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RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT
ADDENDUM AREA OF CONCERN 563 (AOC 563) ZONE E CNC CHARLESTON SC
6/26/2003
CH2M HILL

RFI REPORT ADDENDUM

AOC 563, Zone E



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

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

CH2M-Jones

June 2003

Contract N62467-99-C-0960



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Environmental Control
Bureau of Land and Waste Management
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Columbia, SC 29201

Re: RFI Report Addendum (Revision 1) – AOC 563, Zone E

Dear Mr. Scaturo:

Enclosed please find four copies of the RFI Report Addendum (Revision 1) for AOC 563 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 contact him at 770/604-9182, extension 255, if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

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

RFI REPORT ADDENDUM

AOC 563, Zone E



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

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

PREPARED BY
CH2M-Jones

June 2003

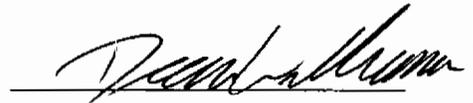
*Revision 1
Contract N62467-99-C-0960
158814.ZE.PR.07*

Certification Page for RFI Report Addendum (Revision 1) – AOC 563, 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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- 3 **A** Figure A-1, which presents the site location from the Public Works Map of the
4 Charleston Navy Shipyard (December 15, 1939)
- 5 **B** CH2M-Jones' Responses to SCDHEC Comments for AOC 563 from the *Zone E RFI*
6 *Report, Revision 0* (EnSafe, 1997)
- 7 **C** Excerpts from the *Zone E RFI Report, Revision 0* (EnSafe, 1997), including Figure C-1,
8 *Shallow Groundwater Contour Map*, and Figure C-2, *Deep Groundwater Contour Map*
- 9 **D** Zone E Groundwater Sampling Form
- 10 **E** Analytical Data Summaries and Data Validation Report for November 2002
11 Groundwater Sampling Event
- 12 **F** CH2M-Jones' Responses to SCDHEC Comments on the *RFI Report Addendum and*
13 *CMS Work Plan, AOC 563, Zone E, Revision 0* (CH2M-Jones, 2002)

1 Acronyms and Abbreviations

2	AOC	Area of concern
3	AST	Aboveground storage tank
4	BCT	BRAC Cleanup Team
5	BEQ	Benzo[a]pyrene equivalent
6	BRAC	Base Realignment and Closure Act
7	BRC	Background reference concentration
8	CA	Corrective action
9	CMS	Corrective measures study
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	DET	Environmental Detachment Charleston
16	EnSafe	EnSafe Inc.
17	EPA	U.S. Environmental Protection Agency
18	FRE	Fixed-point risk evaluation
19	HHRA	Human Health Risk Assessment
20	HI	Hazard index
21	ILCR	Incremental lifetime cancer risk
22	IM	Interim measure
23	LUC	Land use control
24	MCL	Maximum contaminant level
25	MCS	Media cleanup standard
26	$\mu\text{g}/\text{kg}$	Micrograms per kilogram
27	$\mu\text{g}/\text{L}$	Micrograms per liter
28	mg/kg	Milligrams per kilogram
29	mg/L	Milligrams per liter
30	NAVBASE	Naval Base

1 **Acronyms and Abbreviations, Continued**

2	NFA	No further action
3	NFI	No further investigation
4	OP	Organophosphorous
5	OWS	Oil/water separator
6	PCB	Polychlorinated biphenyl
7	POL	Petroleum, oil, and lubricant
8	RAO	Remedial action objective
9	RBC	Risk-based concentration
10	RCRA	Resource Conservation and Recovery Act
11	RFI	RCRA Facility Investigation
12	RGO	Remedial goal option
13	RI	Remedial investigation
14	SAP	Sampling and Analysis Plan
15	SCDHEC	South Carolina Department of Health and Environmental Control
16	SSL	Soil screening level
17	SVOC	Semivolatile organic compound
18	SWMU	Solid waste management unit
19	TDS	Total dissolved solids
20	VOC	Volatile organic compound
21	UST	Underground storage tank

1.0 Introduction

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

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

In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation and remediation services at the CNC. The *RFI Report Addendum and CMS Work Plan, AOC 563, Zone E, Revision 0* was submitted by CH2M-Jones for regulatory review on October 17, 2002 to complete the RCRA Facility Investigation (RFI) for Area of Concern (AOC) 563 in Zone E of CNC. This *RFI Report Addendum, AOC 563, Zone E, Revision 1* document is submitted at this time in accordance with regulatory comments made regarding the Revision 0 document. Appendix F of this document presents CH2M-Jones' responses to SCDHEC comments regarding the prior submittal. The location of AOC 563 in Zone E is shown in Figure 1-1. Figure 1-2 shows an aerial photograph of the site.

1.1 Background

AOC 563 is former Building 37, a locomotive maintenance house constructed in 1913 that was used until 1939. According to the *Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) Report* (EnSafe Inc.[EnSafe]/Allen & Hoshall, 1995a), probable maintenance activities at Building 37 involved petroleum-based lubricants, chlorinated solvents and degreasers, and coal or petroleum fuels. Building 177 was built over the site of former Building 37 in 1955. Building 177 is currently being used for storage and equipment maintenance activities in support of the operations by Detyens Shipyards, Inc.

The materials of concern identified in the *Final Zone E RFI Work Plan, Revision 1* (EnSafe/Allen & Hoshall, 1995b) include lubricants, heavy metals, dielectric fluid, petroleum hydrocarbons, chlorinated solvents and degreasers, and coal/coal by-products.

1 This area of Zone E is zoned M-2, for industrial land use. The CNC RCRA Permit identified
2 AOC 563 as requiring a Confirmatory Sampling Investigation (CSI).

3 A review of the historical engineering drawings for this site shows that railroad lines were
4 previously located directly adjacent to the southwest and northeast sides of former Building
5 37. It is likely that railroad lines extended into former Building 37, as shown in Figure A-1
6 of Appendix A of this report. The railroad lines were either paved over or removed
7 sometime after 1940.

8 The RFI was initially conducted by the Navy/EnSafe team. The RFI activities are described
9 in the *Zone E RFI Report, Revision 0* (EnSafe, 1997). Regulatory review was conducted on this
10 document and draft responses to the comments from SCDHEC on this document were
11 prepared by the Navy/EnSafe team. A copy of the responses to these comments is provided
12 in Appendix B of this document.

13 **1.2 Purpose of the RFI Report Addendum**

14 The purpose of this RFI Report Addendum is to document the results of previous RFI
15 investigations conducted by EnSafe at AOC 563. This RFI Report Addendum also discusses
16 various closeout issues and the findings of previous investigations, existing site conditions,
17 and surrounding area land use.

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

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

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

1.3 Report Organization

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

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

2.0 Summary of RFI Conclusions for AOC 563 – Summarizes the conclusions from the RFI investigations and risk evaluations for AOC 563 as presented in *the Zone E RFI Report, Revision 0* (EnSafe, 1997).

3.0 Interim Measures and UST/AST Removals – Provides information regarding any interim measures (IMs) or tank removal activities performed at the site.

4.0 Summary of Additional Investigations – Summarizes information, if any, collected after completion of the *Zone E RFI Report, Revision 0*.

5.0 COPC/COC Refinement – Provides further evaluation of chemicals of potential concern (COPCs) based on RFI and additional data to assess them as COCs.

6.0 Summary of Information Related to Site Closeout Issues – Discusses the various site closeout issues that the BCT agreed to evaluate prior to site closeout.

