 (AOC 551) AND (AOC 552) ZONE E CNC  
CHARLESTON SC  
12/31/2003  
CH2M HILL

# RFI REPORT ADDENDUM

## AOCs 551 and 552, Zone E



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

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

*CH2M Jones*

*December 2003*

*Contract N62467-99-C-0960*



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December 31, 2003

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 (Revision 1) – AOCs 551 and 552, Zone E

Dear Mr. Scaturo:

Enclosed please find two copies of the RFI Report Addendum (Revision 1) for AOCs 551 and 552 in Zone E 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 Sam Naik. Please do not hesitate to contact him at 770/604-9182, extension 255, should you have any questions or comments.

Sincerely,

CH2M HILL

A handwritten signature in black ink, appearing to read "Dean Williamson".

Dean Williamson, P.E.

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

# RFI REPORT ADDENDUM

## AOCs 551 and 552, Zone E



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

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

PREPARED BY  
***CH2M-Jones***

*December 2003*

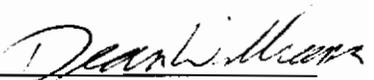
*Revision 1  
Contract N62467-99-C-0960  
158814.ZE.PR.01*

## Certification Page for RFI Report Addendum (Revision 1) – AOCs 551 and 552, Zone E

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.

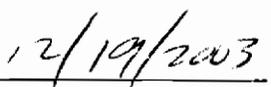
South Carolina

P.E. No. 21428



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Dean Williamson, P.E.



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Date

## Certification Page for RFI Report Addendum (Revision 1) – AOCs 551 and 552, Zone E

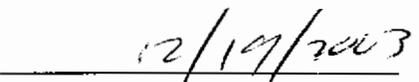
I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina

P.E. No. 21428



Dean Williamson, P.E.

  
Date

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32	in the <i>Zone E RFI Report, Revision 0</i>	



# 1 Acronyms and Abbreviations

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2	AOC	Area of concern
3	ALM	Adult Lead Methodology
4	AST	Aboveground storage tank
5	BCT	BRAC Cleanup Team
6	BEQ	Benzo[a]pyrene equivalent
7	BRAC	Base Realignment and Closure Act
8	BRC	Background reference concentration
9	CA	Corrective action
10	CNC	Charleston Naval Complex
11	COC	Chemical of concern
12	COPC	Chemical of potential concern
13	CSI	Confirmatory sampling investigation
14	DAF	Dilution attenuation factor
15	EnSafe	EnSafe Inc.
16	EPA	U.S. Environmental Protection Agency
17	FRE	Fixed-point risk evaluation
18	HHRA	Human health risk assessment
19	IM	Interim measure
20	HI	Hazard index
21	LUC	Land use control
22	MCL	Maximum contaminant level
23	$\mu\text{g}/\text{kg}$	Microgram per kilogram
24	$\mu\text{g}/\text{L}$	Microgram per liter
25	$\text{mg}/\text{kg}$	Milligram per kilogram
26	NAVBASE	Naval Base
27	OP	Organophosphorous
28	OWS	Oil/water separator

# 1 **Acronyms and Abbreviations, Continued**

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2	PCE	Tetrachloroethene
3	ppb	Parts per billion
4	RBC	Risk-based concentration
5	RCRA	Resource Conservation and Recovery Act
6	RFI	RCRA Facility Investigation
7	SCDHEC	South Carolina Department of Health and Environmental Control
8	SSL	Soil screening level
9	SVOC	Semivolatile organic compound
10	TCE	Trichloroethene
11	TDS	Total dissolved solids
12	UST	Underground storage tank
13	VOC	Volatile organic compound

**Section 1.0**

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# 1 1.0 Introduction

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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 Corrective Action (CA) activities are being conducted under the Resource Conservation and  
8 Recovery Act (RCRA), with the South Carolina Department of Health and Environmental  
9 Control (SCDHEC) as the lead agency for CA activities at the CNC. All RCRA CA activities  
10 are performed 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 complete the RCRA Facility Investigation (RFI) for Areas of Concern (AOCs) 551 and 552 in  
14 Zone E of CNC. These two sites were investigated together during the RFI due to their  
15 proximity. The location of AOCs 551 and 552 in Zone E is shown in Figure 1-1. Figure 1-2  
16 shows an aerial photograph of the site.

## 17 1.1 Background

18 AOC 551 is Building 1119, a boiler house that operated before 1942. The building appears to  
19 have undergone drastic renovations, or it possibly may have been demolished and a new  
20 structure rebuilt on the same site. A boiler was located on site, but no information was  
21 found to indicate the type of fuel used in it. Building 1119 is currently vacant. AOC 552 is  
22 former Building 1030. From 1926 to 1929, the building housed a tooling shop. In 1929, the  
23 building was converted to a storage shop and was later demolished. Currently, the site is  
24 paved with asphalt and traversed by a pair of railroad lines.

25 As identified in the *Final Zone E RFI Work Plan* documentation (EnSafe Inc. [EnSafe]/Allen &  
26 Hoshall, 1995), the materials of concern for AOC 551 included petroleum hydrocarbons and  
27 heavy metals. At AOC 552, the materials of concern were inorganic acids, zinc, and heavy  
28 metals. The AOCs 551 and 552 area is zoned for industrial use (M-2). The CNC RCRA  
29 Permit identified AOCs 551 and 552 as requiring a confirmatory sampling investigation  
30 (CSI).

1 A review of historical engineering drawings for this site shows that railroad lines were  
2 located in the immediate vicinity of AOCs 551 and 552 and are still present within the  
3 boundaries of AOC 552. The historical railroad lines from 1939 are presented in Figure C-1.

4 The RFI was initially conducted by the Navy/EnSafe Inc.(EnSafe) team and the RFI  
5 activities were described in the *Zone E RFI Report, Revision 0* (EnSafe, 1997). Regulatory  
6 review was conducted on this document and a draft response to the comments from  
7 SCDHEC was prepared by the Navy/EnSafe team. These comments and responses are  
8 included in Appendix B of this document.

## 9 **1.2 Purpose of the RFI Report Addendum**

10 The purpose of this RFI Report Addendum is to document the results of previous RFI  
11 investigations conducted by EnSafe at AOCs 551 and 552. This RFI Report Addendum also  
12 discusses various closeout issues and the findings of previous investigations, existing site  
13 conditions, and surrounding area land use.

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

- 16 • Status of the RFI
- 17 • Presence of metals (inorganics) in groundwater
- 18 • Potential linkage to SWMU 37, Investigated Sanitary Sewers at the CNC
- 19 • Potential linkage to Area of Concern (AOC) 699, Investigated Storm Sewers at the CNC
- 20 • Potential linkage of AOC 504, Investigated Railroad Lines at the CNC
- 21 • Potential linkage to surface water bodies (Zone J)
- 22 • Potential contamination associated with oil/water separators (OWSs)
- 23 • Relevance or need for land use controls (LUCs) at the site

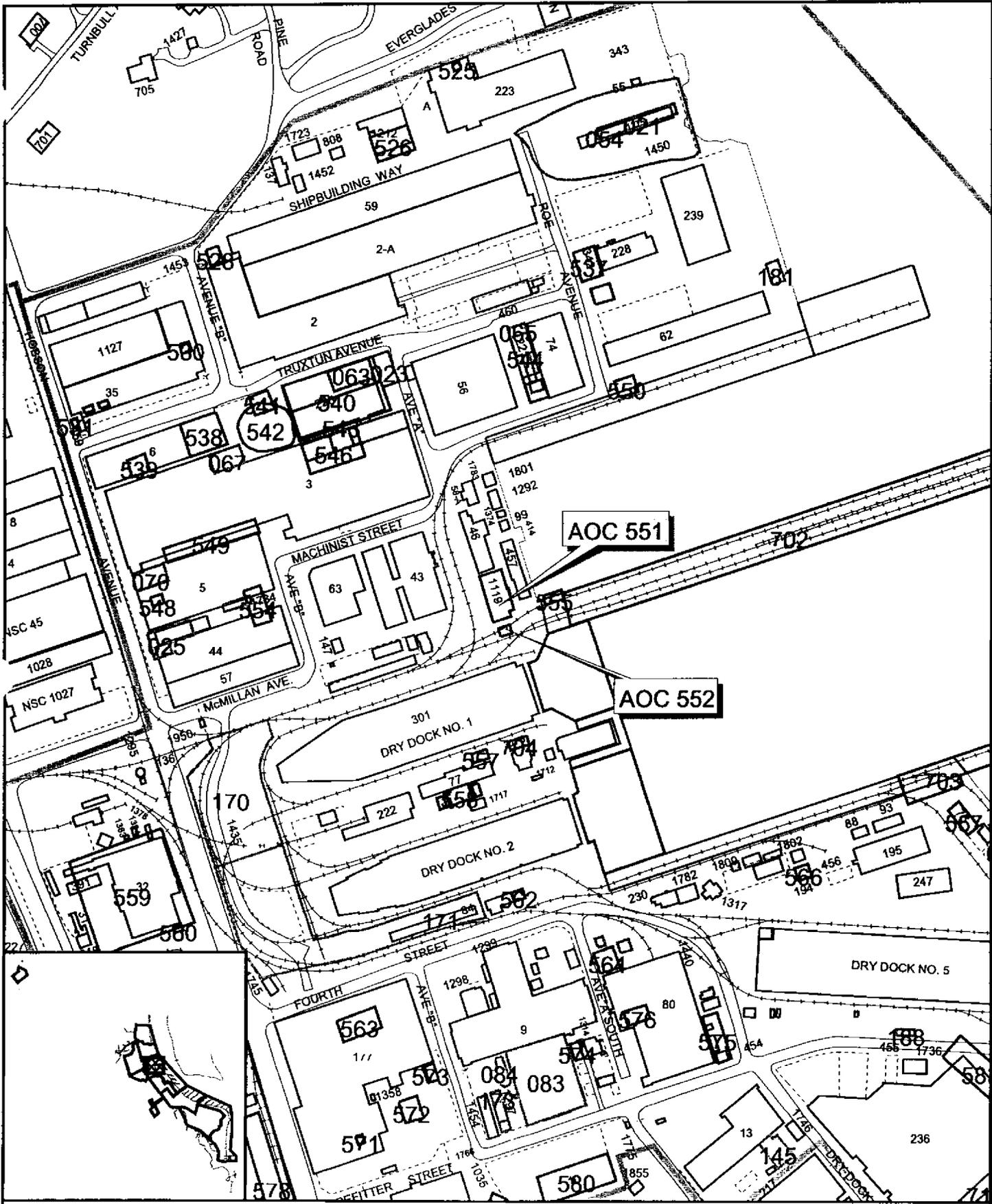
24 Information regarding these issues is also provided in this RFI Report Addendum to  
25 expedite evaluation of closure of the site.

## 26 **1.3 Report Organization**

27 This RFI Report Addendum consists of the following sections, including this introductory  
28 section:

29 **1.0 Introduction** – Presents the purpose of the report and background information relating  
30 to the RFI Report Addendum.

- 1    **2.0 Summary of RFI Conclusions for AOCs 551 and 552** – Summarizes the conclusions  
2       from the RFI investigations and risk evaluations for AOCs 551 and 552 as presented in  
3       *the Zone E RFI Report, Revision 0.*
- 4    **3.0 Interim Measures and UST/AST Removals** – Provides information regarding any  
5       interim measures (IMs) or tank removal activities performed at the site.
- 6    **4.0 Summary of Additional Investigations** – Summarizes information, if any, collected  
7       after completion of the *Zone E RFI Report, Revision 0.*
- 8    **5.0 COPC/COC Refinement** – Provides further evaluation of chemicals of potential concern  
9       (COPC) 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 the various site  
12      closeout issues that the BRAC Cleanup Team (BCT) agreed to evaluate prior to site  
13      closeout.
- 14   **7.0 Recommendations** – Provides recommendations for proceeding with site closure.
- 15   **8.0 References** – Lists the references used in this document.
- 16   **Appendix A** – Contains excerpts from the *Zone E RFI Report, Revision 0*, including a  
17      summary of detections of chemicals, and Figure A-1, a groundwater flow map for the site  
18      vicinity, and available historical groundwater elevation measurements in wells at the site.
- 19   **Appendix B** – Contains responses to SCDHEC comments for AOCs 551 and 552 from the  
20      *Zone E RFI Report, Revision 0* (EnSafe, 1997).
- 21   **Appendix C** – Includes Figure C-1, which presents the site location from the Public Works  
22      Map of the Charleston Navy Shipyard dated December 15, 1939, depicting the presence of  
23      railroad lines at the site.
- 24   **Appendix D** – Copies of analytical reports and data validation summaries for sampling  
25      conducted during May 2003.
- 26   All figures and tables appear at the end of their respective sections.



**Figure 1-1**  
 Location of AOCs 551 and 552 in Zone E  
 Charleston Naval Complex

File Path: c:\118\charleston\del\zone\_e\ch2m\551\_552.dwg Date: 21 Jul 2002 14:47 User: DMILKY



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



0 40 80 Feet

1 inch = 50 feet

**Figure 1-2**  
Aerial Photograph of AOCs 551 and 552, Zone E  
Charleston Naval Complex



## 2.0 Summary of RFI Conclusions for AOCs 551 and 552

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This section summarizes the results and conclusions from the soil and groundwater investigations conducted at AOCs 551 and 552 which were reported in the *Zone E RFI Report, Revision 0* (EnSafe, 1997). Appendix A contains excerpts from the RFI report, including a summary of detections of chemicals and a groundwater flow map for the site vicinity.

As part of the Zone E RFI, soil and groundwater investigations were conducted at AOCs 551 and 552 during 1995 - 1998. The *Zone E RFI Report, Revision 0* presented the results of these investigations and conclusions concerning contamination and risk, as summarized in the following sections. A further evaluation of COCs at this site is provided in Section 5.0. Figure 2-1 shows RFI soil and groundwater sampling locations.

### 2.1 Soil Sampling and Analysis

The RFI at AOCs 551 and 552 included the collection and analysis of 10 surface and 9 subsurface soil samples from locations under concrete and asphalt pavement during two sampling events. Samples from the first sampling event were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, and pH. Two surface soil samples were selected as duplicates and were analyzed for VOCs and SVOCs, as well as herbicides, organophosphorous (OP) pesticides, hexavalent chromium, and dioxins. The samples from the second sampling event were analyzed for SVOCs, metals, and pH. No duplicate samples were collected during the second sampling event.

#### 2.1.1 Surface Soil Results

During the RFI, surface soil detections of organic compounds were evaluated against the U.S. Environmental Protection Agency (EPA) Region III industrial risk-based concentrations (RBCs) (with a hazard index [HI]=0.1 for noncarcinogens). Surface soil detections of inorganic compounds were evaluated against the EPA Region III industrial RBCs (HI=0.1 for noncarcinogens) and the Zone E background reference concentrations (BRCs).

Detected concentrations of organic and inorganic analytes exceeding their respective criteria were as follows:

- 1 • **VOCs:** No VOCs exceeded the screening criteria in surface soils.
- 2 • **SVOCs:** Detected SVOC concentrations did not exceed the screening criteria.
- 3 • **Inorganics:** No inorganic detections exceeded the screening criteria in surface soils.
- 4 • **Dioxins:** No dioxin detections exceeded the screening criteria in surface soils.