7.0 Recommendations – Provides recommendations for proceeding with site closure for AOC 563.

8.0 References – Lists the references used in this document.

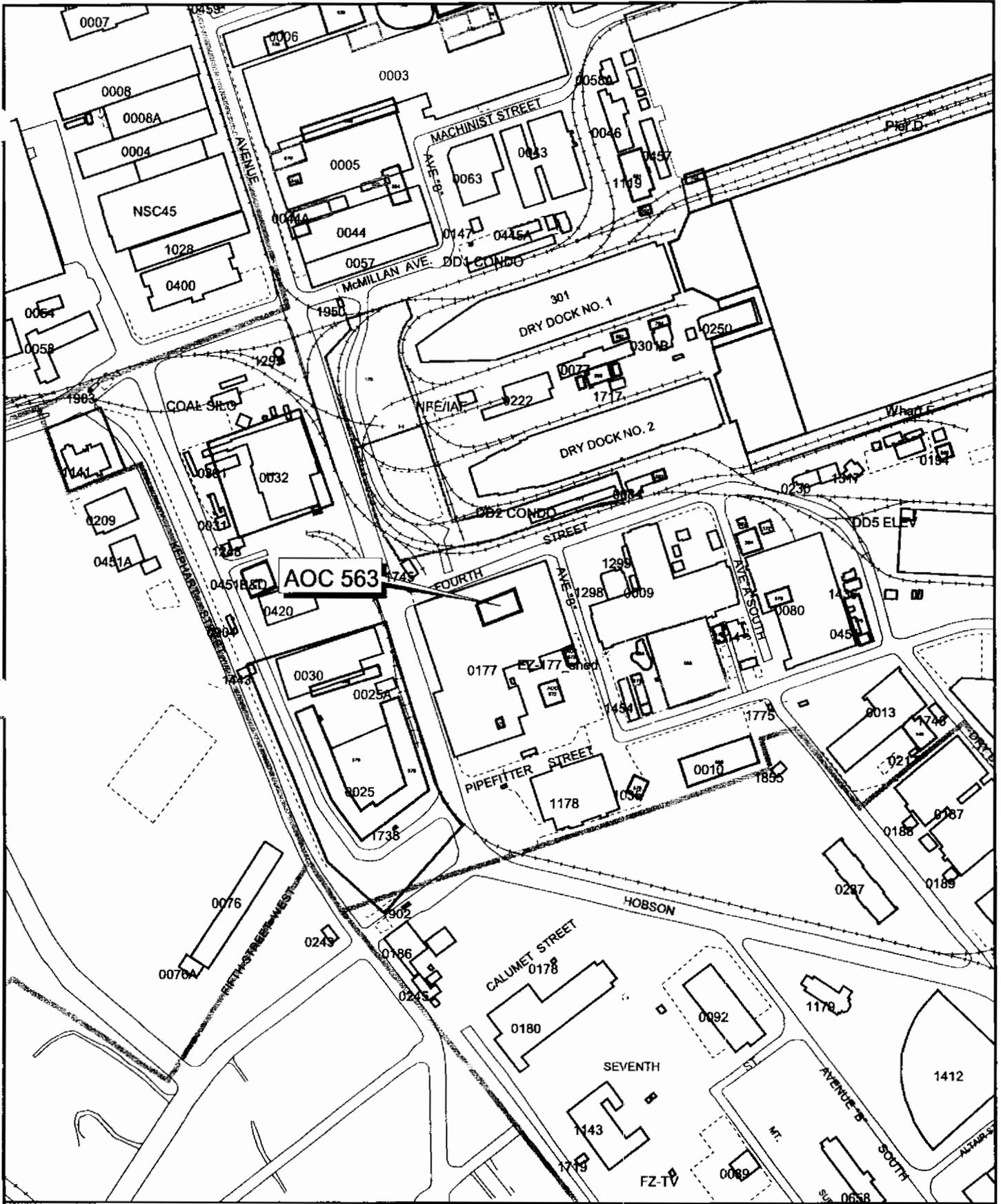
Appendix A– Contains Figure A-1, which presents the site location from the Public Works Map of the Charleston Naval Shipyard dated December 15, 1939, and depicts the presence of railroad lines at the site.

Appendix B – Contains responses to SCDHEC comments for AOC 563 from the *Zone E RFI Report, Revision 0* (EnSafe, 1997).

Appendix C – Contains excerpts from the *Zone E RFI Report, Revision 0*, including summaries of detections of chemicals and shallow and deep groundwater flow maps for the site vicinity.

Appendix D contains a copy of the relevant groundwater sampling form for Zone E at the CNC.

- 1 **Appendix E** contains the analytical data report and data validation report for the
- 2 groundwater sampling event conducted at AOC 563 in November 2002.
- 3 **Appendix F** contains CH2M-Jones' responses to SCDHEC comments on the *RFI Report*
- 4 *Addendum and CMS Work Plan, AOC 563, Zone E, Revision 0*, which was originally submitted
- 5 on October 17, 2002.
- 6 All tables and figures appear at the end of their respective sections.



AOC 563

- Fence
- Railroads
- Roads
- Shoreline
- AOC Boundary
- SWMU Boundary

- Buildings
- Zone Boundary



0 300 600 Feet



1 inch = 300

Figure 1-1
 Location of AOC 563 in Zone E
 AOC 563, Zone E
 Charleston Naval Complex

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NOTE: Aerial Photo Date is 1997



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

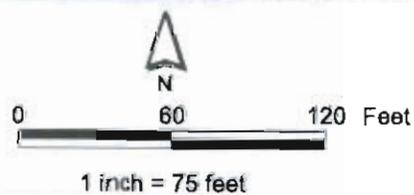


Figure 1-2
Aerial Photograph of AOC 563
AOC 563, Zone E
Charleston Naval Complex

Section 2.0

2.0 Summary of RFI Conclusions for AOC 563

This section summarizes the results and conclusions from the soil and groundwater investigations conducted at AOC 563 as reported in the *Zone E RFI Report, Revision 0* (EnSafe, 1997). Appendix C contains excerpts from the RFI report, including a summary of detections of chemicals and shallow and deep groundwater flow maps for the site vicinity.

As part of the Zone E RFI, soil and groundwater investigations were conducted at AOC 563 during 1996-1998. The RFI report presented the results of these investigations and conclusions concerning contamination and risk, as summarized in the following sections. A further evaluation of the COCs identified at this site is provided in Section 5.0. Figure 2-1 shows the soil and groundwater sampling locations.

2.1 Soil Sampling and Analysis

The RFI at AOC 563 included the collection and analysis of six surface soil and six subsurface soil samples from locations under concrete and asphalt pavement during a single sampling event. Surface soil and subsurface soil samples were also collected during the installation of the three shallow monitoring wells at the site. All samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, pesticides/polychlorinated biphenyls (PCBs), and cyanide. The soil boring locations were identified as E563SB001 through E563SB009. Two soil samples (one surface and one subsurface) were selected as duplicates and were also analyzed for herbicides, organophosphorus (OP) pesticides, hexavalent chromium, and dioxins.

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) (adjusted to a hazard index [HI]=0.1 for noncarcinogens). The 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 are as follows:

VOCs: No VOC detections exceeded the screening criteria in surface soil.

- 1 **SVOCs:** No SVOC detections exceeded the screening criteria in surface soil.
- 2 **Dioxins:** There were no detections in surface soil above the screening criteria for dioxin
3 compounds.
- 4 **Inorganics:** No inorganic detections exceeded the screening criteria for surface soil.
- 5 **Pesticides/PCBs:** There were no detections of pesticides/PCBs above screening criteria.

6 **2.1.2 Subsurface Soil Results**

7 During the RFI, subsurface soil detections of organic compounds were compared to generic
8 soil screening levels (SSLs) (based on a dilution attenuation factor [DAF]=10) and the Zone
9 E BRCs. Subsurface soil detections of inorganic compounds were compared to generic SSLs
10 (DAF=10) and the Zone E BRCs.

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

- 13 **VOCs:** No VOC detections exceeded the screening criteria in subsurface soil.
- 14 **SVOCs:** No SVOC detections exceeded the screening criteria in subsurface soil.
- 15 **Dioxins:** There were no detections in subsurface soils above the screening criteria for dioxin
16 compounds.
- 17 **Inorganics:** No inorganic detections exceeded the screening criteria in subsurface soil.
- 18 **Pesticides/PCBs:** There were no detections of pesticides/PCBs above screening criteria.

19 **2.2 Groundwater Sampling and Analysis**

20 The RFI investigation for AOC 563 included three shallow monitoring wells, identified as
21 E563GW001, E563GW002, and E563GW003 (formerly NBCE563001, NBCE563002, and
22 NBCE563003), and one deep monitoring well, identified as E563GW01D (formerly
23 NBCE56301D, installed at the eastern and western ends of AOC 563 inside Building 177.

24 Figure 2-1 presents the locations of the groundwater monitoring wells. Groundwater
25 samples were analyzed for VOCs, SVOCs, metals, cyanide, pesticides/PCBs, chlorides,
26 sulfates, and total dissolved solids (TDS). No duplicate samples were collected at this site.

27 During the RFI, each well was sampled four times between 1996 and 1997. Detections in
28 groundwater samples were compared with the EPA Region III tap water RBCs, maximum
29 contaminant levels (MCLs) and the Zone E BRCs for shallow and deep aquifers.

1 2.2.1 Shallow Groundwater Results

2 Analyte concentrations in shallow groundwater samples were detected as follows at this
3 site:

4 **VOCs:** The RFI report identified detections in the first sampling event only. Among the
5 detected VOC analytes, only trichloroethene (TCE), at a concentration of 120 micrograms
6 per liter ($\mu\text{g}/\text{L}$), exceeded both its secondary MCL of $5.00 \mu\text{g}/\text{L}$ and the tap water RBC of
7 $1.60 \mu\text{g}/\text{L}$ (HI=0.1).

8 **SVOCs:** No SVOC detections exceeded the screening criteria in shallow groundwater
9 samples from AOC 563.

10 **Inorganics:** The *Zone E RFI Report, Revision 0* reported detections in the first sampling event
11 only. Among detected inorganic analytes, the RFI identified six metals as exceeding at least
12 one of the RFI screening criteria:

- 13 • Aluminum – one sample (E563GW00101) exceeded both the tap water RBC and shallow
14 groundwater BRC for aluminum at a concentration of $22,000 \mu\text{g}/\text{L}$. No shallow
15 groundwater MCL was developed for aluminum in Zone E during the RFI.
- 16 • Arsenic – two samples (E563GW00101 and E563GW00201) exceeded both the tap water
17 RBC and shallow groundwater BRC for arsenic at concentrations of $34.4 \mu\text{g}/\text{L}$ and 26.7
18 $\mu\text{g}/\text{L}$, respectively. Neither detection exceeded the arsenic MCL of $50 \mu\text{g}/\text{L}$.
- 19 • Chromium - one sample (E563GW00101) exceeded both the tap water RBC and shallow
20 groundwater BRC for chromium at a concentration of $42.9 \mu\text{g}/\text{L}$. The detection did not
21 exceed the chromium MCL of $100 \mu\text{g}/\text{L}$.
- 22 • Iron - two samples (E563GW00101 And E563GW00201) exceeded both the tap water
23 RBC and shallow groundwater BRC for iron at concentrations of $29,000 \mu\text{g}/\text{L}$ and $6,160$
24 $\mu\text{g}/\text{L}$, respectively. No shallow groundwater BRC or MCL was developed for iron in
25 Zone E during the RFI.
- 26 • Lead - one sample (E563GW00101) with a concentration of $17.6 \mu\text{g}/\text{L}$ exceeded both the
27 treatment technique action level (TTAL) for lead of $15 \mu\text{g}/\text{L}$ and the Zone E shallow
28 groundwater BRC of 4.8 milligrams per liter (mg/L).