## 5 **2.1.2 Subsurface Soil Results**

6 During the RFI, subsurface soil detections of organic compounds were compared with  
7 generic soil screening levels (SSLs) (using a dilution attenuation factor [DAF]=10).

8 Subsurface soil detections of inorganic compounds were compared with generic SSLs (using  
9 a DAF=10) and the Zone E BRCs.

10 Detected concentrations of organic and inorganic compounds from subsurface soil samples  
11 are as follows:

- 12 • **VOCs:** No VOCs exceeded the screening criteria in surface soils.
- 13 • **SVOCs:** One benzo[a]anthracene detection, E552SB002 (800 micrograms per kilogram  
14 [ $\mu\text{g}/\text{kg}$ ]) exceeded its SSL of 700  $\mu\text{g}/\text{kg}$ .
- 15 • **Inorganics:** One barium detection, E551SB003 (136 milligrams per kilogram [ $\text{mg}/\text{kg}$ ]),  
16 exceeded both its SSL of 32  $\text{mg}/\text{kg}$  and its subsurface soil BRC of 94.1  $\text{mg}/\text{kg}$ .

## 17 **2.2 Groundwater Sampling and Analysis**

18 Two shallow monitoring wells, E551GW001 and E551GW002, and one deep monitoring  
19 well, E551GW02D, were installed during the RFI, at locations shown in Figure 2-1.

20 Groundwater samples were analyzed for VOCs, SVOCs, metals, chlorides, sulfates, total  
21 dissolved solids (TDS), and pH. Groundwater samples from the wells were analyzed for  
22 metals during four sampling events in 1996 and 1997. SVOCs were analyzed for during two  
23 sampling events in 1996. VOCs were analyzed for during a total of four sampling events,  
24 two of which occurred in 1996 and the other two in 1998. No duplicate samples were  
25 collected at this site. Detections in groundwater samples were compared with the EPA  
26 Region III tap water RBCs, maximum contaminant levels (MCLs) and, for inorganics, the  
27 Zone E shallow groundwater BRCs. Results from the first groundwater sampling event  
28 were presented in the *Zone E RFI Report, Revision 0*.

29 During a review of the Revision 0 of this RFIRA, SCDHEC suggested that an explanation be  
30 provided for data qualifiers that include an "S", such as "SU", "S=" and "SJ". These  
31 qualifiers are associated with analytical results of VOCs from the 1998 sampling events. It  
32 appears that these qualifiers have been used with analytical results that may not have  
33 undergone final validation, after initial validation by the offsite analytical laboratory. The

1 "S" represents data to be used for "screening". Analytical results with "S" qualifiers have  
2 been accepted by the CNC BCT as valid for decision-making. Table 2-1 includes the  
3 analytical results with "S" qualifiers from the RFI sampling effort.

#### 4 **2.2.1 Shallow Groundwater Results**

5 Analyte concentrations in shallow groundwater samples were detected as follows at this  
6 site:

7 **VOCs:** There were no VOC detections above laboratory detection limits in shallow  
8 groundwater samples from AOCs 551 and 552.

9 **SVOCs:** There were no detections of SVOC concentrations above screening criteria.

10 **Inorganics:** The *Zone E RFI Report, Revision 0* reported results for the first sampling event  
11 only. Among detected inorganic analytes, iron exceeded the screening criteria.

- 12 • Iron, at a concentration of 14,600 micrograms per liter ( $\mu\text{g}/\text{L}$ ) at E551GW002, exceeded  
13 its tap water RBC at concentration of 1,100  $\mu\text{g}/\text{L}$ . No MCL or shallow groundwater BRC  
14 was developed for iron in Zone E during the RFI.

#### 15 **2.2.2 Deep Groundwater Results**

16 Analyte concentrations in deep groundwater samples were detected as follows at this site:

17 **VOCs:** Among detected analytes, tetrachloroethene (PCE) and trichloroethene (TCE)  
18 exceeded the screening criteria.

- 19 • PCE, at a concentration of 2  $\mu\text{g}/\text{L}$  at E551GW02D, exceeded its tap water RBC of 1.1  
20  $\mu\text{g}/\text{L}$ . The detection did not exceed the PCE MCL of 5  $\mu\text{g}/\text{L}$ .

- 21 • TCE, at a concentration of 2  $\mu\text{g}/\text{L}$  at E551GW02D, exceeded its tap water RBC of 1.6  
22  $\mu\text{g}/\text{L}$ . The detection did not exceed the TCE MCL of 5  $\mu\text{g}/\text{L}$ .

23 **SVOCs:** There were no SVOC detections above laboratory detection limits in deep  
24 groundwater samples from AOCs 551 and 552.

25 **Inorganics:** Among detected inorganic analytes, arsenic and iron exceeded the screening  
26 criteria.

- 27 • Arsenic, at a concentration of 21.2  $\mu\text{g}/\text{L}$  at E551GW02D, exceeded both its tap water  
28 RBC of 0.0450  $\mu\text{g}/\text{L}$  and deep groundwater BRC of 16.4  $\mu\text{g}/\text{L}$ , but not its MCL of 50  
29  $\mu\text{g}/\text{L}$ .

- 1 • Iron, at a concentration of 2,570 µg/L, at E551GW02D, exceeded its tap water RBC of  
2 1,100 µg/L. No primary MCL exists for iron, and no shallow groundwater BRC was  
3 developed for iron in Zone E during the RFI.

## 4 **2.3 RFI Human Health Risk Assessment (HHRA)**

5 The *Zone E RFI Report Revision 0* used a fixed-point risk evaluation (FRE) approach at this  
6 site. The FRE included site resident and site worker exposure scenarios. The detailed risk  
7 assessment for the AOCs 551 and 552 site are presented in Section 10.25.6 of the *Zone E RFI*  
8 *Report, Revision 0* (EnSafe, 1997).

### 9 **2.3.1 Soils**

10 Lead and benzo[a]pyrene equivalents (BEQs) were retained as COCs for surface soil for the  
11 unrestricted (i.e., residential) land use scenario. No COCs were identified for surface soil  
12 under the industrial land use scenario. No COCs were identified for subsurface soils at  
13 AOCs 551 and 552.

### 14 **2.3.2 Groundwater**

15 Thallium was retained as a shallow groundwater COC for the unrestricted (i.e., residential)  
16 land use scenario.

17 Arsenic and PCE were retained as deep groundwater COCs for the residential land use  
18 scenario.

## 19 **2.4 RFI Conclusions and Recommendations**

20 The *Zone E RFI Report, Revision 0* recommended that a Corrective Measures Study (CMS) be  
21 conducted at AOCs 551 and 552 for surface soil and shallow and deep groundwater to  
22 address the analytes identified as COCs under the residential land use scenario.

**TABLE 2-1**  
 VOC Detections in Groundwater, 1998 Sampling  
 AOCs 551 and 552 RFI Report Addendum, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Result ( $\mu\text{g/L}$ )	Qualifier	Date Sampled	EPA Region III Tapwater RBC (HI=0.1) ( $\mu\text{g/L}$ )	MCL ( $\mu\text{g/L}$ )
1,2-Dichloroethene	551GW00101	E551GW001	5.0	U	04/09/1996	5.48	70
	551GW00101a	E551GW001	5.0	SU	03/05/1998		
	551GW00102	E551GW001	5.0	U	07/24/1996		
	551GW00201	E551GW002	5.0	U	04/09/1996		
	551GW00201a	E551GW002	5.0	SU	03/04/1998		
	551GW00202	E551GW002	5.0	U	07/25/1996		
	551GW02D01	E551GW02D	5.0	U	04/10/1996		
	551GW02D01a	E551GW02D	7.0	S=	03/04/1998		
	551GW02D02	E551GW02D	5.0	U	07/25/1996		
Methylene chloride	551GW00101	E551GW001	5.0	U	04/09/1996	4.1	5
	551GW00101a	E551GW001	5.0	SU	03/05/1998		
	551GW00102	E551GW001	5.0	U	07/24/1996		
	551GW00102a	E551GW001	2.0	SJ	10/10/1998		
	551GW00201	E551GW002	5.0	U	04/09/1996		
	551GW00201a	E551GW002	5.0	SU	03/04/1998		
	551GW00202	E551GW002	5.0	U	07/25/1996		
	551GW00202a	E551GW002	2.0	SJ	10/10/1998		
	551GW02D01	E551GW02D	5.0	U	04/10/1996		
	551GW02D01a	E551GW02D	5.0	SU	03/04/1998		
	551GW02D02	E551GW02D	5.0	U	07/25/1996		
	551GW02D02a	E551GW02D	2.0	SJ	10/10/1998		
	551GW02DN1	E551GW02D	5.0	U	05/19/2003		
	Trichloroethylene	551GW00101	E551GW001	5.0	U		
551GW00101a		E551GW001	5.0	SU	03/05/1998		
551GW00102		E551GW001	4.0	J	07/24/1996		
551GW00102a		E551GW001	5.0	SU	10/10/1998		
551GW00201		E551GW002	5.0	U	04/09/1996		
551GW00201a		E551GW002	5.0	SU	03/04/1998		
551GW00202		E551GW002	5.0	U	07/25/1996		
551GW00202a		E551GW002	5.0	SU	10/10/1998		
551GW02D01		E551GW02D	2.0	J	04/10/1996		
551GW02D01a		E551GW02D	21.0	S=	03/04/1998		
551GW02D02		E551GW02D	2.0	J	07/25/1996		
551GW02D02a		E551GW02D	1.0	SJ	10/10/1998		
551GW02DN1		E551GW02D	5.0	U	05/19/2003		

**TABLE 2-1**  
 VOC Detections in Groundwater, 1998 Sampling  
 AOCs 551 and 552 RFI Report Addendum, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Result ( $\mu\text{g/L}$ )	Qualifier	Date Sampled	EPA Region III Tapwater RBC (HI=0.1) ( $\mu\text{g/L}$ )	MCL ( $\mu\text{g/L}$ )
Tetrachloroethylene	551GW00101	E551GW001	5.0	U	04/09/1996	1.1	5
	551GW00101a	E551GW001	5.0	SU	03/05/1998		
	551GW00102	E551GW001	5.0	U	07/24/1996		
	551GW00102a	E551GW001	5.0	SU	10/10/1998		
	551GW00201	E551GW002	5.0	U	04/09/1996		
	551GW00201a	E551GW002	5.0	SU	03/04/1998		
	551GW00202	E551GW002	5.0	U	07/25/1996		
	551GW00202a	E551GW002	5.0	SU	10/10/1998		
	551GW02D01	E551GW02D	2.0	J	04/10/1996		
	551GW02D01a	E551GW02D	2.0	SJ	03/04/1998		
	551GW02D02	E551GW02D	5.0	U	07/25/1996		
	551GW02D02a	E551GW02D	5.0	SU	10/10/1998		
	551GW02DN1	E551GW02D	5.0	U	05/19/2003		

$\mu\text{g/L}$  micrograms per liter

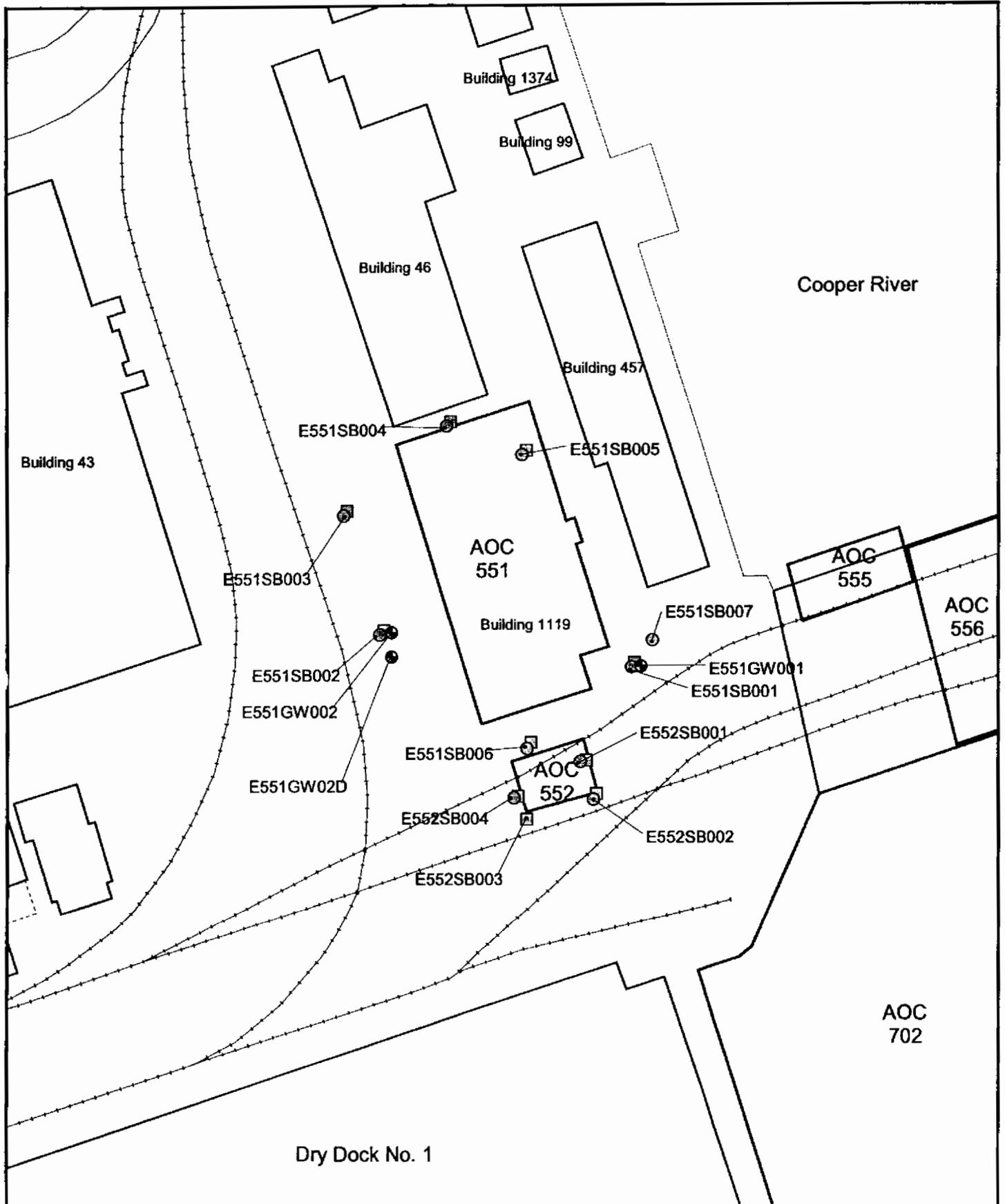
MCL maximum Contaminant Level

U indicates that the concentration was not detected laboratory detection limit.

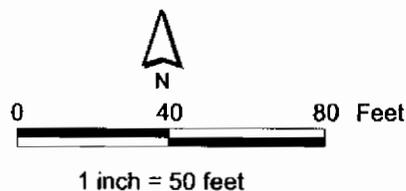
UJ indicates that the concentration was not detected and is estimated.

S indicates that the data was not formally validated, but can be used for COPC screening and decision-making

Data in **bold** indicate exceedance of screening criteria.



- Groundwater Well
- ⊙ Surface Soil
- ⊞ Subsurface Soil
- ⋈ Fence
- ⋈ Railroads
- ⋈ Roads
- ▭ AOC Boundary
- ▭ Buildings



**Figure 2-1**  
RFI Sampling Locations  
AOCs 551 and 552  
Charleston Naval Complex



## 1 **3.0 Interim Measures and UST/AST Removals**

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### 2 **3.1 UST/AST Removals**

3 There is no indication of an underground storage tank (UST) or aboveground storage tank  
4 (AST) being present at this site.