29 **Pesticides/PCBs:** There were no detections of pesticides/PCBs above laboratory detection
30 limits in shallow groundwater samples from AOC 563.

2.2.2 Deep Groundwater Results

Detections in the deep groundwater samples at the site were as follows:

VOCs: There were no VOC detections above laboratory detection limits in deep groundwater samples from AOC 563.

SVOCs: There were no SVOC detections above laboratory detection limits in deep groundwater samples from AOC 563.

Inorganics: None of the detected metals exceeded their respective tap water RBCs, MCLs, or deep groundwater BRCs.

Pesticides/PCBs: There were no detections of pesticides/PCBs above laboratory detection limits in deep groundwater samples from AOC 563.

2.3 RFI Human Health Risk Assessment (HHRA)

The RFI report used a fixed-point risk evaluation (FRE) approach at this site. The FRE considered site resident and site worker scenarios. The detailed risk assessment for the AOC 563 site are presented in Sections 10.31.6.2 and 10.31.6.3 of the *Zone E RFI Report, Revision 0* (EnSafe, 1997).

2.3.1 Soils

For the unrestricted (i.e., residential) future land use scenario, BEQs were retained as COCs for surface soil. No COCs were identified in subsurface soil at AOC 563, and no COCs were identified in soil during the RFI under the industrial reuse scenario.

2.3.2 Groundwater

Aluminum, arsenic, lead, and TCE were retained as shallow groundwater COCs. The FRE did not identify any COCs in deep groundwater monitoring wells at AOC 563.

2.4 RFI Conclusions and Recommendations

The *Zone E RFI Report, Revision 0* recommended that a CMS be conducted for 1) BEQs in surface soil, and 2) aluminum, arsenic, lead, and TCE in shallow groundwater at AOC 563.

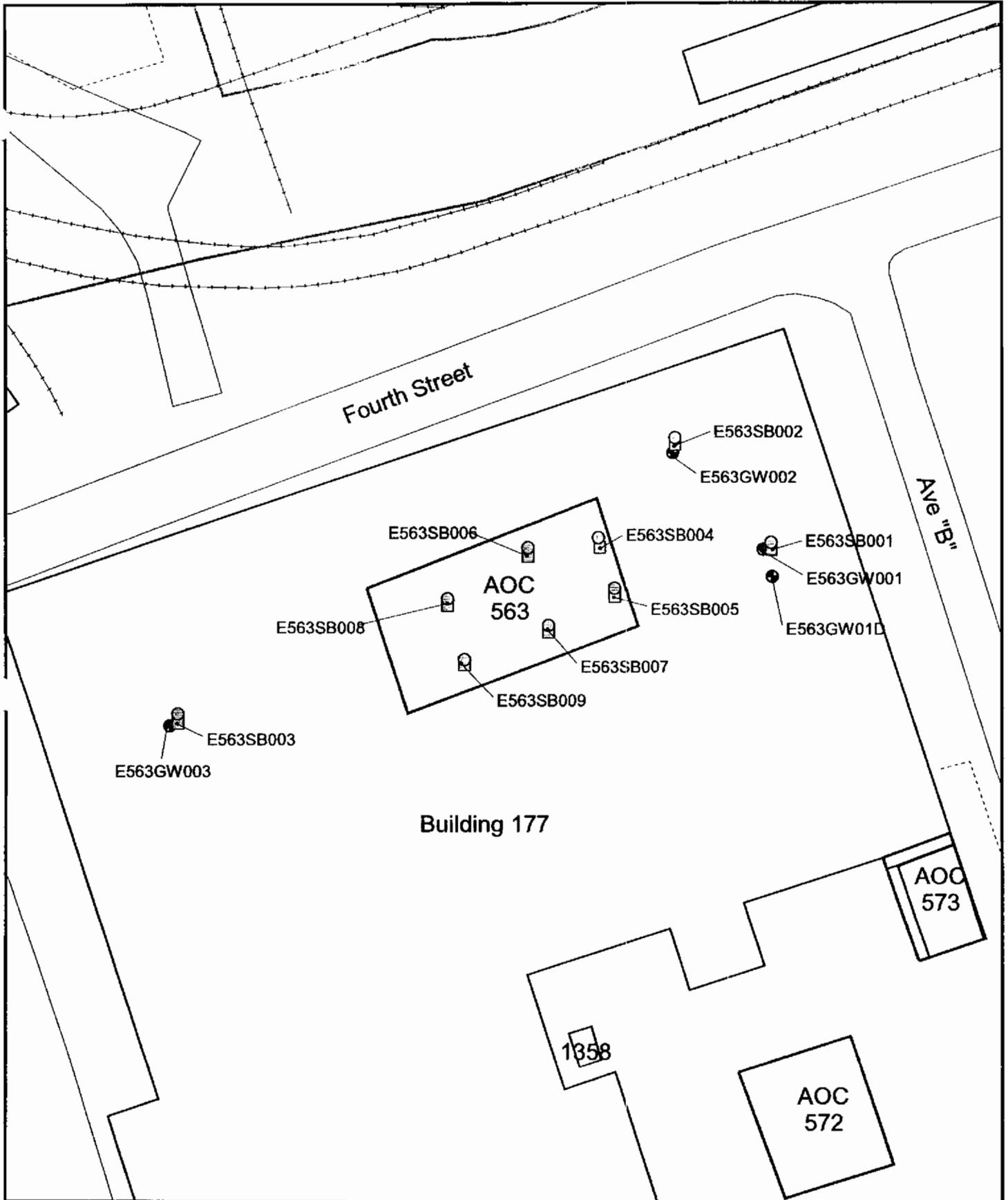
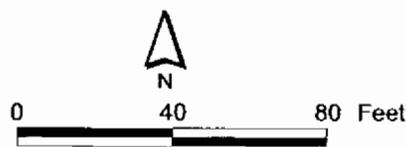


Figure 2-1
RFI Sampling Locations
AOC 563, Zone E
Charleston Naval Complex

- ⊙ Surface Soil
- ⊞ Subsurface Soil
- Groundwater Monitoring Well
- - - Fence
- ⌒ Railroads
- ⌒ Roads
- ▭ AOC Boundary
- ▭ SWMU Boundary
- ▭ Buildings



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

2 **3.1 UST/AST Removals**

3 A review of available maps and documents by CH2M-Jones did not reveal the presence of
4 an underground storage tank (UST). An aboveground storage tank (AST) used to store
5 kerosene is located outside at the southwest corner of Building 177, which is outside the
6 boundary of AOC 563.

7 **3.2 Interim Measures**

8 There were no IMs conducted at the site.

Section 4.0

1 **4.0 Summary of Additional Investigations**

2 **4.1 Groundwater Sampling and Analysis**

3 Additional groundwater sampling was conducted by the Navy/CH2M-Jones team during
4 November 2002 in order to delineate the nature and extent of chlorinated VOCs (CVOCs)
5 that were previously detected in groundwater in the vicinity of AOC 563.

6 As part of this sampling event, six shallow and two deep groundwater monitoring wells
7 were installed. Figure 4-1 shows the locations of these new wells and other wells previously
8 installed near AOC 563 as part of the initial RFI. Samples from these wells were analyzed
9 for VOCs and geochemical parameters such as ferrous iron, oxidation reduction potential
10 (ORP), and dissolved oxygen (DO). In addition, other existing shallow and deep
11 groundwater monitoring wells in this area that are associated with AOCs 563, 569, and 570
12 (see Figure 4-1) were also sampled for VOCs. Samples from some of these additional wells
13 were also analyzed for the geochemical parameters mentioned above. Appendix E contains
14 copies of the validated analytical results report, the data validation narratives, and
15 summaries relevant to the November 2002 groundwater sampling.

16 **4.1.1 Shallow Groundwater Sampling Results**

17 Among the detected VOCs, exceedances of the respective MCLs were identified for
18 tetrachloroethene (PCE) and trichloroethene (TCE). The single exceedance of PCE was
19 detected in the sample from well E563GW005 at 7.8 µg/L, above its MCL of 5 µg/L. The
20 TCE detections were found above the MCL of 5 µg/L in wells E563GW001, E563GW002,
21 E563GW004 and E563GW006, ranging from 5.4 µg/L to 1,700 µg/L, as shown in Table 4-1.

22 **4.1.2 Deep Groundwater Sampling Results**

23 Among the detected VOCs, exceedances of respective MCLs were identified for 1,2-
24 dichloroethene (1,2-DCE) and TCE. A single exceedance of 1,2-DCE was found in the
25 sample from E563GW04D, at 145 µg/L, above the MCL for cis-1,2-DCE of 70 µg/L. Two
26 detections of TCE exceeded the MCL of 5 µg/L. These detections were found in the samples
27 from E563GW04D at 1,700 µg/L, and in the sample from E563GW07D at 46.7 µg/L.