### 5 **3.2 Interim Measures**

6 There were no IMs conducted at the site.

## **Section 4.0**

## 1 **4.0 Summary of Additional Investigations**

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2 Based on a review of the *RFI Report Addendum, AOCs 551 and 552, Revision 0* (CH2M-Jones,  
3 2002), SCDHEC suggested that due to elevated metals detection in the RFI soil boring  
4 E551SB006, additional soil sampling around this boring location be conducted to verify if  
5 concentrations are indicative of a release of metals in the soils in this area. This delineation  
6 sampling was conducted by CH2M-Jones during May 2003. Four soil sampling locations  
7 around E551SB006 were identified as E551SB008, E551SB009, E551SB010 and E551SB011, as  
8 shown in Figure 4-1. These sampling locations were installed as proposed in the sampling  
9 and analysis plan approved by SCDHEC in May 2003. Soil boring E551SB008 could not be  
10 advanced due to subsurface obstructions in the area. Surface and subsurface soils in the  
11 remaining three boring locations were sampled for antimony, cadmium, lead, and zinc. The  
12 analytical results are summarized in Table 4-1, and the analytical results reports and data  
13 validation summaries are included in Appendix D.

14 As presented in Table 4-1, none of the detected metals concentrations exceeds the  
15 unrestricted or industrial land use screening criteria adopted by the CNC BCT, indicating  
16 that an elevated source of metals does not appear to exist in the vicinity of E551SB006.

17 Additionally, a groundwater sample from the upgradient deep well E551GW02D was also  
18 collected during May 2003 and analyzed for VOCs to verify the presence of a potential  
19 upgradient deep groundwater source of VOCs. Table 4-2 shows the detected concentrations  
20 of VOCs in this sample, which indicate that no VOCs were detected above laboratory  
21 detection limits in the sample from E551GW02D. The recent data do not indicate that the  
22 groundwater in the deeper zone of the aquifer near AOCs 551 and 552 is currently being  
23 impacted by an upgradient source.

1

**TABLE 4-1**  
 Surface and Subsurface Soil Detections - May 2003 Soil Sampling  
 RFI Report Addendum, AOCs 551 and 552, Zone E, Charleston Naval Complex

Parameter	StationID	SampleID	Result (mg/kg)	Qualifier	Date Collected	EPA Region III RBC (with a HI = 0.1) (mg/kg)	SSL (DAF= 10) (mg/kg)	Max. Zone E Backgrd. Conc. (mg/kg)
<b>Surface Soil</b>								
Antimony	E551SB009	551SB00901	0.712	U	05/20/2003	3.1	3	7.4
	E551SB010	551SB01001	0.742	U	05/19/2003			
	E551SB011	551SB01101	0.701	U	05/20/2003			
Cadmium	E551SB009	551SB00901	0.53	J	05/20/2003	8	4	1.5
	E551SB010	551SB01001	0.088	U	05/19/2003			
	E551SB011	551SB01101	0.60	J	05/20/2003			
Lead	E551SB009	551SB00901	1.24	=	05/20/2003	400	400	400
	E551SB010	551SB01001	39.70	=	05/19/2003			
	E551SB011	551SB01101	150.00	=	05/20/2003			
Zinc	E551SB009	551SB00901	16.70	=	05/20/2003	2,346	6,200	855
	E551SB010	551SB01001	44.50	=	05/19/2003			
	E551SB011	551SB01101	143.00	=	05/20/2003			
<b>Subsurface Soil</b>								
Antimony	E551SB009	551SB00902	0.711	U	05/20/2003	NA	3	1.6
	E551SB010	551SB01002	0.789	U	05/19/2003			
	E551SB011	551SB01102	0.856	U	05/20/2003			
Cadmium	E551SB009	551SB00902	0.47	J	05/20/2003	NA	4	0.96
	E551SB010	551SB01002	0.094	U	05/19/2003			
	E551SB011	551SB01102	0.34	J	05/20/2003			
Lead	E551SB009	551SB00902	9.97	=	05/20/2003	NA	400	322
	E551SB010	551SB01002	5.95	=	05/19/2003			
	E551SB011	551SB01102	132.00	=	05/20/2003			
Zinc	E551SB009	551SB00902	30.60	=	05/20/2003	NA	6,200	438
	E551SB010	551SB01002	40.70	=	05/19/2003			
	E551SB011	551SB01102	165.00	=	05/20/2003			

NA not applicable  
 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 concentration was not detected.  
 UJ indicates that the concentration was not detected and is estimated.

**TABLE 4-2**  
 Analytical Results of Groundwater Sampling at E552GW02D, AOCs 551 and 552, May 2003  
 RFI Report Addendum, AOCs 551 and 552, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Sampled
1,1,1-Trichloroethane	E551GW02D	551GW02DN1	5	U	05/19/2003
1,1,2,2-Tetrachloroethane	E551GW02D	551GW02DN1	5	U	05/19/2003
1,1,2-Trichloroethane	E551GW02D	551GW02DN1	5	U	05/19/2003
1,1-Dichloroethane	E551GW02D	551GW02DN1	5	U	05/19/2003
1,1-Dichloroethene	E551GW02D	551GW02DN1	5	U	05/19/2003
1,2,3-Trichlorobenzene	E551GW02D	551GW02DN1	5	U	05/19/2003
1,2,4-Trichlorobenzene	E551GW02D	551GW02DN1	5	U	05/19/2003
1,2-Dichlorobenzene	E551GW02D	551GW02DN1	5	U	05/19/2003
1,2-Dichloroethane	E551GW02D	551GW02DN1	5	U	05/19/2003
1,2-Dichloroethene (total)	E551GW02D	551GW02DN1	5	U	05/19/2003
1,2-Dichloropropane	E551GW02D	551GW02DN1	5	U	05/19/2003
1,3-Dichlorobenzene	E551GW02D	551GW02DN1	5	U	05/19/2003
1,4-Dichlorobenzene	E551GW02D	551GW02DN1	5	U	05/19/2003
2-Hexanone	E551GW02D	551GW02DN1	10	U	05/19/2003
Acetone	E551GW02D	551GW02DN1	10	U	05/19/2003
Benzene	E551GW02D	551GW02DN1	5	U	05/19/2003
Bromodichloromethane	E551GW02D	551GW02DN1	5	U	05/19/2003
Bromoform	E551GW02D	551GW02DN1	5	U	05/19/2003
Bromomethane	E551GW02D	551GW02DN1	10	U	05/19/2003
Carbon Disulfide	E551GW02D	551GW02DN1	5	U	05/19/2003
Carbon Tetrachloride	E551GW02D	551GW02DN1	5	U	05/19/2003
Chlorobenzene	E551GW02D	551GW02DN1	5	U	05/19/2003
Chloroethane	E551GW02D	551GW02DN1	10	U	05/19/2003
Chloroform	E551GW02D	551GW02DN1	5	U	05/19/2003
Chloromethane	E551GW02D	551GW02DN1	10	UJ	05/19/2003
cis-1,2-Dichloroethylene	E551GW02D	551GW02DN1	5	U	05/19/2003
cis-1,3-Dichloropropene	E551GW02D	551GW02DN1	5	U	05/19/2003
Dibromochloromethane	E551GW02D	551GW02DN1	5	U	05/19/2003
Ethylbenzene	E551GW02D	551GW02DN1	5	U	05/19/2003
m+p Xylene	E551GW02D	551GW02DN1	5	U	05/19/2003
Methyl ethyl ketone (2-Butanone)	E551GW02D	551GW02DN1	10	U	05/19/2003
Methyl isobutyl ketone (4-Methyl-2-pentanone)	E551GW02D	551GW02DN1	10	U	05/19/2003
Methylene Chloride	E551GW02D	551GW02DN1	5	U	05/19/2003
o-Xylene	E551GW02D	551GW02DN1	5	U	05/19/2003
Styrene	E551GW02D	551GW02DN1	5	U	05/19/2003
Tetrachloroethylene (PCE)	E551GW02D	551GW02DN1	5	U	05/19/2003

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Sampled
Toluene	E551GW02D	551GW02DN1	5	U	05/19/2003
trans-1,2-Dichloroethene	E551GW02D	551GW02DN1	5	U	05/19/2003
trans-1,3-Dichloropropene	E551GW02D	551GW02DN1	5	U	05/19/2003
Trichloroethylene (TCE)	E551GW02D	551GW02DN1	5	U	05/19/2003
Vinyl acetate	E551GW02D	551GW02DN1	10	U	05/19/2003
Vinyl chloride	E551GW02D	551GW02DN1	10	U	05/19/2003
Xylenes, Total	E551GW02D	551GW02DN1	5	U	05/19/2003

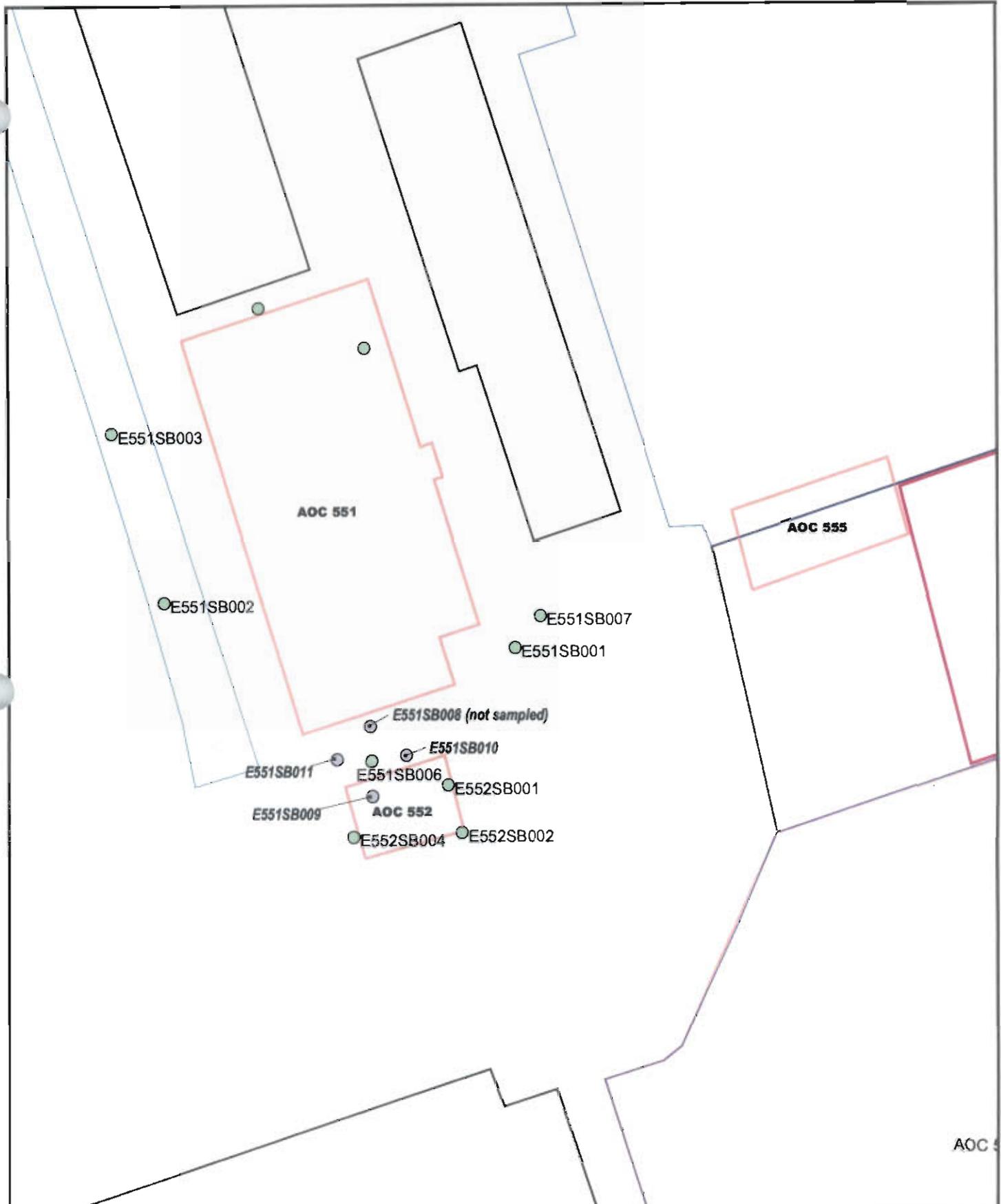
$\mu\text{g/L}$  micrograms per liter

MCL maximum contaminant level

U indicates that the concentration was not detected laboratory detection limit.

UJ indicates that the concentration was not detected and is estimated.

1



Soil Borings with labels in italics represent May 2003 sampling locations. Other locations are from RFI.

- Soil Sampling Locations
- Roads
- AOC Boundary
- SWMU Boundary



**Figure 4-1**  
 May 2003 and RFI Soil Sampling Locations  
 AOCs 551 and 552, Zone E  
 Charleston Naval Complex



## 1 5.0 COPC/COC Refinement

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2 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) did not identify any COCs for the industrial  
3 land use scenario at AOCs 551 and 552. Therefore, the site is suitable for immediate use  
4 under an industrial land use-based scenario. Under the unrestricted (i.e., residential) land  
5 use scenario, BEQs and lead were identified as surface soil COCs, thallium as a shallow  
6 groundwater COC, and arsenic and PCE as deep groundwater COCs for AOCs 551 and 552.  
7 The nature of occurrence and the relevance of the chemicals at these sites is further  
8 discussed below to expedite site closeout.

9 Additional soil sampling for metals and groundwater sampling for VOCs conducted during  
10 May 2003 did not identify COCs at the locations sampled, as discussed in Section 4.0.

11 In addition, the BCT has agreed to rescreen VOC detections against generic SSLs, using a  
12 DAF of 1. The rescreening is summarized in Table 5-1.

### 13 5.1 COCs in Soil

#### 14 5.1.1 BEQs

15 It was reported in the *Zone E RFI Report, Revision 0* that among detected SVOC compounds,  
16 BEQ concentrations (8.9 – 479  $\mu\text{g}/\text{kg}$ ) did not exceed the industrial RBC of 780  $\mu\text{g}/\text{kg}$ .  
17 However, BEQs were identified in the RFI report as a surface soil COC for unrestricted (i.e.,  
18 residential) land use based on exceedances of the EPA Region III residential RBC of 88  
19  $\mu\text{g}/\text{kg}$  for benzo[a]pyrene. Based on the BEQ calculation method adopted by the CNC BCT,  
20 the BEQ concentrations in the surface soil samples range from 274  $\mu\text{g}/\text{kg}$  to 871  $\mu\text{g}/\text{kg}$  and  
21 do not exceed the CNC BEQ sitewide surface soil reference concentration of 1,304  $\mu\text{g}/\text{kg}$ , as  
22 shown in Table 5-1. Direct exposure to these BEQ concentrations is not a concern in this  
23 highly industrialized area of Zone E.