1 **4.2 COPC Summary**

- 2 The COPCs identified for shallow groundwater are TCE and PCE. The COPCs identified for
- 3 deep groundwater are 1,2-DCE and TCE.

TABLE 4-1
 VOC Detections in Shallow and Deep Groundwater, November 2002 Sampling
 RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Sample Location	Sample Identification	Concentration (µg/L)	Qualifier	Date Sampled	EPA Region III Tap water RBC (HI=0.1) (µg/L)	MCL (µg/L)
Acetone	E563GW003	563GW003M4	10.7	J	11/18/2002	61	NA
Benzene	E563GW004	563GW004M4	0.41	J	11/22/2002	0.32	5
	E563GW005	563GW005M4	0.34	J	11/21/2002		
1,2-DCE (total)	E563GW001	563GW001M4	10.2	J	11/18/2002	5.5	70
	E563GW002	563GW002M4	7.6	J	11/18/2002		
	E563GW004	563GW004M4	1.2	J	11/22/2002		
	E563GW006	563GW006M4	9.6	=	11/21/2002		
	E563GW009	563GW009M4	0.74	J	11/22/2002		
	E563GW04D	563GW04DM4	145	=	11/22/2002		
	E563GW07D	563GW07DM4	7.5	=	11/22/2002		
trans-1,2-DCE	E563GW001	563GW001M4	1.9	J	11/18/2002	12	100
	E563GW002	563GW002M4	1.4	J	11/18/2002		
cis-1,2-DCE	E563GW001	563GW001M4	8.3	J	11/18/2002	6	70
	E563GW002	563GW002M4	6.1	J	11/18/2002		
	E563GW004	563GW004M4	1.2	J	11/22/2002		
	E563GW006	563GW006M4	9.6	=	11/21/2002		
	E563GW009	563GW009M4	0.74	J	11/22/2002		
	E563GW04D	563GW04DM4	145	=	11/22/2002		
	E563GW07D	563GW07DM4	7.5	=	11/22/2002		
Ethylbenzene	E563GW004	563GW004M4	0.41	J	11/22/2002	134	700
	E563GW006	563GW006M4	0.31	J	11/21/2002		
	E563GW007	563GW007M4	0.22	J	11/22/2002		
	E563GW008	563GW008M4	0.29	J	11/21/2002		
PCE	E563GW002	563GW002M4	0.55	J	11/18/2002	1.1	5
	E563GW003	563GW003M4	2.6	J	11/18/2002		
	E563GW003	563HW003M4	2.7	J	11/18/2002		
	E563GW004	563GW004M4	0.65	J	11/22/2002		
	E563GW005	563GW005M4	7.8	=	11/21/2002		
	E563GW006	563GW006M4	4.2	J	11/21/2002		

TABLE 4-1
 VOC Detections in Shallow and Deep Groundwater, November 2002 Sampling
 RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Sample Location	Sample Identification	Concentration (µg/L)	Qualifier	Date Sampled	EPA Region III Tap water RBC (HI=0.1) (µg/L)	MCL (µg/L)
PCE	E563GW008	563GW008M4	0.84	J	11/21/2002	1.1	5
	E563GW07D	563GW07DM4	0.89	J	11/22/2002		
TCE	E563GW001	563GW001M4	7.9	J	11/18/2002	1.5	5
	E563GW002	563GW002M4	5.4	J	11/18/2002		
	E563GW003	563HW003M4	2.9	J	11/18/2002		
	E563GW003	563GW003M4	3.2	J	11/18/2002		
	E563GW004	563GW004M4	71.3	=	11/22/2002		
	E563GW005	563GW005M4	0.92	J	11/21/2002		
	E563GW006	563GW006M4DL	110	=	11/21/2002		
	E563GW007	563GW007M4	2.4	J	11/22/2002		
	E563GW008	563GW008M4	1.3	J	11/21/2002		
	E563GW009	563GW009M4	5	=	11/22/2002		
	E563GW04D	563GW04DM4	1,700	=	11/22/2002		
	E563GW07D	563GW07DM4	46.7	=	11/22/2002		
	m+p Xylene	E563GW004	563GW004M4	0.87	J		
E563GW006		563GW006M4	0.64	J	11/21/2002		
E563GW008		563GW008M4	0.63	J	11/21/2002		
o-Xylene	E563GW004	563GW004M4	0.28	J	11/22/2002	1,216	10,000
Xylenes, Total	E563GW004	563GW004M4	1.2	J	11/22/2002	1,216	10,000
	E563GW006	563GW006M4	0.64	J	11/21/2002		
	E563GW008	563GW008M4	0.63	J	11/21/2002		

All values are presented in units of micrograms per liter (µg/L).

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

HI Hazard Index

MCL Maximum Contaminant Level

NA Not applicable/not available

= Indicates that analyte is detected at the concentration shown.

J Indicates an estimated value. A "J" qualifier may signify that the concentration is below the PQL, or that the "J" has been applied as a result of the data validation.

1 **5.0 COPC/COC Refinement**

2 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) identified BEQs as surface soil COCs and
3 aluminum, arsenic, lead, and TCE as shallow groundwater COCs for AOC 563. These
4 chemicals are discussed further in the following sections.

5 In addition, the BCT has agreed that detections of VOCs in surface and subsurface soil
6 should be rescreened using generic SSLs that are based on DAF=1. This section presents the
7 results of this additional screening.

8 **5.1 COCs in Surface Soil**

9 **5.1.1 BEQs**

10 The RFI reported that among detected SVOC compounds, BEQ concentrations (which
11 ranged from 0.501 to 137.8 micrograms per kilogram [$\mu\text{g}/\text{kg}$]) did not exceed the industrial
12 land use RBC of 780 $\mu\text{g}/\text{kg}$ for benzo[a]pyrene. However, BEQs were identified in the RFI
13 report as a COPC based on exceedances of the residential RBC of 88 $\mu\text{g}/\text{kg}$ for
14 benzo[a]pyrene. Based on the BEQ calculation method currently adopted by the CNC BCT,
15 the BEQ concentrations in the soil samples range from 287 to 474 $\mu\text{g}/\text{kg}$ and do not exceed
16 the CNC BEQ sitewide reference concentration of 1,304 $\mu\text{g}/\text{kg}$, as shown in Table 5-1. For
17 these reasons, BEQs are not considered COCs for surface soil at this site.

18 **5.1.2 Soil VOC Screening using SSL at DAF=1**

19 Soil VOC detections were compared to SSLs at DAF =1. Acetone, methylene chloride, and
20 TCE were detected in soil samples at AOC 563. Only one chemical, methylene chloride,
21 exceeded this screening criteria. Methylene chloride was detected in three of nine surface
22 soil samples and five of nine subsurface soil samples. The detections of methylene chloride
23 above the SSL (DAF=1) ranged from 13 to 16 $\mu\text{g}/\text{kg}$ in three surface soil samples, and from
24 7 to 25 $\mu\text{g}/\text{kg}$ in five subsurface soil samples, as shown in Tables 5-2 and 5-3. All of these
25 detections exceeded the SSL of 1 $\mu\text{g}/\text{kg}$ (DAF=1).

26 Because methylene chloride concentrations in several soil samples exceeded the generic
27 SSL, a site-specific SSL was calculated for both the unpaved and paved scenarios. The
28 reported concentrations of methylene chloride were compared to the site-specific SSLs. The
29 SSL calculation is consistent with the *EPA Soil Screening Guidance: Technical Background*
30 *Document* (EPA, 1996a) and the *EPA Soil Screening Guidance: User's Guide* (EPA, 1996b).

1 Table 5-4 presents the SSL calculations and input parameters. The table shows the
2 calculation of SSLs for both paved and unpaved site conditions. The unpaved and paved
3 SSLs are also shown in Tables 5-2 and 5-3.

4 A comparison of detected concentrations of methylene chloride to the site-specific SSLs
5 resulted in one of the 16 soil samples exceeding the unpaved SSL. All samples contained
6 methylene chloride at concentrations below the paved SSL.

7 Because individual exceedances of the SSL do not necessarily represent a threat to local
8 groundwater, the mean methylene chloride concentration was compared to the site-specific
9 SSLs. Table 5-5 presents the reported VOC concentrations and the calculated mean
10 concentrations. The detected concentration of each sample was used in the calculation of the
11 mean concentration. For samples where methylene chloride was not detected, one-half of
12 the reported value was used in the calculation.

13 As can be seen in Table 5-5, the mean concentration of methylene chloride (0.007 mg/kg) is
14 below the paved and unpaved site-specific SSLs. It is not expected to present a threat to the
15 shallow groundwater, even when based on an unpaved scenario. There is currently a
16 building located on this site, and the site is expected to remain paved. Therefore, the
17 migration of methylene chloride is highly unlikely. Based on this information, methylene
18 chloride is not considered a soil COC at AOC 563.

19 **5.2 COCs in Groundwater**

20 **5.2.1 Aluminum**

21 The RFI report considered aluminum to be a COC based on the detections of aluminum
22 above the EPA Region III tap water RBC in shallow groundwater at AOC 563. One of these
23 detections during the initial sampling event (E563GW001: 22,000 µg/L) exceeded the
24 maximum Zone E background aluminum concentration in shallow groundwater of 16,100
25 µg/L. There is no primary MCL for aluminum. The groundwater sampling form for this
26 well for the sampling event where elevated aluminum was detected indicates that the
27 groundwater turbidity was elevated at the time of sampling (367 nephelometric turbidity
28 units [NTUs]). This elevated turbidity is likely the reason for the elevated aluminum in this
29 sample. Appendix D contains a copy of the groundwater sampling form. The aluminum
30 detections in well E563GW001 in the subsequent three groundwater sampling events were
31 below the maximum Zone E background aluminum concentration in shallow groundwater,
32 as shown in Table 5-6. Based on the information presented above, aluminum is not a
33 groundwater COC for this site.