24 The detected BEQs are possibly associated with the previous and existing railroad lines at  
25 the site, and are not likely associated with site operations at AOCs 551 and 552. Figure C-1  
26 shows the presence of historic railroad lines at the site. Almost all of these samples are  
27 under asphalt pavement, which could also be a source of the detected BEQs. Subsurface soil  
28 BEQ detections, which ranged from 450.65  $\mu\text{g}/\text{kg}$  to 1,038.21  $\mu\text{g}/\text{kg}$ , did not exceed the  
29 CNC BEQ sitewide subsurface soil reference concentration of 1,400  $\mu\text{g}/\text{kg}$ , as shown in  
30 Table 5-1. No BEQs were detected in groundwater at this site, indicating that BEQs are not a

1 leaching concern at this site. For these reasons, BEQs are not considered COCs for surface  
2 soil at this site.

### 3 **5.1.2 Lead**

4 Lead was detected in a single surface soil sample collected from AOCs 551 and 552 above  
5 the residential target screening criterion of 400 mg/kg and the maximum Zone E  
6 background concentration for lead in surface soil of 400 mg/kg. The surface soil sample  
7 from E551SB006 showed a lead concentration of 934 mg/kg. Additional soil sampling  
8 conducted during May 2003 at three locations, each approximately 10 feet away from  
9 E551SB006, did not show the presence of lead above the target screening criterion of 400  
10 mg/kg for unrestricted land use, indicating that there is no significant release of lead in  
11 soils in this area. The site average concentration calculated for lead in surface soil is 112  
12 mg/kg (see Table 5-1), which is below the unrestricted land use criterion for lead of 400  
13 mg/kg. The detection was also below the EPA's Adult Lead Methodology (ALM) cleanup  
14 value for industrial sites of 1,218 mg/kg. Details of this methodology are found in *Technical*  
15 *Memorandum: Adult Lead Methodology (ALM) Derived Target Lead Concentrations for Industrial*  
16 *Land Use* (CH2M-Jones, 2001). Direct exposure to these concentrations is not a concern in  
17 this highly industrialized area of Zone E. Lead was not detected in groundwater wells  
18 associated with AOCs 551 and 552, indicating that it is not a leachability concern at this site.  
19 Based on these observations, lead is not considered a COC at this site.

### 20 **5.1.3 Soil VOC Screening using SSL at DAF=1**

21 Soil VOC detections were compared to generic SSLs at DAF =1, and only one chemical,  
22 methylene chloride, exceeded this screening criterion.

23 Methylene chloride was detected in one of nine subsurface soil samples and was not  
24 detected in the nine surface soil samples. Methylene chloride was detected in a single  
25 subsurface soil sample at 30 µg/kg, collected at sample location E552SB001. This is above the  
26 SSL (DAF=1) of 1 µg/kg, as shown in Table 5-1. This detection does not represent  
27 widespread distribution of methylene chloride in soil at the AOCs 551 and 552 site.

28 In groundwater, methylene chloride was detected during the second quarterly groundwater  
29 monitoring event in the shallow and deep monitoring wells at a concentration of 2 µg/L,  
30 which is below the MCL of 5 µg/L. Methylene chloride was not detected in groundwater  
31 during the preceding sampling event and subsequent two sampling events. This intermittent  
32 methylene chloride detection in groundwater samples collected from monitoring wells  
33 associated with AOCs 551 and 552 indicate that methylene chloride in soil does not likely  
34 pose a threat to groundwater via leaching.

1 Methylene chloride was detected in one of the laboratory blank samples associated with the  
2 AOCs 551 and 552 sample data group (SDG 23663) at a concentration of 300  $\mu\text{g}/\text{kg}$ , as  
3 shown in Appendix A. Methylene chloride is a recognized common laboratory contaminant  
4 and has been widely detected previously in many blanks associated with CNC samples.  
5 Based on EPA's "ten times rule," methylene chloride at concentrations up to 3,000 parts per  
6 billion (ppb) may be considered as possible laboratory contamination. Because of its  
7 presence in one of the laboratory blanks and a single site sample, it is likely that methylene  
8 chloride is detected due to contamination as a laboratory contaminant. It is unlikely to be  
9 associated with site operations at combined AOCs 551 and 552.

10 For these reasons, methylene chloride is not considered a COC for soil at this site.

## 11 **5.2 COCs in Groundwater**

### 12 **5.2.1 Arsenic**

13 During the RFI, arsenic was detected in the deep well 551GW02D during all four  
14 groundwater sampling events, as shown in Table 5-2. The detections ranged from 15.4  $\mu\text{g}/\text{L}$   
15 to 25.4  $\mu\text{g}/\text{L}$ , and these three detections exceeded the tap water RBC. However, none of  
16 these detections exceeded the South Carolina MCL of 50  $\mu\text{g}/\text{L}$  or the maximum Zone E  
17 deep groundwater background arsenic concentration of 132  $\mu\text{g}/\text{L}$ , indicating that these  
18 arsenic concentrations in deep groundwater are attributable to natural occurrence. For these  
19 reasons arsenic is not a shallow groundwater COC for this site.

### 20 **5.2.2 Thallium**

21 During the RFI, thallium was detected in the shallow wells at concentrations of 3.1  $\mu\text{g}/\text{L}$   
22 and 4.4  $\mu\text{g}/\text{L}$  at E551GW001 and E551GW002, respectively, exceeding the MCL of 2  $\mu\text{g}/\text{L}$ ,  
23 as shown in Table 5-2. However, none of the thallium detections exceeded the maximum  
24 Zone E shallow background thallium concentration of 6  $\mu\text{g}/\text{L}$ . Based on the information  
25 presented above, thallium is not a groundwater COC for this site.

### 26 **5.2.3 PCE**

27 The RFI report considered PCE as a COC at AOCs 551 and 552 based on its detection in  
28 deep groundwater sample, 5551GW02D, at a concentration of 2  $\mu\text{g}/\text{L}$ , that exceeded the tap  
29 water RBC for PCE of 1.1  $\mu\text{g}/\text{L}$ . However, the detection did not exceed the PCE MCL of 5  
30  $\mu\text{g}/\text{L}$ , as shown in Table 5-2. During the three subsequent sampling events, PCE at  
31 5551GW02D was either not detected above laboratory detection limits, or detected at  
32 concentration below the MCL. PCE was not detected in the two shallow wells associated

1 with AOCs 551 and 552 during the four RFI groundwater sampling events. Based on the  
2 information presented above, PCE is not a groundwater COC for this site.

### 3 **5.2.4 TCE in Deep Groundwater**

4 The RFI risk assessment did not consider TCE as a COC at AOCs 551 and 552. It was  
5 detected in deep groundwater sample, 5551GW02D, at a concentration of 2  $\mu\text{g}/\text{L}$ , that  
6 exceeded the tap water RBC for TCE of 1.6  $\mu\text{g}/\text{L}$ . However, the detection did not exceed the  
7 TCE MCL of 5  $\mu\text{g}/\text{L}$ , as shown in Table 5-2. During the third sampling event, TCE was  
8 detected at a concentration of 21  $\mu\text{g}/\text{L}$  at 5551GW02D, exceeding its MCL. However this  
9 detection was preceded and followed by detected concentrations that were below the MCL.  
10 TCE was detected only once in the two shallow wells associated with AOCs 551 and 552  
11 during the four RFI groundwater sampling events. The detection at a concentration of 4  
12  $\mu\text{g}/\text{L}$  at E551GW001 was below the MCL of 5  $\mu\text{g}/\text{L}$ . There are no data to indicate that site  
13 activities at AOCs 551 or 552 are a source of TCE contamination. Based on the information  
14 presented above, TCE is not a groundwater COC for this site.

## 15 **5.3 COC Summary**

16 No COCs were identified under the industrial land use scenario. After review of the site  
17 data, no COCs under the unrestricted land use scenario are identified.

**TABLE 5-1**  
 Detected Concentrations of BEQs, Lead, and Methylene Chloride in Surface and Subsurface Soil  
 RFI Report Addendum, AOCs 551 and 552, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Concentration	Qualifier	Date Collected	EPA Region III Residential RBC	SSL	Zone E Background Range of Conc.
<b>BEQs<sup>a</sup></b>	<b>Surface Soil</b>					88	NA	1,304
	E551SB001	551SB00101	831.96	U	09/29/1995			
	E551SB002	551SB00201	924.40	U	09/29/1995			
	E551SB003	551SB00301	538.26	=	10/02/1995			
	E551SB004	551SB00401	273.45	=	10/02/1995			
	E551SB005	551SB00501	901.29	U	09/29/1995			
	E551SB006	551SB00601	367.50	=	09/29/1995			
	E551SB007	551SB00701b	427.54	U	09/18/1996			
	E552SB001	552SB00101	427.54	U	09/28/1995			
	E552SB002	552SB00201	443.64	=	09/28/1995			
	E552SB004	552SB00401	871.19	=	09/29/1995			
	<b>Subsurface Soil</b>					88	NA	1,400
	E551SB001	551SB00102	913.53	=	09/29/1995			
	E551SB002	551SB00202	657.33	=	09/29/1995			
	E551SB003	551SB00302	587.44	=	10/02/1995			
	E551SB004	551SB00402	947.51	U	10/02/1995			
	E551SB005	551SB00502	982.18	U	09/29/1995			
	E551SB006	551SB00602	679.04	=	09/29/1995			
	E552SB001	552SB00102	450.65	U	09/28/1995			
E552SB002	552SB00202	1038.21	=	09/28/1995				
E552SB004	552SB00402	1005.29	U	09/29/1995				
<b>Lead</b>	<b>Surface Soil</b>					400	400	1 - 400
				<b>(mg/kg)</b>				
	E551SB001	551SB00101	17.9	J	09/29/1995			
	E551SB002	551SB00201	36.4	J	09/29/1995			
	E551SB003	551SB00301	74.1	J	10/02/1995			
	E551SB004	551SB00401	78.8	J	10/02/1995			
	E551SB005	551SB00501	24.1	J	09/29/1995			
	E551SB006	551SB00601	<b>934</b>	J	09/29/1995			
	E551SB007	551SB00701b	27.2	=	09/18/1996			
	E552SB001	552SB00101	10.5	=	09/28/1995			
	E552SB002	552SB00201	41.7	=	09/28/1995			
	E552SB004	552SB00401	29.6	J	09/29/1995			
	E551SB009	551SB00901	1.24	=	05/20/2003			
	E551SB010	551SB01001	39.70	=	05/19/2003			
	E551SB011	551SB01101	150.00	=	05/20/2003			
				<b>Site Average</b>	112			
	<b>Subsurface Soil</b>					400	400	1.8 - 322
	E551SB001	551SB00102	193.00	J	09/29/1995			
	E551SB002	551SB00202	106.00	J	09/29/1995			
E551SB003	551SB00302	168.00	J	10/02/1995				

**TABLE 5-1**  
 Detected Concentrations of BEQs, Lead, and Methylene Chloride in Surface and Subsurface Soil  
 RFI Report Addendum, AOCs 551 and 552, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Concentration	Qualifier	Date Collected	EPA Region III Residential RBC	SSL	Zone E Background Range of Conc.
<b>Lead</b>	<b>Subsurface Soil</b>					400	400	1.8 - 322
	E551SB004	551SB00402	2.30	J	10/02/1995			
	E551SB005	551SB00502	10.00	J	09/29/1995			
	E551SB006	551SB00602	344.00	J	09/29/1995			
	E552SB001	552SB00102	6.60	=	09/28/1995			
	E552SB002	552SB00202	59.80	=	09/28/1995			
	E552SB004	552SB00402	30.90	J	09/29/1995			
	E551SB009	551SB00902	9.97	=	05/20/2003			
	E551SB010	551SB01002	5.95	=	05/19/2003			
	E551SB011	551SB01102	132.00	=	05/20/2003			
<b>Methylene Chloride</b>	<b>Surface Soil</b>					85	1 (DAF=1)	NA
	E552SB004	552SB00401	6	U	09/29/1995			
	E552SB002	552SB00201	6	U	09/28/1995			
	E552SB001	552SB00101	6	U	09/28/1995			
	E551SB006	551SB00601	7	UJ	09/29/1995			
	E551SB005	551SB00501	6	U	09/29/1995			
	E551SB004	551SB00401	5	U	10/02/1995			
	E551SB003	551SB00301	6	U	10/02/1995			
	E551SB002	551SB00201	6	U	09/29/1995			
	E551SB001	551SB00101	5	U	09/29/1995			
	<b>Subsurface Soil</b>					85	1	NA
	E551SB006	551SB00602	190	U	09/29/1995			
	E551SB002	551SB00202	35	U	09/29/1995			
	E551SB001	551SB00102	32	U	09/29/1995			
	E552SB001	552SB00102	<b>30</b>	J	09/28/1995			
	E551SB005	551SB00502	8	U	09/29/1995			
	E552SB004	552SB00402	6	U	09/29/1995			
E552SB002	552SB00202	6	U	09/28/1995				
E551SB004	551SB00402	6	U	10/02/1995				
E551SB003	551SB00302	6	U	10/02/1995				

<sup>a</sup> BEQ calculation method based on background PAHs study report, *Technical Information for Development of Background BEQ values* (CH2M-Jones, February 2001).

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

- = 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 concentration was not detected.

**TABLE 5-2**  
 Detected Concentrations of Arsenic, Thallium, PCE, TCE, and Methylene Chloride in Shallow and Deep Groundwater  
 RFI Report Addendum, AOCs 551 and 552, Zone E, Charleston Naval Complex

Station ID	Sample ID	Concentration ( $\mu\text{g/L}$ )	Qualifier	Date Collected	EPA Region III Tap Water RBC	MCL
<b>Arsenic</b>					0.045	50 <sup>a</sup>
E551GW001	551GW00101	5.0	U	04/09/1996		
E551GW001	551GW00102	2.5	U	07/24/1996		
E551GW001	551GW00103	2.5	U	11/26/1996		
E551GW001	551GW00104	2.5	U	02/12/1997		
E551GW002	551GW00201	5.0	U	04/09/1996		
E551GW002	551GW00202	2.5	U	07/25/1996		
E551GW002	551GW00203	2.8	U	11/26/1996		
E551GW002	551GW00204	2.5	U	02/12/1997		
E551GW02D	551GW02D01	21.2	=	04/10/1996		
E551GW02D	551GW02D02	22.3	=	07/25/1996		
E551GW02D	551GW02D03	15.4	=	12/05/1996		
E551GW02D	551GW02D04	25.4	=	02/12/1997		
<b>Thallium</b>					0.26	2
E551GW001	551GW00101	5.0	U	04/09/1996		
E551GW001	551GW00102	5.9	U	07/24/1996		
E551GW001	551GW00103	3.3	U	11/26/1996		
E551GW001	551GW00104	3.1	J	02/12/1997		
E551GW002	551GW00201	5.0	U	04/09/1996		
E551GW002	551GW00202	2.7	U	07/25/1996		
E551GW002	551GW00203	3.5	U	11/26/1996		
E551GW002	551GW00204	4.4	J	02/12/1997		
E551GW02D	551GW02D01	5.0	U	04/10/1996		
E551GW02D	551GW02D02	2.7	U	07/25/1996		
E551GW02D	551GW02D03	2.7	UJ	12/05/1996		
E551GW02D	551GW02D04	2.7	U	02/12/1997		
<b>Tetrachloroethen (PCE)</b>					1.1	5
E551GW001	551GW00101	5.0	U	04/09/1996		
E551GW001	551GW00101a	5.0	SU	03/05/1998		
<b>Tetrachloroethene (PCE)</b>					1.1	5

**TABLE 5-2**  
 Detected Concentrations of Arsenic, Thallium, PCE, TCE, and Methylene Chloride in Shallow and Deep Groundwater  
 RFI Report Addendum, AOCs 551 and 552, Zone E, Charleston Naval Complex

Station ID	Sample ID	Concentration ( $\mu\text{g/L}$ )	Qualifier	Date Collected	EPA Region III Tap Water RBC	MCL
E551GW001	551GW00102	5.0	U	07/24/1996		
E551GW001	551GW00102a	5.0	SU	10/10/1998		
E551GW002	551GW00201	5.0	U	04/09/1996		
E551GW002	551GW00201a	5.0	SU	03/04/1998		
E551GW002	551GW00202	5.0	U	07/25/1996		
E551GW002	551GW00202a	5.0	SU	10/10/1998		
E551GW02D	551GW02D01	2.0	J	04/10/1996		
E551GW02D	551GW02D01a	2.0	SJ	03/04/1998		
E551GW02D	551GW02D02	5.0	U	07/25/1996		
E551GW02D	551GW02D02a	5.0	SU	10/10/1998		
<b>Trichloroethylene (TCE)</b>					1.6	5
E551GW001	551GW00101	5.0	U	04/09/1996		
E551GW001	551GW00102	4.0	J	07/24/1996		
E551GW001	551GW00101a	5.0	SU	03/05/1998		
E551GW001	551GW00102a	5.0	SU	10/10/1998		
E551GW002	551GW00201	5.0	U	04/09/1996		
E551GW002	551GW00202	5.0	U	07/25/1996		
E551GW002	551GW00201a	5.0	SU	03/04/1998		
E551GW002	551GW00202a	5.0	SU	10/10/1998		
E551GW02D	551GW02D01	2.0	J	04/10/1996		
E551GW02D	551GW02D02	2.0	J	07/25/1996		
E551GW02D	551GW02D01a	21.0	S=	03/04/1998		
E551GW02D	551GW02D02a	1.0	SJ	10/10/1998		
<b>Methylene Chloride</b>					4.1	5
E551GW001	551GW00101	5.00	U	04/09/1996		
E551GW001	551GW00101a	5.00	U	03/05/1998		
E551GW001	551GW00102	5.00	U	07/24/1996		
E551GW001	551GW00102a	2.00	J	10/10/1998		
E551GW002	551GW00201	5.00	U	04/09/1996		
<b>Methylene Chloride</b>					4.1	5

**TABLE 5-2**  
 Detected Concentrations of Arsenic, Thallium, PCE, TCE, and Methylene Chloride in Shallow and Deep Groundwater  
*RFI Report Addendum, AOCs 551 and 552, Zone E, Charleston Naval Complex*

Station ID	Sample ID	Concentration ( $\mu\text{g/L}$ )	Qualifier	Date Collected	EPA Region III Tap Water RBC	MCL
E551GW002	551GW00201a	5.0	SU	03/04/1998		
E551GW002	551GW00202	5.0	U	07/25/1996		
E551GW002	551GW00202a	2.0	SJ	10/10/1998		
E551GW02D	551GW02D01	5.0	U	04/10/1996		
E551GW02D	551GW02D01a	5.0	SU	03/04/1998		
E551GW02D	551GW02D02	5.0	U	07/25/1996		
E551GW02D	551GW02D02a	2.0	SJ	10/10/1998		

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

<sup>a</sup> MCL for arsenic currently in effect for the CNC project.

$\mu\text{g/L}$  Micrograms per liter

MCL Maximum Contaminant Level

= 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 concentration was not detected laboratory detection limit.

UJ Indicates that the concentration was not detected and is estimated.



## 1 **6.0 Summary of Information Related to Site** 2 **Closeout Issues**

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### 3 **6.1 RFI Status**

4 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) addressed SWMUs/AOCs within Zone E of  
5 the CNC, including AOCs 551 and 552. With submission of this RFI Report Addendum, the  
6 RFI is considered complete.

7 The remaining subsections address the issues that the BCT agreed to evaluate prior to site  
8 closeout.

### 9 **6.2 Presence of Inorganics in Groundwater**

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

15 There were no detections of arsenic or antimony in shallow wells above the laboratory  
16 detection limits. Intermittent detections of thallium in shallow groundwater at the site  
17 above the MCL do not point to a site-specific source, but can be attributed to natural  
18 occurrence. These detections did not exceed the maximum Zone E shallow groundwater  
19 background thallium concentration, as discussed in Section 5.5.2. Table 5-2 shows thallium  
20 concentrations from the RFI groundwater sampling at AOCs 551 and 552. These detections  
21 of thallium do not indicate a site-related thallium release.

22 There were no detections of antimony or thallium in deep wells above the laboratory  
23 detection limits. There were no detections of arsenic above the MCL in samples from the  
24 deep groundwater monitoring wells. Therefore, further evaluation of this issue is not  
25 warranted.

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

There are no data suggesting that there was an impact to the sanitary sewers from this site. Therefore, further evaluation of this issue is not warranted.

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

No COCs requiring further evaluation were identified at this site and no data suggest that impacts to the storm sewers have been caused by this site. Based on these findings, further evaluation of this issue is not warranted.

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

There is an existing railroad line that is within the boundary of AOC 552. This railroad line was likely constructed after the demolition of Building 1030 after 1929, as discussed earlier in Section 1.1. Figure C-1 in Appendix C shows the presence of historic railroad lines at the site from the Public Works Map of the CNC dated December 15, 1939. There is no known linkage between AOCs 551 and 552 and the investigated railroad lines of AOC 504. Therefore, further evaluation of this issue is not warranted.

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

The nearest surface water body to AOCs 551 and 552 is the Cooper River, which lies approximately 60 feet east of the site. The only potential migration pathway from the site to surface water is via overland flow via stormwater runoff. The entire site is covered with buildings and pavement, which eliminates contact of surface soil with stormwater. Similarly, runoff directed to the storm sewer system, which discharges to the Cooper River, does not contact the surface soil. Since no COCs requiring further evaluation are present at this site, no further evaluation of a potential pathway for contaminant migration via stormwater runoff is warranted.

1 **6.7 Potential Contamination in Oil/Water Separators (OWSs)**

2 There are no OWSs associated with AOCs 551 and 552. In addition, there is no reference to  
3 an OWS at the site in the *Oil Water Separator Data* report, Department of the Navy,  
4 September 2000. Therefore, further evaluation of this issue is not warranted.

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

6 The RFI Report Addendum screening did not identify any COCs in soil or groundwater at  
7 AOCs 551 and 552 for the unrestricted or industrial land use scenarios. Therefore, land use  
8 controls are not necessary.

9 However, the BCT has agreed that land use controls will be applied across all of Zone E at  
10 the CNC. These LUCs are expected to include, at a minimum, restrictions for future land  
11 use to non-residential use only. These LUCs will apply at the AOCs 551 and 552 site due to  
12 its location within Zone E.



## 1 **7.0 Recommendations**

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2 AOC 551 is Building 1119, a boiler house that operated before 1942. The building appears to  
3 have undergone drastic renovations, or it possibly may have been demolished and a new  
4 structure rebuilt on the same site. A boiler was located onsite, but no information was found  
5 to indicate the type of fuel used in it. Building 1119 is currently vacant.

6 AOC 552 is former Building 1030. From 1926 to 1929, the building housed a tooling shop. In  
7 1929, the building was converted to a storage shop and was later demolished. Currently, the  
8 site is paved with asphalt and traversed by a pair of railroad tracks.

9 The CNC RCRA Permit identified AOCs 551 and 552 as requiring a CSI.

10 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) did not identify any COCs for the industrial  
11 land use scenario. For the future unrestricted (i.e., residential) land use scenario, lead and  
12 BEQs in surface soil, thallium in shallow groundwater, and arsenic and PCE in deep  
13 groundwater were identified as COCs for unrestricted land use at the AOCs 551 and 552  
14 site. Further evaluation of COCs as discussed in Section 5.0 indicates that lead, BEQs,  
15 thallium, arsenic, and PCE are not COCs for the unrestricted or industrial land use  
16 scenarios at AOCs 551 and 552. No other COCs have been identified at this site and no  
17 further corrective action is necessary. Therefore, this site is suitable for continued industrial  
18 reuse without an active corrective measures. LUCs to limit site use to industrial will be  
19 implemented as part of the overall Zone E LUCs.

20 Once the BCT concurs that LUCs are appropriate for the site, a Statement of Basis will be  
21 prepared that will be made available for public comment in accordance with SCDHEC  
22 policy. This will allow for public participation in the final remedy selection.

**Section 8.0**

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## 1 8.0 References

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- 2 CH2M-Jones. *Technical Memorandum: A Summary of Inorganic Chemical Concentrations in*  
3 *Background Soil and Groundwater at the CNC.* 2001.
- 4 CH2M-Jones. *Technical Memorandum: Adult Lead Methodology (ALM) Derived Target Lead*  
5 *Concentrations for Industrial Land Use.* 2001.
- 6 South Carolina Department of Health and Environmental Control, Final RCRA Part B  
7 Permit No. SC0 170 022 560.
- 8 EnSafe Inc. *Zone E RFI Report, Revision 0, NAVBASE Charleston.* November 1997.
- 9 EnSafe Inc./Allen & Hoshall. *Final RCRA Facility Assessment, Naval Base Charleston.* June  
10 1995.
- 11 EnSafe Inc./Allen & Hoshall. *Final Zone E RFI Work Plan, Revision 1, Naval Base Charleston.*  
12 June 1995.
- 13 EnSafe Inc. *Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) Report.*  
14 July 1995.



Chemicals Detected in Zone E Soil Samples  
AOC 551

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
<b><i>Volatile Organic Compounds (ug/kg)</i></b>						
Acetone	551SB002	12.00	ND	780000.00	NA	NA
	551SB006	18.00	580.00			
Methylene chloride	551SB002	17.00	ND	85000.00	NA	NA
	551SB006	23.00	ND			
Trichlorofluoromethane	551SB006	4.00	ND	2300000.00	NA	NA
<b><i>Semi-volatile Compounds (ug/kg)</i></b>						
2-Methylnaphthalene	551SB006	88.00	ND	NA	NA	NA
Acenaphthene	551SB001	ND	23.00	470000.00	NA	NA
Anthracene	551SB001	ND	94.00			
	551SB004	88.00	ND			
	551SB006	ND	210.00			
Benzo(a)anthracene	551SB001	ND	460.00	880.00	NA	NA
	551SB002	110.00	200.00			
	551SB003	93.00	110.00			
	551SB004	130.00	ND			
	551SB006	200.00	520.00			
Benzo(a)pyrene	551SB001	ND	640.00	88.00	NA	NA
	551SB002	140.00	200.00			
	551SB003	140.00	120.00			
	551SB004	140.00	ND			
	551SB006	245.00	410.00			
Benzo(b)fluoranthene	551SB003	120.00	ND	880.00	NA	NA
	551SB004	120.00	ND			
	551SB006	220.00	ND			
Benzo(g,h,i)perylene	551SB001	ND	410.00	310000.00	NA	NA
	551CB002	110.00	140.00			
	551SB003	130.00	ND			
	551SB004	120.00	ND			
	551SB006	210.00	310.00			
Benzo(k)fluoranthene	551SB001	ND	800.00	8800.00	NA	NA
	551CB002	200.00	260.00			
	551SB003	87.00	120.00			
	551SB004	130.00	ND			
	551SB006	295.00	650.00			
Chrysene	551SB001	ND	530.00	88000.00	NA	NA
	551SB002	140.00	230.00			
	551SB003	92.00	140.00			
	551SB004	150.00	ND			
	551SB006	365.00	540.00			
Di-n-butylphthalate	551SB004	77.00	ND	7800000.00	NA	NA
Dibenz(a,h)anthracene	551SB001	ND	85.00	88000.00	NA	NA
	551SB004	74.00	ND			
	551SB006	140.00	140.00			
Dibenzofuran	551SB001	ND	13.00	31000.00	NA	NA
	551SB006	16.00	ND			

Chemicals Detected in Zone E Soil Samples  
AOC 551

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Fluoranthene	551SB001	ND	750.00	3100000.00	NA	NA
	551SB002	200.00	280.00			
	551SB003	150.00	200.00			
	551SB004	170.00	ND			
	551SB006	250.00	960.00			
	551SB001	ND	16.00	310000.00	NA	NA
Fluorene	551SB001	ND	380.00	880.00	NA	NA
	551SB002	110.00	110.00			
	551SB003	110.00	96.00			
	551SB004	220.00	ND			
	551SB006	285.00	270.00			
	551SB001	ND	430.00	310000.00	NA	NA
Phenanthrene	551SB002	100.00	190.00			
	551SB003	93.00	97.00			
	551SB004	150.00	ND			
	551SB006	265.00	970.00			
	551SB001	ND	710.00	230000.00	NA	NA
	551SB002	153.00	510.00			
Pyrene	551SB003	280.00	280.00			
	551SB004	220.00	ND			
	551SB005	92.00	ND			
	551SB006	285.00	880.00			

***Dioxin/Dibenzofuran (ng/kg)***

1234678-HpCDD	551CB002	1.42	ND	NA	NA	NA
	551CB006	761.93	ND			
1234678-HpCDF	551CB006	138.68	ND	NA	NA	NA
123478-HxCDD	551CB006	0.71	ND	NA	NA	NA
123478-HxCDF	551CB002	0.32	ND	NA	NA	NA
1234789-HpCDF	551CB006	6.01	ND	NA	NA	NA
123678-HxCDD	551CB006	15.61	ND	NA	NA	NA
123678-HxCDF	551CB006	22.45	ND	NA	NA	NA
123789-HxCDD	551CB006	3.12	ND	NA	NA	NA
234678-HxCDF	551CB002	0.21	ND	NA	NA	NA
	551CB006	0.89	ND			
OCDD	551CB002	21.54	ND	NA	NA	NA
	551CB006	7735.72	ND			
OCDF	551CB006	804.17	ND	NA	NA	NA
Total Hepta-Dioxins	551CB002	4.50	ND	NA	NA	NA
	551CB006	1423.32	ND			
Total Hepta-Furans	551CB006	144.69	ND	NA	NA	NA
Total Hexa-Dioxins	551CB006	73.02	ND	NA	NA	NA
Total Hexa-Furans	551CB006	104.95	ND	NA	NA	NA
Total Penta-Furans	551CB006	6.77	ND	NA	NA	NA
Total Tetra-Dioxins	551CB002	0.33	ND	NA	NA	NA
	551CB006	0.61	ND			