1 **5.2.2 Arsenic**

2 The RFI report considered arsenic to be a COC at AOC 563 based on its detection in two
3 shallow groundwater samples, 563GW00101 and 563GW00201, at concentrations of 34.4 and
4 26.7 µg/L, respectively, that exceeded both the tap water RBC and shallow groundwater
5 BRC for arsenic. However, neither detection exceeded the state of South Carolina arsenic
6 MCL of 50 µg/L, as shown in Table 5-6. Arsenic detections during the subsequent
7 groundwater sampling events were also below the MCL. For this reason arsenic is not a
8 shallow groundwater COC for this site.

9 **5.2.3 Lead**

10 The RFI report considered lead to be a COC at AOC 563 based on its detection in one
11 shallow groundwater sample during the initial sampling event (E563GW001: 17.6 µg/L)
12 that exceeded both the TTAL of 15 µg/L and shallow groundwater BRC of 4.8 µg/L for
13 lead. Lead detections in well E563GW001 in the subsequent three groundwater sampling
14 events were below the TTAL of 15 µg/L and the maximum Zone E background lead
15 concentration in shallow groundwater of 47µg/L, as shown in Table 5-6. The groundwater
16 sampling form for this well for the sampling event where elevated lead was detected
17 indicates that the groundwater turbidity was also elevated at the time of sampling (367
18 NTUs). The elevated turbidity is likely the reason for the elevated lead in this sample. See
19 Appendix D for a copy of the groundwater sampling form. Based on the information
20 presented above, lead is not a shallow groundwater COC for AOC 563.

21 **5.2.4 TCE**

22 Table 5-6 and Figure 5-1 show the detected TCE concentrations in shallow groundwater and
23 deep groundwater at AOC 563 from the RFI and 2002 sampling events.

24 **Shallow Groundwater**

25 As shown in Figure C-1 included in Appendix C, the shallow groundwater flow in the
26 vicinity of AOC 563 is in a northeasterly direction. During the installation of well
27 E563GW004 in the November 2002 sampling event, TCE was detected in the well at 71.3
28 µg/L, which is above the MCL of 5 µg/L. Well E563GW004 is located directly upgradient of
29 AOC 563. Figure 5-1 presents the TCE results from the groundwater sampling conducted
30 during November 2002.

31 In the cross-gradient wells on the western side of AOC 563, TCE concentrations in well
32 E563GW003, which is slightly cross-gradient compared to E563GW004, showed a steadily
33 decreasing trend over the seven sampling events, decreasing from 120 µg/L to a detection

1 of 3.2 µg/L. This indicates the possibility of a low-level source in this area that has
2 attenuated naturally over time near well E563GW003. TCE concentrations in well
3 E569GW004, which were installed during March 2002, were 0.45 µg/L during the March
4 2002 sampling event and 0.8 mg/L during the November 2002 sampling event, which is
5 below the MCL of 5 µg/L. TCE concentrations in well E563GW005, installed during
6 November 2002, was 0.92 mg/L. In well E563GW006 (also installed in November 2002), the
7 TCE concentration was 110 mg/L, indicating a possible localized source in this area.

8 TCE detections in well E563GW002, which is downgradient of AOC 563, showed only one
9 slight exceedance of the MCL in the third and fourth sampling events (each at 6 µg/L),
10 followed by estimated detections below the MCL in two subsequent sampling events. In the
11 most recent sampling event in November 2002, TCE was detected in this well at 5.4 µg/L,
12 slightly above the MCL, indicating that TCE concentrations in this area are generally not
13 elevated well above the MCL. In other cross-gradient wells on the eastern (downgradient)
14 direction, TCE detections in wells E563GW007 and E563GW008 were below the MCL. TCE
15 concentrations in the cross-gradient well E563GW001 (on the eastern side) peaked during
16 the third sampling event in 1996 and showed a decrease to levels below laboratory
17 detection limits in 1998.

18 Based on these trends, TCE appears to be present at fairly low concentrations in shallow
19 groundwater, from a nearby low-level TCE source on the western (upgradient) side of AOC
20 563, but does not appear to be present downgradient of AOC 563 in levels sufficient to
21 indicate that historic operations associated with Building 37 (which was demolished prior
22 to the construction of Building 177 in 1955) are causing groundwater contamination.

23 A new site (AOC 723) has been identified for investigation on the southwestern side of
24 Building 177, directly upgradient of AOC 563. As part of the RFI for AOC 723, an additional
25 shallow well E723GW001, has been proposed to be installed in the RFI Work Plan for AOC
26 723 (CH2M-Jones, 2003). The groundwater contamination due to TCE in the vicinity of
27 AOC 563 will be evaluated for corrective measures as part of the AOC 723 investigations.

28 Based on the above observations, for the purposes of this RFIRA, TCE will not be evaluated
29 as a shallow groundwater COC, but will be retained as a COPC for AOC 723.

30 **Deep Groundwater**

31 As indicated in Figure C-2 included in Appendix C, the deep groundwater flow in the AOC
32 563 area is in an easterly direction. There are two deep groundwater monitoring wells in
33 this area. These are E563GW04D, which is cross-gradient of AOC 563 on the southwestern
34 side, and E563GW01D, which is downgradient of AOC 563.

1 There was an elevated TCE detection of 1,700 µg/L in well E563GW04D in November 2002,
2 when it was sampled after installation. It is unlikely that historic operations at AOC 563 are
3 the source of this TCE detection, and the detection could be due to another source in the
4 vicinity of this well.

5 TCE detections in the downgradient RFI well E563GW01D during six RFI sampling events
6 and the November 2002 sampling event have all been below laboratory detection limits,
7 indicating that operations at AOC 563 have not impacted the deep groundwater in this area.

8 Based on these observations, TCE is not considered a COC in deep groundwater at AOC
9 563. The elevated detection in well E563GW04D will be evaluated as part of the AOC 723
10 investigation, as indicated above.

11 **5.2.5 1,2-DCE**

12 Table 5-6 and Figure 5-2 show the detected 1,2-DCE concentrations in shallow groundwater
13 and deep groundwater at AOC 563 from the RFI and 2002 sampling events.

14 **Shallow Groundwater**

15 Detections of 1,2-DCE in groundwater monitoring wells in the vicinity of AOC 563 during
16 the RFI and November 2002 sampling events were all below the MCL of 70 µg/L. Therefore,
17 1,2-DCE is not considered a COC in shallow groundwater for AOC 563.

18 **Deep Groundwater**

19 During the RFI and November 2002 sampling events, there was only one detection of 1,2-
20 DCE exceeding the MCL of 70 µg/L. This detection of 145 µg/L was found in the sample
21 from well E563GW04D. This well is cross-gradient of AOC 563, and it is unlikely that the
22 1,2-DCE detection in this well is a result of contamination due to historical operations at
23 AOC 563. This 1,2-DCE exceedance will be addressed as part of the RFI for AOC 723. Based
24 on these observations, 1,2-DCE is not considered a deep groundwater COC at AOC 563.

25 **5.2.6 PCE**

26 Table 5-6 and Figure 5-3 show the detected PCE concentrations in shallow and deep
27 groundwater at AOC 563 from the RFI and 2002 sampling events.

28 **Shallow Groundwater**

29 Among the detected concentrations of PCE from the RFI and November 2002 sampling in
30 the wells near AOC 563, there were historic detections above MCL of 5 µg/L in only three
31 wells: E563GW003, E569GW004, and E563GW005.

1 In well E563GW003, there was one detection of PCE of 37 µg/L in the fourth of seven
2 sampling events, preceded and followed by detections below laboratory detection limits.
3 This well is upgradient of AOC 563.

4 In well E569GW004, which was installed during March 2002, there was a PCE detection of
5 5.9 µg/L during the March 2002 sampling and 11.7 µg /L during the November 2002
6 sampling. This well is located farther upgradient of well E563GW003, as presented in Figure
7 5-3.

8 In well E563GW005, which was installed during November 2002, there was a PCE detection
9 of 7.8 µg/L, which is above the MCL. This concentration was detected during the
10 November 2002 sampling. The well is located cross-gradient of AOC 563.

11 All of these wells are located on the upgradient (southern and western) side of AOC 563.
12 None of the wells on the downgradient (northern and eastern) side of AOC 563 showed
13 PCE detections above MCL. These observations indicate that the PCE detections on the
14 western side of AOC 563 are not a result of historic operations at AOC 563. The exceedances
15 in well E569GW004, as described above, will be addressed as part of the CMS for AOCs 569,
16 570, and 578. Based on these observations, PCE is not considered a COC in shallow
17 groundwater for AOC 563.

18 **Deep Groundwater**

19 There were no detections of PCE above its MCL of 5 µg/L in the deep groundwater
20 monitoring wells E563GW01D, E563GW04D, or E563GW07D, which are located in the
21 vicinity of AOC 563. Therefore, PCE is not considered a deep groundwater COC at this site.

22 **5.3 COC Summary**

23 Based on the discussions above, recent sampling indicates that a low-level source of
24 chlorinated VOCs upgradient of AOC 563, appears to be contributing to shallow
25 groundwater contamination in the upgradient areas. Deep groundwater contamination
26 from VOCs was not found above MCLs in the deep groundwater monitoring wells in the
27 vicinity of AOC 563. As discussed above, groundwater contamination from chlorinated
28 VOCs upgradient and cross-gradient of AOC 563 are proposed to be addressed under the
29 RFI for AOC 723. No other COCs for any media under either the unrestricted or industrial
30 future land use scenarios have been identified at this site.

TABLE 5-1
 Detected Concentrations of BEQs in Surface and Subsurface Soil at AOC 563
 RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Concentration ($\mu\text{g}/\text{kg}$)	Qualifier	Date Collected	EPA Region III Residential RBC	SSL (DAF=1)	Zone E Background Range of Conc.
BEQs^a	Surface Soil					88	NA	1,304
	E563SB001	563SB00101	425	=	01/29/1996			
	E563SB002	563SB00201	439	U	01/29/1996			
	E563SB003	563SB00301	328	=	01/29/1996			
	E563SB004	563SB00401	474	U	01/29/1996			
	E563SB005	563SB00501	462	U	01/29/1996			
	E563SB006	563SB00601	438	=	01/30/1996			
	E563SB007	563SB00701	287	=	01/30/1996			
	E563SB008	563SB00801	423	=	01/30/1996			
	E563SB009	563SB00901	416	U	01/30/1996			
	Subsurface Soil					88	NA	1,400
	E563SB001	563SB00102	451	U	01/29/1996			
	E563SB002	563SB00202	275	=	01/29/1996			
	E563SB003	563SB00302	427	=	01/29/1996			
	E563SB004	563SB00402	474	U	01/29/1996			
	E563SB005	563SB00502	428	U	01/29/1996			
	E563SB006	563SB00602	439	U	01/30/1996			
	E563SB007	563SB00702	286	=	01/30/1996			
	E563SB008	563SB00802	462	U	01/30/1996			
	E563SB009	563SB00902	437	=	01/30/1996			

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

^a BEQ calculation method based on the background PAHs study report, *Technical Information for Development of Background BEQ Values* (CH2M-Jones, February 2001).

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

NA Not applicable/not available.

U Indicates that the concentration was not detected.

TABLE 5-2
 Volatile Organic Compounds Detected in Surface Soil at AOC 563
 RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Date Collected	Concentration (mg/kg)	Qualifier	SSL _{generic} (DAF=1)	SSL _{unpaved} (DAF=4.9)	SSL _{paved} (DAF=49)
Acetone	E563SB005	563SB00501	01/29/1996	0.072	J	0.8	NA	NA
Methylene Chloride	E563SB001	563SB00101	01/29/1996	0.014	=	0.001	0.016	0.156
	E563SB002	563SB00201	01/29/1996	0.016	=			
	E563SB003	563SB00301	01/29/1996	0.013	=			
TCE	E563SB003	563SB00301	01/29/1996	0.002	J	0.015	NA	NA

All values are presented in units of milligrams per kilogram (mg/kg).

SSL_{generic} values are from the *EPA Soil Screening Guidance* (EPA, 1996a)

SSL_{unpaved} values are calculated for site- and chemical-specific data (see Table 5-4).

SSL_{paved} values are calculated for site- and chemical-specific data (see Table 5-4).

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.

= Indicates that the compound was detected, the reported concentration is the measured concentration.

NA Not available/not applicable.

TABLE 5-3
 Volatile Organic Compounds Detected in Subsurface Soil at AOC 563
 RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Date Collected	Concentration (mg/kg)	Qualifier	SSL _{generic} (DAF=1)	SSL _{unpaved} (DAF=4.9)	SSL _{paved} (DAF=49)
Methylene Chloride	E563SB001	563SB00102	01/29/1996	0.010	=	0.001	0.016	0.156
	E563SB002	563SB00202	01/29/1996	0.025	=			
	E563SB003	563SB00302	01/29/1996	0.008	=			
	E563SB004	563SB00402	01/29/1996	0.007	=			
	E563SB005	563SB00502	01/29/1996	0.008	=			

All values are presented in units of milligrams per kilogram (mg/kg).

SSL_{generic} values are from the *EPA Soil Screening Guidance* (EPA, 1996a)

SSL_{unpaved} values are calculated for site- and chemical-specific data (see Table 5-4).

SSL_{paved} values are calculated for site- and chemical-specific data (see Table 5-4).

Bold values exceed the SSL_{unpaved} value.

= Indicates that the compound was detected, the reported concentration is the measured concentration.

NA Not applicable/not available.

Table 5-4
 Leachate Transport Analysis Model
 RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

		Parameter	Methylene chloride
Chemical Specific Input Parameters			
Cw	= Target groundwater concentration MCL (mg/L)		5.00E-03
H	= Henry's Law Constant, dimensionless		8.98E-02
ks	= Soil-water sorption coefficient (cm ³ water / g soil = L/kg) = Koc x foc where koc = organic carbon-water sorption coefficient, (cm ³ (ml) water) / (g soluble organic carbon) foc = Fraction of organic content, dimensionless	0.037	4.33E-01 1.17E+01
Site Specific Input Parameters			
Sw	= Width of Source Parallel to Groundwater Flow Direction (impacted soil zone)	36.6 m 120 ft	
da	= Aquifer Thickness	7.1 m 23.25 ft	
d	= Groundwater Mixing Zone thickness (paved) (unpaved)	3.95 m 13.0 ft 5.07 m 16.6 ft	
i	= Groundwater Gradient		5.7E-03 (unitless)
Ks	= Saturated Hydraulic Conductivity	667.5 m/yr 2190.0 ft/yr	
θw	= Volumetric Water Content of Soil Pore Space	0.3 cm ³ vapor/cm ³ soil 0.3 in ³ vapor/in ³ soil	
θv	= Volumetric Vapor Content of Soil Pore Space	0.15 cm ³ vapor/cm ³ soil 0.15 in ³ vapor/in ³ soil	
ρs	= Soil Bulk Density	1.5 g/cm ³ 93.64 lb _m /ft ³	
qi	= Water Infiltration Rate (paved) (unpaved)	0.0086 m/yr 0.1372 m/yr 0.0283 ft/yr 0.4500 ft/yr	
	Partition Term, Cw/Csoil, (L/kg)		6.42E-01
	Dilution Term, dimensionless (paved) (unpaved)		4.87E+01 4.86E+00
	Csoil/Cw = Partition term * Dilution term (mg/kg / mg/L) = L/kg (paved) (unpaved)	$\frac{C_{soil}}{C_w} \left(\frac{\theta_w + K_s \rho_s + H \theta_v}{\rho_s} \right) \left(\frac{K_s i d + q_i S_w}{q_i S_w} \right)$	3.13E+01 3.12E+00
Calculated Site Specific Target Level for Soil			
	Csoil calculated source soil concentration (SSL, mg/kg) Cw*(partion term)*(dilution term) (paved) (unpaved)		0.156 0.016

Cw is the MCL from EPA National Drinking Water Standards (March 2001) or US EPA Region III RBCs (October, 2000).
 H from Table 36 of the Soil Screening Guidance, Technical Background Document (EPA, 1996).
 ks = koc x foc.
 koc from Table 39 of the Soil Screening Guidance, Technical Background Document (EPA, 1996).
 foc calculated as the mean foc from TOC measurements from Zone E.
 Sw Estimated as the distance along gw flow path (length, NW-SE) of AOC 563 (120 ft).
 d is calculated as $M = (0.0112 L^2)^{0.5} + d_a(1 - e^{-L d / K_s d_a})$ or da, whichever is less.
 da is based on top of Ashley (-20 ft, GIS) and nearest isocontour line for groundwater level (3.25 ft msl, GIS).
 i Calculated from isocontour groundwater map for Zone E ([3.11-2.89]/38.5 ~ 0.005, CH2MHill, 2002).
 Ks Based on CH2MHill's hydraulic conductivity theme in the GIS (6 ft/d).
 θw is the default value presented in the Soil Screening Guidance: User's Guide (EPA, 1996).
 θv is calculated as total porosity (0.45, assumed) - θw (0.3) = 0.15.
 ρs is the default value presented in the Soil Screening Guidance: User's Guide (EPA, 1996).
 qi is a derived value (unpaved, 5.4 in/yr or paved, 0.34 in/yr) based on annual precipitation, evapo-transportation, and runoff coefficient values for the Charleston area.

TABLE 5-5
 Calculated Mean Concentration and SSL Comparison for Methylene Chloride in Soil at AOC 563
RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Station ID	Sample ID	Concentration (mg/kg)	Qualifier	Value Used for Mean	Mean Concentration ^a	SSL _{unpaved} (DAF=4.9)	SSL _{paved} (DAF=49)
E563SB001	563SB00101	0.014	=	0.014	0.008	0.016	0.156
	563SB00102	0.01	=	0.010			
E563SB002	563SB00201	0.016	=	0.016			
	563SB00202	0.025	=	0.025			
E563SB003	563SB00301	0.013	=	0.013			
	563SB00302	0.008	=	0.008			
E563SB004	563SB00401	0.006	U	0.003			
	563SB00402	0.007	=	0.007			
E563SB005	563SB00501	0.006	U	0.003			
	563SB00502	0.008	=	0.008			
E563SB006	563SB00601	0.006	U	0.003			
	563SB00602	0.006	U	0.003			
E563SB007	563SB00701	0.014	U	0.007			
	563SB00702	0.006	U	0.003			
E563SB008	563SB00801	0.006	U	0.003			
	563SB00802	0.006	U	0.003			
E563SB009	563SB00901	0.005	U	0.003			
	563SB00902	0.015	U	0.008			

All values are presented in units of milligrams per kilogram (mg/kg).