**Chemicals Detected in Zone E Soil Samples**  
AOC 551

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
<b><i>Inorganic Compounds (mg/kg)</i></b>						
Aluminum (Al)	551SB001	2130.00	5690.00	7800.00	26000	41100
	551SB002	4675.00	4150.00			
	551SB003	3390.00	2550.00			
	551SB004	2380.00	2480.00			
	551SB005	3330.00	6360.00			
	551SB006	3825.00	3990.00			
	551SB007	1860.00	NS			
Antimony (Sb)	551SB001	ND	0.64	3.10	1.77	1.6
	551SB002	ND	0.54			
	551SB003	0.97	1.20			
	551SB004	22.20	ND			
	551SB005	0.83	0.62			
	551SB006	6.10	1.70			
	551SB007	0.59	NS			
Arsenic (As)	551SB001	1.50	5.80	3.10	1.77	1.6
	551SB002	3.35	4.30			
	551SB003	3.50	2.00			
	551SB004	1.60	0.84			
	551SB005	4.60	5.00			
	551SB006	7.40	12.00			
	551SB007	2.10	NS			
Barium (Ba)	551SB001	10.80	33.00	550.00	130	94.1
	551SB002	12.30	23.60			
	551SB003	23.00	136.00			
	551SB004	11.20	5.20			
	551SB005	17.10	20.50			
	551SB006	163.00	61.20			
	551SB007	10.50	NS			
Beryllium (Be)	551SB001	0.27	0.48	0.15	1.7	2.71
	551SB002	0.20	0.29			
	551SB003	0.29	0.24			
	551SB005	0.81	0.18			
	551SB006	0.45	0.53			
	551SB007	0.33	NS			
	Cadmium (Cd)	551SB001	0.20	0.30	3.90	1.5
551SB002		0.11	0.21			
551SB003		ND	0.17			
551SB004		0.34	ND			
551SB006		1.75	2.00			
551SB007		0.33	NS			
Calcium (Ca)		551SB001	26100.00	23200.00	NA	NA
	551SB002	80400.00	44600.00			
	551SB003	21500.00	8650.00			
	551SB004	1440.00	755.00			
	551SB005	8130.00	1500.00			
	551SB006	20000.00	16600.00			

**Chemicals Detected in Zone E Soil Samples**  
AOC 551

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Chromium (Cr)	551SB007	74200.00	NS			
	551SB001	10.50	16.50	39.00	94.6	75.2
	551SB002	7.40	9.80			
	551SB003	7.30	4.30			
	551SB004	4.70	2.60			
	551SB005	8.00	12.50			
	551SB006	34.70	15.20			
Cobalt (Co)	551SB007	10.80	NS			
	551SB001	0.79	1.60	470.00	19	14.9
	551SB002	2.55	1.40			
	551SB003	0.97	0.74			
	551SB004	2.50	ND			
	551SB005	5.70	4.50			
	551SB006	54.85	8.00			
Copper (Cu)	551SB007	1.10	NS			
	551SB001	5.80	64.80	310.00	66	152
	551SB002	11.45	24.20			
	551SB003	49.00	18.40			
	551SB004	49.20	0.90			
	551SB005	6.30	1.30			
	551SB006	271.50	68.80			
Iron (Fe)	551SB007	9.00	NS			
	551SB001	2990.00	8060.00	2300.00	NA	NA
	551SB002	3000.00	5530.00			
	551SB003	3370.00	3080.00			
	551SB004	1750.00	1160.00			
	551SB005	10400.00	12600.00			
	551SB006	9090.00	15000.00			
Lead (Pb)	551SB007	1980.00	NS			
	551SB001	17.90	193.00	400.00	265	173
	551SB002	25.50	106.00			
	551SB003	74.10	168.00			
	551SB004	78.80	2.30			
	551SB005	24.10	10.00			
	551SB006	854.50	344.00			
Magnesium (Mg)	551SB007	27.20	NS			
	551SB001	451.00	1130.00	NA	NA	NA
	551SB002	1125.00	989.00			
	551SB003	605.00	345.00			
	551SB004	121.00	62.10			
	551SB005	322.00	579.00			
	551SB006	697.50	798.00			
Manganese (Mn)	551SB007	1130.00	NS			
	551SB001	16.00	56.80	180.00	302	881
	551SB002	89.50	73.80			
	551SB003	39.40	39.20			
	551SB004	13.30	5.70			

**Chemicals Detected in Zone E Soil Samples**  
AOC 551

<b>Name</b>	<b>ID</b>	<b>Surface Conc.</b>	<b>Subsurface Conc.</b>	<b>RBC (THQ=.1)</b>	<b>Surface UTL</b>	<b>Subsurface UTL *</b>
	551SB005	42.30	36.10			
	551SB006	74.00	148.00			
	551SB007	40.60	NS			
<b>Mercury (Hg)</b>	551SB001	0.06	0.72	2.30	2.6	1.59
	551SB002	0.06	0.22			
	551SB003	0.08	0.15			
	551SB004	0.09	ND			
	551SB005	0.11	0.03			
	551SB006	3.15	0.72			
	551SB007	0.10	NS			
<b>Nickel (Ni)</b>	551SB001	6.50	8.30	160.00	77.1	57
	551SB002	6.25	5.80			
	551SB003	4.00	2.80			
	551SB004	3.00	0.71			
	551SB005	5.00	3.50			
	551SB006	35.10	9.70			
	551SB007	6.10	NS			
<b>Potassium (K)</b>	551SB001	478.00	1220.00	NA	NA	NA
	551SB002	711.00	843.00			
	551SB003	745.00	545.00			
	551SB004	157.00	108.00			
	551SB005	701.00	387.00			
	551SB006	829.00	1190.00			
<b>Selenium (Se)</b>	551SB006	0.65	ND	39.00	1.7	2.4
	551SB007	0.39	NS			
<b>Sodium (Na)</b>	551SB001	308.00	184.00	NA	NA	NA
	551SB002	84.20	190.00			
	551SB003	212.00	ND			
	551SB005	78.90	170.00			
	551SB006	190.00	230.50			
	551SB007	510.00	NS			
<b>Thallium (Tl)</b>	551SB006	ND	0.74	0.29	2.8	NA
<b>Tin (Sn)</b>	551SB001	ND	5.60	4700.00	59.4	9.23
	551SB002	2.70	4.20			
	551SB003	2.80	3.20			
	551SB004	212.00	ND			
	551SB006	13.95	5.20			
<b>Vanadium (V)</b>	551SB001	5.40	13.50	55.00	94.3	155
	551SB002	5.60	9.70			
	551SB003	7.40	4.90			
	551SB004	2.30	1.20			
	551SB005	21.10	19.00			
	551SB006	11.50	15.10			
	551SB007	6.50	NS			
<b>Zinc (Zn)</b>	551SB001	33.00	212.00	2300.00	827	886
	551SB002	52.50	122.00			
	551SB003	79.50	97.20			

**Chemicals Detected in Zone E Soil Samples  
AOC 551**

<b>Name</b>	<b>ID</b>	<b>Surface Conc.</b>	<b>Subsurface Conc.</b>	<b>RBC (THQ=.1)</b>	<b>Surface UTL</b>	<b>Subsurface UTL *</b>
	551SB004	159.00	1.90			
	551SB005	26.60	9.60			
	551SB006	754.50	1020.00			
	551SB007	46.10	NS			

**Notes:**

**ND: Not Detected**

**NS: No Sample Taken/Sample Not Analyzed**

**NA: Not applicable**

**For compounds detected in both the primary and duplicate sample, the concentration for both detections are averaged and listed as one detection.**

**For compounds that were detected in only one of the primary or duplicate sample, the value of the detection was used.**

**\* Surface soil samples will be used for human health risk assessment for the Zone E report.**

Chemicals Detected in Zone E Groundwater Samples  
AOC 551

Name	Location	Round 1 Conc.	Round 2 Conc.	Round 3 Conc.	Round 4 Conc.	RBC (THQ=.1)	UTL	MCL
<i>Volatile Organic Compounds (ug/l)</i>								
Tetrachloroethene	551GW02D	2.00	ND	NS	NS	1.1	NA	5
Trichloroethene	551GW001	ND	4.00	NS	NS	1.6	NA	5
	551GW02D	2.00	2.00	NS	NS			
<i>Semi-volatile Compounds (ug/l)</i>								
Acenaphthene	551GW002	2.00	2.00	NS	NS	220	NA	NA
Benzoic acid	551GW002	ND	1.00	NS	NS	15000	NA	NA
	551GW02D	ND	1.00	NS	NS			
<i>Other Compounds (mg/l)</i>								
Chloride	551GW001	ND	47.30	47.20	37.40	NA	NA	NA
	551GW002	108.00	143.00	139.00	155.00			
	551GW02D	14.80	13.40	6.10	12.40			
Sulfate	551GW001	86.00	23.70	3.90	7.60	NA	NA	NA
	551GW002	ND	0.71	6.60	1.90			
	551GW02D	14.00	9.60	47.70	9.80			
Total Dissolved Solids (TDS)	551GW001	546.00	536.00	476.00	480.00	NA	NA	NA
	551GW002	524.00	1120.00	1090.00	1010.00			
	551GW02D	356.00	324.00	440.00	300.00			
<i>Inorganic Compounds (ug/l)</i>								
Aluminum (Al)	551GW001	ND	65.70	ND	24.30	3700	2810	NA
	551GW002	ND	34.40	ND	39.70			
	551GW02D	ND	114.00	1260.00	26.50		319	
Arsenic (As)	551GW02D	21.20	22.30	15.40	25.40	0.05	18.7	50
Barium (Ba)	551GW001	ND	34.10	31.80	25.60	260	211	2000
	551GW002	ND	68.30	65.70	72.50			
	551GW02D	18.70	22.30	33.20	18.00		218	
Calcium (Ca)	551GW001	112000.00	111000.00	105000.00	99300.00	NA	NA	NA
	551GW002	105000.00	100000.00	98100.00	112000.00			
	551GW02D	64200.00	41300.00	130000.00	47200.00		NA	
Cobalt (Co)	551GW02D	ND	ND	1.90	2.30	220	2.5	NA
Copper (Cu)	551GW02D	ND	ND	4.70	ND	150	2.7	1300
Iron (Fe)	551GW001	977.00	846.00	190.00	134.00	1100	NA	NA
	551GW002	14600.00	12100.00	11700.00	14400.00			
	551GW02D	2570.00	3260.00	15300.00	2610.00		NA	
Magnesium (Mg)	551GW001	14800.00	12900.00	13200.00	11600.00	NA	NA	NA
	551GW002	70400.00	66400.00	66800.00	62900.00			
	551GW02D	4820.00	3960.00	7330.00	4150.00		NA	
Manganese (Mn)	551GW001	130.00	113.00	101.00	85.80	84	2560	NA
	551GW002	450.00	393.00	396.00	441.00			
	551GW02D	317.00	248.00	154.00	319.00		869	
Mercury (Hg)	551GW001	ND	ND	ND	0.21	1100	NA	2
	551GW002	ND	ND	ND	0.35			
	551GW02D	0.20	ND	ND	0.28		0.2	
Nickel (Ni)	551GW001	ND	1.40	ND	ND	73	15.2	100
	551GW002	ND	1.50	ND	1.80			
	551GW02D	ND	1.40	ND	1.00		42.2	
Potassium (K)	551GW001	8600.00	8440.00	7540.00	5910.00	NA	NA	NA

**Chemicals Detected in Zone E Groundwater Samples  
AOC 551**

Name	Location	Round 1 Conc.	Round 2 Conc.	Round 3 Conc.	Round 4 Conc.	RBC (THQ=.1)	UTL	MCL
Sodium (Na)	551GW002	37700.00	39800.00	39200.00	34600.00			
	551GW02D	3790.00	3770.00	5510.00	3670.00		NA	
	551GW001	ND	31100.00	34000.00	29500.00	NA	NA	NA
	551GW002	218000.00	182000.00	195000.00	176000.00			
Thallium (Tl)	551GW02D	65000.00	58400.00	4770.00	55800.00		NA	
	551GW001	ND	ND	ND	3.10	0.29	5.4	2
Vanadium (V)	551GW002	ND	ND	ND	4.40			
	551GW001	ND	ND	ND	0.91	26	11.4	NA
	551GW002	1.10	ND	0.60	0.64			
Zinc (Zn)	551GW02D	ND	ND	2.80	D		5.3	
	551GW001	ND	ND	ND	10.80	11000	27.3	NA
	551GW002	ND	ND	ND	13.00			
	551GW02D	ND	ND	35.80	14.30		11.8	

Notes:

ND: Not Detected

NS: No Sample Taken/Sample Not Analyzed

NA: Not applicable

For compounds detected in both the primary and duplicate sample, the concentration for both detections are averaged and listed as one detection.

For compounds that were detected in only one of the primary or duplicate sample, the value of the detection was used.

Chemicals Detected in Zone E Soil Samples  
AOC 552

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
<b><i>Volatile Organic Compounds (ug/kg)</i></b>						
Acetone	552SB00101	110.00	120.00	780000.00	NA	NA
	552SB00201	18.00	17.00			
Carbon disulfide	552SB00202	ND	2.00	780000.00	NA	NA
Methylene chloride	552SB00102	ND	30.00	85000.00	NA	NA
<b><i>Semi-volatile Compounds (ug/kg)</i></b>						
Anthracene	552SB00202	ND	62.00	23000000.00	NA	NA
Benzo(a)anthracene	552SB00201	120.00	800.00	880.00	NA	NA
Benzo(a)pyrene	552SB00201	210.00	650.00	88.00	NA	NA
Benzo(b)fluoranthene	552SB00202	ND	430.00	880.00	NA	NA
	552SB00401	89.00	ND			
Benzo(g,h,i)perylene	552SB00201	180.00	420.00	310000.00	NA	NA
Benzo(k)fluoranthene	552SB00201	400.00	740.00	8800.00	NA	NA
Chrysene	552SB00201	140.00	810.00	88000.00	NA	NA
Dibenz(a,h)anthracene	552SB00202	ND	220.00	88000.00	NA	NA
Fluoranthene	552SB00201	120.00	810.00	3100000.00	NA	NA
Indeno(1,2,3-cd)pyrene	552SB00201	140.00	370.00	880.00	NA	NA
Phenanthrene	552SB00202	ND	240.00	310000.00	NA	NA
Pyrene	552SB00201	190.00	1100.00	230000.00	NA	NA
	552SB00401	81.00	ND			
<b><i>Inorganic Compounds (mg/kg)</i></b>						
Aluminum (Al)	552SB00101	6500.00	7290.00	7800.00	26000	41100
	552SB00201	4090.00	4660.00			
	552SB00401	6230.00	5390.00			
Antimony (Sb)	552SB00201	1.00	0.90	3.10	1.77	1.6
	552SB00401	0.89	0.86			
Arsenic (As)	552SB00101	0.68	ND	3.10	1.77	1.6
	552SB00201	3.00	3.10			
	552SB00401	4.90	6.70			
Barium (Ba)	552SB00101	13.60	8.60	550.00	130	94.1
	552SB00201	20.10	37.50			
	552SB00401	21.10	17.10			
Beryllium (Be)	552SB00101	0.14	0.12	0.15	1.7	2.71
	552SB00201	0.29	0.27			
	552SB00401	0.41	0.51			
Cadmium (Cd)	552SB00201	0.19	0.12	3.90	1.5	0.96
	552SB00401	0.72	ND			
Calcium (Ca)	552SB00101	13900.00	3560.00	NA	NA	NA
	552SB00201	29300.00	17800.00			
	552SB00401	31300.00	23800.00			
Chromium (Cr)	552SB00101	7.00	8.60	39.00	94.6	75.2
	552SB00201	46.10	11.00			
	552SB00401	16.30	15.70			
Cobalt (Co)	552SB00101	4.20	0.99	470.00	19	14.9
	552SB00201	1.60	1.00			

**Chemicals Detected in Zone E Soil Samples**  
AOC 552

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Copper (Cu)	552SB00401	2.70	1.10			
	552SB00101	5.80	2.10	310.00	66	152
	552SB00201	45.20	17.90			
Iron (Fe)	552SB00401	33.10	18.60			
	552SB00101	1860.00	1200.00	2300.00	NA	NA
	552SB00201	4530.00	4820.00			
Lead (Pb)	552SB00401	6810.00	7310.00			
	552SB00101	10.50	6.60	400.00	265	173
	552SB00201	41.70	59.80			
Magnesium (Mg)	552SB00401	29.60	30.90			
	552SB00101	557.00	270.00	NA	NA	NA
	552SB00201	1850.00	878.00			
Manganese (Mn)	552SB00401	1130.00	984.00			
	552SB00101	31.20	12.30	180.00	302	881
	552SB00201	49.70	32.10			
Mercury (Hg)	552SB00401	80.00	56.30			
	552SB00202	ND	0.25	2.30	2.6	1.59
Nickel (Ni)	552SB00401	0.09	0.04			
	552SB00101	4.60	2.40	160.00	77.1	57
	552SB00201	6.80	3.30			
Potassium (K)	552SB00401	7.30	5.70			
	552SB00101	822.00	547.00	NA	NA	NA
	552SB00201	875.00	693.00			
Silver (Ag)	552SB00401	971.00	755.00			
	552SB00101	0.24	ND	39.00	NA	NA
Sodium (Na)	552SB00401	0.27	ND			
	552SB00101	82.70	ND	NA	NA	NA
	552SB00201	157.00	164.00			
Thallium (Tl)	552SB00401	161.00	138.00			
	552SB00202	ND	0.76	0.29	2.8	NA
Tin (Sn)	552SB00401	3.10	2.60	4700.00	59.4	9.23
Vanadium (V)	552SB00101	6.90	5.30	55.00	94.3	155
	552SB00201	13.30	9.70			
	552SB00401	13.20	18.60			
Zinc (Zn)	552SB00101	16.60	12.70	2300.00	827	886
	552SB00201	73.20	68.10			
	552SB00401	89.20	59.50			

Notes:

ND: Not Detected

NS: No Sample Taken/Sample Not Analyzed

NA: Not applicable

For compounds detected in both the primary and duplicate sample, the concentration for both detections are averaged and listed as one detection.