^a Mean concentration was calculated using the reported value for samples where the compound was detected and 1/2 the reported value for non-detects (U and UJ) unless noted. Otherwise, U indicates that the compound was not detected, the reported concentration is the detection limit.

All samples were collected on January 29, 1996.

= Indicates that the compound was detected, the reported concentration is the measured concentration.

TABLE 5-6
 Detected Concentrations of COPCs in Groundwater at AOC 563
RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Station Location	Sample Identification	Concentration (µg/L)	Qualifier	Date Collected	EPA Region III Tap Water RBC(µg/L)	MCL (µg/L)	Zone E Range of Background Concentrations (µg/L)
Aluminum	E563GW001	E563GW00101	22,000	J	03/28/1996	3,700	NA	19 - 16,100
	E563GW001	E563GW00102	2,600	=	07/24/1996			
	E563GW001	E563GW00103	4,940	J	11/20/1996			
	E563GW001	E563GW00104	1,560	=	02/04/1997			
	E563GW002	E563GW00201	356	J	03/28/1996			
	E563GW002	E563GW00202	332	=	07/24/1996			
	E563GW002	E563GW00203	479	=	11/22/1996			
	E563GW002	E563GW00204	388	=	02/05/1997			
	E563GW003	E563GW00301	125	U	03/28/1996			
	E563GW003	E563GW00302	165	=	07/31/1996			
	E563GW003	E563GW00303	255	=	11/22/1996			
	E563GW003	E563GW00304	194	J	02/05/1997			
	E563GW01D	E563GW01D01	25	U	04/04/1996	3,700	NA	19 - 461
	E563GW01D	E563GW01D02	18	UJ	07/24/1996			
	E563GW01D	E563GW01D03	19.9	J	11/20/1996			
	E563GW01D	E563GW01D04	18	U	02/04/1997			
Arsenic	E563GW001	E563GW00101	34.4	=	03/28/1996	0.045	50	2.6 - 316
	E563GW001	E563GW00102	31.8	=	07/24/1996			

TABLE 5-6
 Detected Concentrations of COPCs in Groundwater at AOC 563
RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Station Location	Sample Identification	Concentration (µg/L)	Qualifier	Date Collected	EPA Region III Tap Water RBC(µg/L)	MCL (µg/L)	Zone E Range of Background Concentrations (µg/L)
Arsenic	E563GW001	E563GW00103	37.9	=	11/20/1996	0.045	50	2.6 - 316
	E563GW001	E563GW00104	25.2	=	02/04/1997			
	E563GW002	E563GW00201	26.7	=	03/28/1996			
	E563GW002	E563GW00202	32.9	=	07/24/1996			
	E563GW002	E563GW00203	36.5	=	11/22/1996			
	E563GW002	E563GW00204	25.2	=	02/05/1997			
	E563GW003	E563GW00301	5.8	J	03/28/1996			
	E563GW003	E563GW00302	2.5	U	07/31/1996			
	E563GW003	E563GW00303	2.5	U	11/22/1996			
	E563GW003	E563GW00304	2.5	U	02/05/1997			
	E563GW01D	E563GW01D01	5	U	04/04/1996	0.045	50	2.6 - 132
	E563GW01D	E563GW01D02	3.4	U	07/24/1996			
	E563GW01D	E563GW01D03	6.4	J	11/20/1996			
	E563GW01D	E563GW01D04	2.9	J	02/04/1997			
Lead	E563GW001	E563GW00101	17.6	=	03/28/1996	NA	15*	NA
	E563GW001	E563GW00102	5.1	U	07/24/1996			
	E563GW001	E563GW00103	13.6	=	11/20/1996			
	E563GW001	E563GW00104	3.1	=	02/04/1997			

TABLE 5-6
 Detected Concentrations of COPCs in Groundwater at AOC 563
RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Station Location	Sample Identification	Concentration ($\mu\text{g/L}$)	Qualifier	Date Collected	EPA Region III Tap Water RBC($\mu\text{g/L}$)	MCL ($\mu\text{g/L}$)	Zone E Range of Background Concentrations ($\mu\text{g/L}$)
Lead	E563GW002	E563GW00201	3	U	03/28/1996	NA	15*	NA
	E563GW002	E563GW00202	1.7	U	07/24/1996			
	E563GW002	E563GW00203	1.7	UJ	11/22/1996			
	E563GW002	E563GW00204	1.7	U	02/05/1997			
	E563GW003	E563GW00301	3	U	03/28/1996			
	E563GW003	E563GW00302	1.7	U	07/31/1996			
	E563GW003	E563GW00303	1.7	UJ	11/22/1996			
	E563GW003	E563GW00304	1.7	U	02/05/1997			
	E563GW01D	E563GW01D01	3	U	04/04/1996	NA	15*	2.1 - 3.0
	E563GW01D	E563GW01D02	1.7	U	07/24/1996			
	E563GW01D	E563GW01D03	1.7	U	11/20/1996			
	E563GW01D	E563GW01D04	1.7	U	02/04/1997			
TCE	E563GW001	E563GW00101	5	U	03/28/1996	1.6	5	NA
	E563GW001	E563GW00102	6	=	07/24/1996			
	E563GW001	E563GW00103	14	=	11/20/1996			
	E563GW001	E563GW00104	10	=	02/04/1997			
	E563GW001	E563GW00101a	5	S=	03/10/1998			
	E563GW001	E563GW00102a	5	SU	10/13/1998			

TABLE 5-6
 Detected Concentrations of COPCs in Groundwater at AOC 563
RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Station Location	Sample Identification	Concentration (µg/L)	Qualifier	Date Collected	EPA Region III Tap Water RBC(µg/L)	MCL (µg/L)	Zone E Range of Background Concentrations (µg/L)
TCE	E563GW001	E563GW001M4	7.9	J	11/18/2002	1.6	5	NA
	E563GW002	E563GW00201	5	U	03/28/1996			
	E563GW002	E563GW00202	5	=	07/24/1996			
	E563GW002	E563GW00203	6	=	11/22/1996			
	E563GW002	E563GW00204	6	=	02/05/1997			
	E563GW002	E563GW00201a	3	SJ	03/10/1998			
	E563GW002	E563GW00202a	3	SJ	10/13/1998			
	E563GW002	E563GW002M4	5.4	J	11/18/2002			
	E563GW003	E563GW00301	120	=	03/28/1996			
	E563GW003	E563GW00302	120	=	07/31/1996			
	E563GW003	E563GW00303	100	=	11/22/1996			
	E563GW003	E563GW00304	44	=	02/05/1997			
	E563GW003	E563GW00301a	12	S=	03/10/1998			
	E563GW003	E563GW00302a	5	SU	10/13/1998			
	E563GW003	E563GW003M4	3.2	J	11/18/2002			
	E563GW004	E563GW004M4	71.3	=	11/22/2002			
	E563GW005	E563GW005M4	0.92	J	11/21/2002			
	E563GW007	E563GW007M4	2.4	J	11/22/2002			

TABLE 5-6
 Detected Concentrations of COPCs in Groundwater at AOC 563
RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Station Location	Sample Identification	Concentration (µg/L)	Qualifier	Date Collected	EPA Region III Tap Water RBC(µg/L)	MCL (µg/L)	Zone E Range of Background Concentrations (µg/L)
TCE	E563GW008	E563GW008M4	1.3	J	11/21/2002	1.6	5	NA
	E563GW009	E563GW009M4	5	=	11/22/2002			
	E563GW01D	E563GW01D01	5	U	04/04/1996			
	E563GW01D	E563GW01D02	5	U	07/24/1996			
	E563GW01D	E563GW01D03	5	U	11/20/1996			
	E563GW01D	E563GW01D04	5	U	02/04/1997			
	E563GW01D	E563GW01D01a	5	SU	03/10/1998			
	E563GW01D	E563GW01D02a	5	SU	10/13/1998			
	E563GW04D	E563GW04DM4	1,700	=	11/22/2002			
	E563GW07D	E563GW07DM4	46.7	=	11/22/2002			
1,2-DCE	E563GW001	E563GW00101	10	=	03/28/1996	0.04	70	NA
	E563GW001	E563GW00101a	8	=	03/10/1998			
	E563GW001	E563GW00102	15	=	07/24/1996			
	E563GW001	E563GW00103	25	=	11/20/1996			
	E563GW001	E563GW00104	24	=	02/04/1997			
	E563GW001	E563GW001M4	10.2	J	11/18/2002			
	E563GW002	E563GW00201	12	=	03/28/1996			
	E563GW002	E563GW00202	16	=	07/24/1996			