For compounds that were detected in only one of the primary or duplicate sample, the value of the detection was used.

\* Surface soil samples will be used for human health risk assessment for the Zone E report.

Analytical Data Summary

12/29/2003 5:24 PM

StationID	LABQC		LABQC		LABQC		LABQC		LABQC		
SampleID	BLK0366348		BLK0366349		BLK0366373		BLK0366374		BLK0366375		
DateCollected											
DateExtracted											
DateAnalyzed	10/05/1995		10/06/1995		10/06/1995		10/09/1995		10/10/1995		
SDGNumber	23663		23663		23663		23663		23663		
Parameter	Units										
1,1,1,2-Tetrachloroethane	ug/Kg	5	U	5	U						
1,2,3-Trichloropropane	ug/Kg	5	U	5	U						
1,2-Dibromo-3-chloropropane	ug/Kg	10	U	10	U						
1,4-Dioxane	ug/Kg	500	U	500	U						
3-Chloropropene	ug/Kg	5	U	5	U						
Acetonitrile	ug/Kg	200	U	200	U						
Acrolein	ug/Kg	50	U	50	U						
Acrylonitrile	ug/Kg	50	U	50	U						
Chloroprene	ug/Kg	5	U	5	U						
Dichlorodifluoromethane	ug/Kg	5	U	5	U						
Ethylene Dibromide (1,2-Dibromoethane)	ug/Kg	5	U	5	U						
Isobutyl alcohol	ug/Kg	200	U	200	U						
Methacrylonitrile	ug/Kg	100	U	100	U						
Methyl iodide	ug/Kg	5	U	5	U						
Methylene bromide	ug/Kg	10	U	10	U						
Propionitrile	ug/Kg	100	U	100	U						
trans-1,4-Dichloro-2-butene	ug/Kg	5	U	5	U						
Trichlorofluoromethane	ug/Kg	5	U	5	U						
1,2,4-Trichlorobenzene	ug/Kg										
1,2,4-Trichlorobenzene	ug/L										
Chloromethane	ug/Kg	10	U	10	U			10	U	10	U
Chloromethane	ug/L					10	U				
Vinyl chloride	ug/Kg	10	U	10	U			10	U	10	U
Vinyl chloride	ug/L					10	U				
Bromomethane	ug/Kg	10	U	10	U			10	U	10	U
Bromomethane	ug/L					10	U				
Chloroethane	ug/Kg	10	U	10	U			10	U	10	U
Chloroethane	ug/L					10	U				
1,1-Dichloroethene	ug/Kg	5	U	5	U			5	U	5	U
1,1-Dichloroethene	ug/L					5	U				
Acetone	ug/Kg	10	U	10	U			10	U	10	U
Acetone	ug/L					10	U				
Carbon Disulfide	ug/Kg	5	U	5	U			5	U	5	U

Analytical Data Summary

12/29/2003 5:24 PM

	StationID	LABQC		LABQC	
	SampleID	BLK0366376		BLK0366377	
	DateCollected				
	DateExtracted				
	DateAnalyzed	10/10/1995		10/10/1995	
	SDGNumber	23663		23663	
Parameter	Units				
1,1,1,2-Tetrachloroethane	ug/Kg				
1,2,3-Trichloropropane	ug/Kg				
1,2-Dibromo-3-chloropropane	ug/Kg				
1,4-Dioxane	ug/Kg				
3-Chloropropene	ug/Kg				
Acetonitrile	ug/Kg				
Acrolein	ug/Kg				
Acrylonitrile	ug/Kg				
Chloroprene	ug/Kg				
Dichlorodifluoromethane	ug/Kg				
Ethylene Dibromide (1,2-Dibromoethane)	ug/Kg				
Isobutyl alcohol	ug/Kg				
Methacrylonitrile	ug/Kg				
Methyl iodide	ug/Kg				
Methylene bromide	ug/Kg				
Propionitrile	ug/Kg				
trans-1,4-Dichloro-2-butene	ug/Kg				
Trichlorofluoromethane	ug/Kg				
1,2,4-Trichlorobenzene	ug/Kg				
1,2,4-Trichlorobenzene	ug/L				
Chloromethane	ug/Kg	1200	U		
Chloromethane	ug/L			10	U
Vinyl chloride	ug/Kg	1200	U		
Vinyl chloride	ug/L			10	U
Bromomethane	ug/Kg	1200	U		
Bromomethane	ug/L			10	U
Chloroethane	ug/Kg	1200	U		
Chloroethane	ug/L			10	U
1,1-Dichloroethene	ug/Kg	620	U		
1,1-Dichloroethene	ug/L			5	U
Acetone	ug/Kg	320	J		
Acetone	ug/L			10	U
Carbon Disulfide	ug/Kg	620	U		

Analytical Data Summary

12/29/2003 5:24 PM

StationID	LABQC		LABQC		LABQC		LABQC		LABQC		
SampleID	BLK0366348		BLK0366349		BLK0366373		BLK0366374		BLK0366375		
DateCollected											
DateExtracted											
DateAnalyzed	10/05/1995		10/06/1995		10/06/1995		10/09/1995		10/10/1995		
SDGNumber	23663		23663		23663		23663		23663		
Parameter	Units										
Carbon Disulfide	ug/L				5	U					
Methylene Chloride	ug/Kg	5	U	5	U			5	U	5	U
Methylene Chloride	ug/L				5	U					
1,1-Dichloroethane	ug/Kg	5	U	5	U			5	U	5	U
1,1-Dichloroethane	ug/L				5	U					
Vinyl acetate	ug/Kg	10	U	10	U			10	U	10	U
Vinyl acetate	ug/L				10	U					
Methyl ethyl ketone (2-Butanone)	ug/Kg	10	U	10	U			10	U	10	U
Methyl ethyl ketone (2-Butanone)	ug/L				10	U					
1,2-Dichloroethene (total)	ug/Kg	5	U	5	U			5	U	5	U
1,2-Dichloroethene (total)	ug/L				5	U					
Chloroform	ug/Kg	5	U	5	U			5	U	5	U
Chloroform	ug/L				5	U					
1,1,1-Trichloroethane	ug/Kg	5	U	5	U			5	U	5	U
1,1,1-Trichloroethane	ug/L				5	U					
Carbon Tetrachloride	ug/Kg	5	U	5	U			5	U	5	U
Carbon Tetrachloride	ug/L				5	U					
1,2-Dichloroethane	ug/Kg	5	U	5	U			5	U	5	U
1,2-Dichloroethane	ug/L				5	U					
Benzene	ug/Kg	5	U	5	U			5	U	5	U
Benzene	ug/L				5	U					
Trichloroethylene (TCE)	ug/Kg	5	U	5	U			5	U	5	U
Trichloroethylene (TCE)	ug/L				5	U					
1,2-Dichloropropane	ug/Kg	5	U	5	U			5	U	5	U
1,2-Dichloropropane	ug/L				5	U					
Bromodichloromethane	ug/Kg	5	U	5	U			5	U	5	U
Bromodichloromethane	ug/L				5	U					
2-Chloroethyl vinyl ether	ug/Kg	10	U	10	U			10	U	10	U
2-Chloroethyl vinyl ether	ug/L				10	U					
cis-1,3-Dichloropropene	ug/Kg	5	U	5	U			5	U	5	U
cis-1,3-Dichloropropene	ug/L				5	U					
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/Kg	10	U	10	U			10	U	10	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/L				10	U					

Analytical Data Summary

12/29/2003 5:24 PM

StationID	LABQC	LABQC
SampleID	BLK0366376	BLK0366377
DateCollected		
DateExtracted		
DateAnalyzed	10/10/1995	10/10/1995
SDGNumber	23663	23663

Parameter	Units				
Carbon Disulfide	ug/L			5	U
Methylene Chloride	ug/Kg	300	J		
Methylene Chloride	ug/L			5	U
1,1-Dichloroethane	ug/Kg	620	U		
1,1-Dichloroethane	ug/L			5	U
Vinyl acetate	ug/Kg	1200	U		
Vinyl acetate	ug/L			10	U
Methyl ethyl ketone (2-Butanone)	ug/Kg	1200	U		
Methyl ethyl ketone (2-Butanone)	ug/L			10	U
1,2-Dichloroethene (total)	ug/Kg	620	U		
1,2-Dichloroethene (total)	ug/L			5	U
Chloroform	ug/Kg	620	U		
Chloroform	ug/L			5	U
1,1,1-Trichloroethane	ug/Kg	620	U		
1,1,1-Trichloroethane	ug/L			5	U
Carbon Tetrachloride	ug/Kg	620	U		
Carbon Tetrachloride	ug/L			5	U
1,2-Dichloroethane	ug/Kg	620	U		
1,2-Dichloroethane	ug/L			5	U
Benzene	ug/Kg	620	U		
Benzene	ug/L			5	U
Trichloroethylene (TCE)	ug/Kg	620	U		
Trichloroethylene (TCE)	ug/L			5	U
1,2-Dichloropropane	ug/Kg	620	U		
1,2-Dichloropropane	ug/L			5	U
Bromodichloromethane	ug/Kg	620	U		
Bromodichloromethane	ug/L			5	U
2-Chloroethyl vinyl ether	ug/Kg	1200	U		
2-Chloroethyl vinyl ether	ug/L			10	U
cis-1,3-Dichloropropene	ug/Kg	620	U		
cis-1,3-Dichloropropene	ug/L			5	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/Kg	1200	U		
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/L			10	U

Analytical Data Summary

12/29/2003 5:24 PM

StationID	LABQC										
SampleID	BLK0366348		BLK0366349		BLK0366373		BLK0366374		BLK0366375		
DateCollected											
DateExtracted											
DateAnalyzed	10/05/1995		10/06/1995		10/06/1995		10/09/1995		10/10/1995		
SDGNumber	23663		23663		23663		23663		23663		
Parameter	Units										
Toluene	ug/Kg	5	U	5	U			5	U	5	U
Toluene	ug/L					5	U				
trans-1,3-Dichloropropene	ug/Kg	5	U	5	U			5	U	5	U
trans-1,3-Dichloropropene	ug/L					5	U				
1,1,2-Trichloroethane	ug/Kg	5	U	5	U			5	U	5	U
1,1,2-Trichloroethane	ug/L					5	U				
2-Hexanone	ug/Kg	10	U	10	U			10	U	10	U
2-Hexanone	ug/L					10	U				
Tetrachloroethylene (PCE)	ug/Kg	5	U	5	U			5	U	5	U
Tetrachloroethylene (PCE)	ug/L					5	U				
Dibromochloromethane	ug/Kg	5	U	5	U			5	U	5	U
Dibromochloromethane	ug/L					5	U				
Chlorobenzene	ug/Kg	5	U	5	U			5	U	5	U
Chlorobenzene	ug/L					5	U				
Ethylbenzene	ug/Kg	5	U	5	U			5	U	5	U
Ethylbenzene	ug/L					5	U				
Xylenes, Total	ug/Kg	5	U	5	U			5	U	5	U
Xylenes, Total	ug/L					5	U				
Styrene	ug/Kg	5	U	5	U			5	U	5	U
Styrene	ug/L					5	U				
Bromoform	ug/Kg	5	U	5	U			5	U	5	U
Bromoform	ug/L					5	U				
1,1,2,2-Tetrachloroethane	ug/Kg	5	U	5	U			5	U	5	U
1,1,2,2-Tetrachloroethane	ug/L					5	U				

Analytical Data Summary

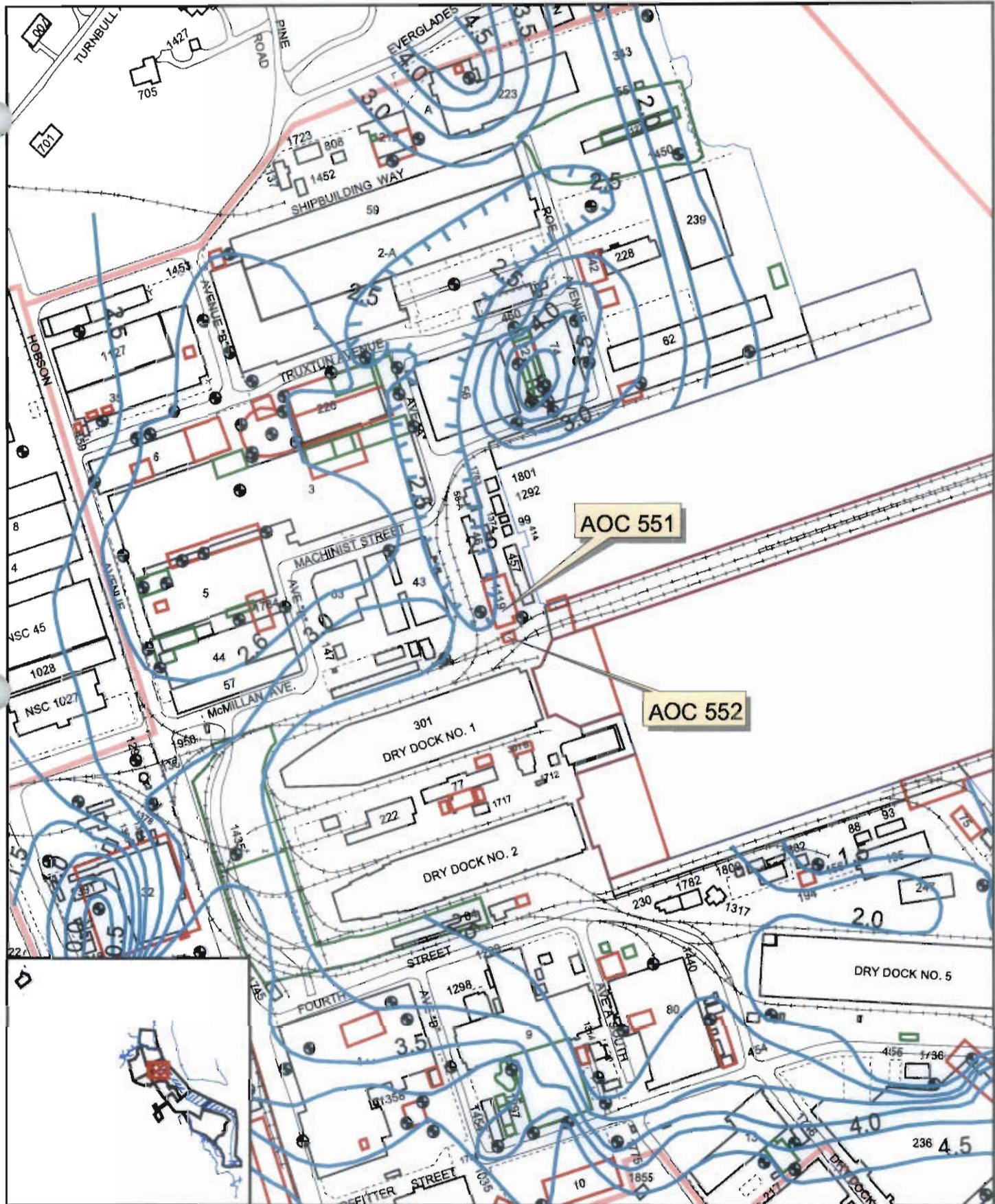
12/29/2003 5:24 PM

StationID	LABQC		LABQC	
SampleID	BLK0366376		BLK0366377	
DateCollected				
DateExtracted				
DateAnalyzed	10/10/1995		10/10/1995	
SDGNumber	23663		23663	
Parameter	Units			
Toluene	ug/Kg	620	U	
Toluene	ug/L			5 U
trans-1,3-Dichloropropene	ug/Kg	620	U	
trans-1,3-Dichloropropene	ug/L			5 U
1,1,2-Trichloroethane	ug/Kg	620	U	
1,1,2-Trichloroethane	ug/L			5 U
2-Hexanone	ug/Kg	1200	U	
2-Hexanone	ug/L			10 U
Tetrachloroethylene (PCE)	ug/Kg	620	U	
Tetrachloroethylene (PCE)	ug/L			5 U
Dibromochloromethane	ug/Kg	620	U	
Dibromochloromethane	ug/L			5 U
Chlorobenzene	ug/Kg	620	U	
Chlorobenzene	ug/L			5 U
Ethylbenzene	ug/Kg	620	U	
Ethylbenzene	ug/L			5 U
Xylenes, Total	ug/Kg	620	U	
Xylenes, Total	ug/L			5 U
Styrene	ug/Kg	620	U	
Styrene	ug/L			5 U
Bromoform	ug/Kg	620	U	
Bromoform	ug/L			5 U
1,1,2,2-Tetrachloroethane	ug/Kg	620	U	
1,1,2,2-Tetrachloroethane	ug/L			5 U

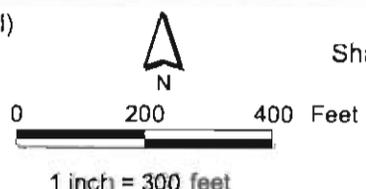
**TABLE A-1**  
 Historical Groundwater Elevations at AOCs 551 and 552  
*RFI Report Addendum, AOCs 551 and 552, Zone E, Charleston Naval Complex*

Station ID	Groundwater Elevation (ft msl)			Date Measured
	E551GW001	E551GW002	E551GW02D	
	3.48	2.46	2.66	03/13/1996
	3.69	2.25	2.49	04/09/1996
	3.68	2.08	2.58	07/24/1996
	3.5	2.31	2.64	11/26/1996
	3.46	1.81	2.8	02/12/1997

msl      mean sea level



- Shallow Groundwater Elevation (ft. above msl)
- Shallow Groundwater Well
- Fence
- Railroads
- Roads
- Buildings
- AOC boundary
- SWMU boundary
- Zone boundary



**Figure A-1**  
 Shallow Groundwater Contour Map, May 2002  
 AOCs 551 and 552, Zone E  
 Charleston Naval Complex



**Comment Prepared by Eric F. Cathcart**

**AOC 551**

**SCDHEC Comment 47:**

Grid wells around AOC 551 have revealed elevated levels for tetrachloroethene, chlorobenzene, dichloroethylene, and trichloroethene in past sampling events. This data should be included in the RFI report. Also, the local groundwater flow regime has not been fully represented. The Department recommends collection of a minimum of four consecutive quarters of groundwater data and the production of associated flow maps. The Navy has not successfully delineated the nature and extent of the contamination at the area.

**Navy/EnSafe Response:**

Grid well NBCEGDE17D indicated detectable concentrations of several of the constituents mentioned, however, these constituents did not exceed their respective MCLs in groundwater samples collected at AOC 551. The Navy has delineated the nature of contamination in this area, however, in order to define the extent of contamination, the installation of several additional monitoring wells to the north and west of AOC 551 and grid well NBCEGDE17D may be required. These particular constituents have been identified at elevated concentrations at several sites and in grid wells throughout the northern portion of Zone E. Analytical results from this area will be evaluated and additional well locations determined. Please refer to responses to comments 2 and 16, regarding groundwater flow maps. Also, please refer to Appendix H, part 1 for summarized results of each quarterly sampling event.

**CH2M-Jones Response:**

*There is no indication that past site activities at AOCs 551 and 552 are a source of these detections of VOCs upgradient of the site.*







Analytical Data Summary

12/23/2003 3:40 PM

StationID	E551GW02D
SampleID	551GW02DN1
DateCollected	05/19/2003
DateExtracted	05/28/2003
DateAnalyzed	05/28/2003
SDGNumber	80593

Parameter	Units		
Chloromethane	ug/L	10	UJ
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	R
cis-1,3-Dichloropropene	ug/L	5	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/L	10	U
Toluene	ug/L	5	U
trans-1,3-Dichloropropene	ug/L	5	U
1,1,2-Trichloroethane	ug/L	5	U
2-Hexanone	ug/L	10	U
Tetrachloroethylene (PCE)	ug/L	5	U

Analytical Data Summary

12/23/2003 3:40 PM

StationID	E551GW02D
SampleID	551GW02DN1
DateCollected	05/19/2003
DateExtracted	05/28/2003
DateAnalyzed	05/28/2003
SDGNumber	80593

Parameter	Units		
Dibromochloromethane	ug/L	5	U
Chlorobenzene	ug/L	5	U
Ethylbenzene	ug/L	5	U
m+p Xylene	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	U
1,4-Dichlorobenzene	ug/L	5	U
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

12/23/2003 3:40 PM

StationID	E551SB009		E551SB009		E551SB010		E551SB010		E551SB010	
SampleID	551SB00901 (0-1ft)		551SB00902 (3-5ft)		551SB01001 (0-1ft)		551SB01002 (3-5ft)		551SB01003	
DateCollected	05/20/2003		05/20/2003		05/19/2003		05/19/2003		05/20/2003	
DateExtracted	05/22/2003		05/22/2003		05/22/2003		05/22/2003		05/22/2003	
DateAnalyzed	05/23/2003		05/23/2003		05/23/2003		05/23/2003		05/23/2003	
SDGNumber	80591		80591		80591		80591		80591	
Parameter	Units									
Antimony	mg/kg	0.712	U	0.711	U	0.742	U	0.789	U	0.701
Cadmium	mg/kg	0.532	J	0.473	J	0.088	U	0.094	U	0.597
Lead	mg/kg	1.24	=	9.97	=	39.7	=	5.95	=	150
Zinc	mg/kg	16.7	=	30.6	=	44.5	=	40.7	=	143

Analytical Data Summary

12/23/2003 3:40 PM

<b>StationID</b>	SB011	E551SB011
<b>SampleID</b>	01 (0-1ft)	551SB01102 (3-5ft)
<b>DateCollected</b>	/2003	05/20/2003
<b>DateExtracted</b>	/2003	05/22/2003
<b>DateAnalyzed</b>	/2003	05/23/2003
<b>SDGNumber</b>	591	80591

<b>Parameter</b>	<b>Units</b>			
Antimony	mg/kg	U	0.856	U
Cadmium	mg/kg	J	0.34	J
Lead	mg/kg	=	132	=
Zinc	mg/kg	=	165	=

## Data Validation Summary - Charleston Naval Complex - Zone E, AOC 551 & 552

TO: Sam Naik/CH2M HILL/ATL

FROM: Amy Juchem/CH2M HILL/GNA  
Herb Kelly/CH2M HILL/GNA

DATE: July 24, 2003

The purpose of this memorandum is to present the results of the data validation process for the samples collected AOC 551 & 552 in Zone E. The samples were collected on May 19 and 20, 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 General Engineering Laboratories, Inc., in Charleston, South Carolina, for the following analyses: SW-846 8260 Volatile Organic Compounds (VOC) and Metals following SW-846 6010 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

80591	551SB00901	80591001	SO	N	05/20/03		X
80591	551SB00902	80591002	SO	N	05/20/03		X
80591	551SB01001	80591003	SO	N	05/19/03		X
80591	551SB01002	80591004	SO	N	05/19/03		X
80591	551SB01101	80591005	SO	N	05/20/03		X
80591	551SB01102	80591006	SO	N	05/20/03		X
80591	1200427334	1200427334	SQ	LB			X
80591	1200427335	1200427335	SQ	BS			X
80593	551TW02DN1	80593001	WQ	TB	05/19/03	X	
80593	551EW02DN1	80593002	WQ	EB	05/19/03	X	
80593	551GW02DN1	80593003	WG	N	05/19/03	X	
80593	551EB008N1	80593004	WQ	EB	05/19/03		X
80593	1200429645	1200429645	WQ	LB			X
80593	1200429646	1200429646	WQ	BS			X
80593	551EB008N1MS	1200430278	WQ	MS	05/19/03		X
80593	551EB008N1SD	1200430279	WQ	SD	05/19/03		X
80593	1200430643	1200430643	WQ	LB		X	
80593	1200430646	1200430646	WQ	BS		X	
80593	551GW02DN1MS	1200430647	WG	MS	05/19/03	X	
80593	551GW02DN1SD	1200430648	WG	SD	05/19/03	X	
80593	1200435744	1200435744	WQ	LB		X	
80593	1200435745	1200435745	WQ	BS		X	

**MATRIX CODE**

WG – Ground Water  
WQ - Water QC Samples  
SO – Soil  
SQ - Soil QC Samples

**SAMPLE TYPE CODE**

BS - Blank Spike  
EB - Equipment Blank  
LB - Laboratory Blank  
N - Native Sample  
MS – Matrix Spike  
SD – Matrix Spike Duplicate  
TB – Trip Blank

**ANALYSIS CODE**

VOC - Volatile Organic Compounds

## 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, trip 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.
- **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.
- **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.
- **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 below:

- Toluene was detected in the equipment blank, 551EW02DN1, below the reporting limit at 0.5 ug/L. Associated field sample was non-detect for Toluene.

No results were qualified due to blank contamination.

### 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 E, AOC 551 & 552, Charleston, SC

80593	551GW02DN1 MS/MSD	Chloromethane	65.8* / 76.6	70-130	551GW02DN1	Detects-J; Non-Detects-UJ
		2-Chloroethyl vinyl ether	0* / 0*	70-130	551GW02DN1	Detects-J; Non-Detects-R
80593	1200430646 LCS	Acetone	138*	70-130	551TW02DN1 (TB); 551EW02DN1 (EB); 551GW02DN1	Detects only - J
80593	551TW02DN1	Dibromofluoromethane (surrogate)	123*	80-120	551TW02DN1 (TB)	Detects only - J (TB - No flags applied)
		Toluene-d8 (surrogate)	117*	88-110		
		Bromofluorobenzene (surrogate)	117*	86-115		
80593	551EW02DN1	Toluene-d8 (surrogate)	114*	88-110	551EW02DN1 (EB)	Detects only - J (EB - No flags applied)
* - 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 E, AOC 551 & 552, Charleston, SC

VOA2-CCAL-05/27/03, 2025	Methylene chloride	26.6% high	551TW02DN1 (TB); 551EW02DN1 (EB); 551GW02DN1
	Dibromochloromethane	22.6% high	
	Bromoform	22.8% high	

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.
- **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 4~~.

**TABLE 4**

Blank Contamination: Metals

Charleston Naval Complex, Zone E, AOC 551 & 552, Charleston, SC

80591	CCB		CCB	Zinc	0.550	ug/L	0.1375 mg/Kg
80591	1200427334	1200427334	LB	Zinc	0.101	mg/Kg	0.505 mg/Kg
80591	80593004	551EB008N1	EB	Zinc	1.20	ug/L	0.300 mg/Kg
80593	80593004	551EB008N1	EB	Zinc	1.20	ug/L	0.300 mg/Kg
80593	CCB		CCB	Lead	3.49	ug/L	17.45 ug/L
80593	CCB		CCB	Antimony	3.75	ug/L	18.75 ug/L
80593	CCB		CCB	Zinc	0.976	ug/L	4.88 ug/L
80593	1200429645	1200429645	LB	Lead	2.40	ug/L	12.0 ug/L
80593	1200429645	1200429645	LB	Zinc	1.98	ug/L	9.9 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.

No data were qualified due to blank contamination.

## Rejected Data

One result was qualified as "R", rejected, due to associated QC parameters out of criteria, such that there is not a valid result for that parameter in each sample. The rejected data are summarized in **Table 5** below. The only compound rejected was 2-Chloroethyl vinyl ether. This compound is very reactive and is not detected under acidic conditions, such as those used in preservation of field samples.

**TABLE 5**  
Data Qualification Summary: Rejected Data  
Charleston Naval Complex, Zone E, AOC 551 & 552, Charleston, SC

80593	551GW02DN1	VOA	2-Chloroethyl vinyl ether	10	U	10	R	ug/L	MS
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## Conclusion

A review of the analytical data submitted regarding the investigation of Zone E, AOC 551 & 552, 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 was a specific result that was 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 E, AOC 551 and 552 - Data Validation

Parameter Class	Analytical Method	Parameter	Site	Sample ID	Lab Sample ID	Unit	Value	Qualifier	Value	Qualifier	Unit	Qualifier
METAL	SW6010B	CADMIUM	80591	551SB00901	80591001	SO	0.532	B	0.532	J	mg/kg	IB
METAL	SW6010B	CADMIUM	80591	551SB00902	80591002	SO	0.473	B	0.473	J	mg/kg	IB
METAL	SW6010B	CADMIUM	80591	551SB01101	80591005	SO	0.597	B	0.597	J	mg/kg	IB
METAL	SW6010B	CADMIUM	80591	551SB01102	80591006	SO	0.34	B	0.34	J	mg/kg	IB
VOA	SW8260B	2-Chloroethyl vinyl ether	80593	551GW02DN1	80593003	WG	10	U	10	R	ug/L	MS
VOA	SW8260B	CHLOROMETHANE	80593	551GW02DN1	80593003	WG	10	U	10	UJ	ug/L	MS