TABLE 5-6
 Detected Concentrations of COPCs in Groundwater at AOC 563
RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Station Location	Sample Identification	Concentration (µg/L)	Qualifier	Date Collected	EPA Region III Tap Water RBC(µg/L)	MCL (µg/L)	Zone E Range of Background Concentrations (µg/L)
1,2-DCE	E563GW002	E563GW00203	17	=	11/22/1996	0.04	70	NA
	E563GW002	E563GW00204	17	=	02/05/1997			
	E563GW002	E563GW002M4	7.6	J	11/18/2002			
	E563GW003	E563GW00301	8	=	03/28/1996			
	E563GW003	E563GW00302	6	=	07/31/1996			
	E563GW003	E563GW00303	4	J	11/22/1996			
	E563GW003	E563GW00304	2	J	02/05/1997			
		E563GW002M4	5	U	11/18/2002			
	E563GW004	E563GW004M4	1.2	J	11/22/2002			
	E563GW005	E563GW005M4	5	U	11/18/2002			
	E563GW006	E563GW006M4	9.6	=	11/21/2002			
	E563GW007	E563GW007M4	5	U	11/18/2002			
	E563GW008	E563GW008M4	5	U	11/18/2002			
	E563GW009	E563GW009M4	0.74	J	11/22/2002			
	E563GW01D	E563GW01D01	5	U	04/04/1996			
	E563GW01D	E563GW01D02	5	U	07/24/1996			
	E563GW01D	E563GW01D03	5	U	11/20/1996			
E563GW01D	E563GW01D04	5	U	02/04/1997				

TABLE 5-6
 Detected Concentrations of COPCs in Groundwater at AOC 563
RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Station Location	Sample Identification	Concentration (µg/L)	Qualifier	Date Collected	EPA Region III Tap Water RBC(µg/L)	MCL (µg/L)	Zone E Range of Background Concentrations (µg/L)
1,2-DCE	E563GW01D	E563GW01DM4	5	U	11/18/2002	0.04	70	NA
	E563GW04D	E563GW04DM4	145	=	11/22/2002			
	E563GW07D	E563GW07DM4	7.5	=	11/22/2002			
Methylene Chloride	E563GW001	E563GW00101	5	U	03/28/1996	4.1	5	NA
	E563GW001	E563GW00102	5	U	07/24/1996			
	E563GW001	E563GW00103	7	=	11/20/1996			
	E563GW001	E563GW00104	5	U	02/04/1997			
	E563GW001	E563GW00101a	5	SU	03/10/1998			
	E563GW001	E563GW00102a	5	SU	10/13/1998			
	E563GW002	E563GW00201	5	U	03/28/1996			
	E563GW002	E563GW00202	5	U	07/24/1996			
	E563GW002	E563GW00203	5	U	11/22/1996			
	E563GW002	E563GW00204	5	U	02/05/1997			
	E563GW002	E563GW00201a	5	SU	03/10/1998			
	E563GW002	E563GW00202a	5	SU	10/13/1998			
	E563GW003	E563GW00301	17	U	03/28/1996			
	E563GW003	E563GW00302	5	U	07/31/1996			
	E563GW003	E563GW00303	6	U	11/22/1996			

TABLE 5-6
 Detected Concentrations of COPCs in Groundwater at AOC 563
RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Station Location	Sample Identification	Concentration (µg/L)	Qualifier	Date Collected	EPA Region III Tap Water RBC(µg/L)	MCL (µg/L)	Zone E Range of Background Concentrations (µg/L)
Methylene Chloride	E563GW003	E563GW00304	5	U	02/05/1997	4.1	5	NA
	E563GW003	E563GW00301a	5	SU	03/10/1998			
	E563GW003	E563GW00302a	5	SU	10/13/1998			
	E563GW01D	E563GW01D01	6	U	04/04/1996			
	E563GW01D	E563GW01D02	5	U	07/24/1996			
	E563GW01D	E563GW01D03	2	J	11/20/1996			
	E563GW01D	E563GW01D04	5	U	02/04/1997			
	E563GW01D	E563GW01D01a	5	SU	03/10/1998			
	E563GW01D	E563GW01D02a	5	SU	10/13/1998			
PCE	E563GW001	563GW00101	5	U	03/28/1996	1.1	5	NA
	E563GW001	563GW00102	5	U	07/24/1996			
	E563GW001	563GW00103	1	J	11/20/1996			
	E563GW001	563GW00104	5	U	02/04/1997			
	E563GW002	563GW00201	5	U	03/28/1996			
	E563GW002	563GW00202	5	U	07/24/1996			
	E563GW002	563GW00203	5	U	11/22/1996			
	E563GW002	563GW00204	5	U	02/05/1997			
	E563GW002	563GW002M4	0.55	J	11/18/2002			

TABLE 5-6
 Detected Concentrations of COPCs in Groundwater at AOC 563
RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Station Location	Sample Identification	Concentration ($\mu\text{g/L}$)	Qualifier	Date Collected	EPA Region III Tap Water RBC($\mu\text{g/L}$)	MCL ($\mu\text{g/L}$)	Zone E Range of Background Concentrations ($\mu\text{g/L}$)
PCE	E563GW003	563GW00301	5	U	03/28/1996	1.1	5	NA
	E563GW003	563GW00302	5	U	07/31/1996			
	E563GW003	563GW00303	5	U	11/22/1996			
	E563GW003	563GW00304	5	U	02/05/1997			
	E563GW003	563GW003M4	2.6	J	11/18/2002			
	E563GW004	563GW004M4	0.65	J	11/22/2002			
	E563GW005	563GW005M4	7.8	=	11/21/2002			
	E563GW006	563GW006M4	4.2	J	11/21/2002			
	E563GW007	E563GW007M4	5	U	11/18/2002			
	E563GW008	563GW008M4	0.84	J	11/21/2002			
	E563GW009	E563GW009M4	0.74	J	11/22/2002			
	E563GW01D	563GW01D01	5	U	04/04/1996			
	E563GW01D	563GW01D02	5	U	07/24/1996			
	E563GW01D	563GW01D03	5	U	11/20/1996			
	E563GW01D	563GW01D04	5	U	02/04/1997			
	E563GW01D	E563GW01DM4	5	U	11/18/2002			
	E563GW04D	E563GW04DM4	100	U	11/22/2002			
	E563GW07D	563GW07DM4	0.89	J	11/22/2002			

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

TABLE 5-6
 Detected Concentrations of COPCs in Groundwater at AOC 563
RFI Report Addendum, AOC 563, Zone E, Charleston Naval Complex

Parameter	Station Location	Sample Identification	Concentration (µg/L)	Qualifier	Date Collected	EPA Region III Tap Water RBC(µg/L)	MCL (µg/L)	Zone E Range of Background Concentrations (µg/L)
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Concentrations in bold text and outlined within the table represent exceedances of the appropriate screening criteria.

- = Indicates that the analyte was detected at the concentration shown.
 - * Indicates that there is no MCL published for lead. Value shown is the treatment technique action level (TTAL).
 - 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.
- MCL Maximum Contaminant Level
- S Indicates that the data has not been validated but can be used for screening purposes.
 - S= Indicates that the analyte was detected at the concentration shown, used for screening purposes only.
 - SU Indicates that the analyte was not detected, used for screening purposes only.
 - U Indicates that the analyte was not detected.

6.0 Summary of Information Related to Site Closeout Issues

6.1 RFI Status

The *Zone E RFI Report, Revision 0* (EnSafe, 1997) addressed SWMUs/AOCs within Zone E of the CNC, including AOC 563.

The RFI for AOC 563 identified COCs for surface soils and shallow groundwater. Based on the discussion presented in Section 5.0, no COCs in soils or groundwater have been identified at AOC 563.

6.2 Presence of Inorganics in Groundwater

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

There were no detections of antimony or thallium in shallow or deep wells above the laboratory detection limits. There were no detections of arsenic above the MCL determined for the State of South Carolina in samples from the shallow or deep groundwater monitoring wells. Therefore, further evaluation of this issue is not 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 direct impact from this site to the investigated storm sewers is known to exist. Therefore, no further evaluation of this issue is warranted.

1 **6.5 Potential Linkage to AOC 504, Investigated Railroad Lines**
2 **at the CNC**

3 The nearest existing railroad line to AOC 563 is approximately 100 feet north of the site.
4 There is no known linkage between AOC 563 and the investigated railroad lines of AOC
5 504, thus further evaluation of this issue is not warranted.

6 **6.6 Potential Migration Pathways to Surface Water Bodies at**
7 **the CNC**

8 The nearest surface water body to AOC 563 is the Cooper River, which lies approximately
9 600 feet northeast of the site. The only potential migration pathway from the site to surface
10 water is via overland flow via stormwater runoff. The entire site is covered with buildings
11 and pavement, which eliminates any contact of surface soil with stormwater. Similarly,
12 runoff directed to the storm sewer system, which discharges to the Cooper River, does not
13 come in contact with the surface soil. Because the site is currently located beneath Building
14 177, no further evaluation of a potential pathway for contaminant migration via stormwater
15 runoff is warranted.

16 **6.7 Potential Contamination in Oil/Water Separators (OWSs)**

17 There is no indication of OWSs associated with AOC 563 according to the *Oil Water*
18 *Separator Data* document, issued by the Department of the Navy, September 2000. Therefore,
19 further evaluation of this issue is not warranted.

20 **6.8 Land Use Controls (LUCs)**

21 The CNC BCT has agreed that LUCs will be applied across all of Zone E at the CNC. These
22 LUCs are expected to include, at a minimum, restrictions for future land use to non-
23 residential use only. These LUCs will be applied to AOC 563 due to its location within Zone
24 E.

1 **7.0 Recommendations**

2 AOC 563 is former Building 37, a locomotive maintenance house constructed in 1913 and
3 used until 1939. According to the RFA, probable maintenance activities involved petroleum-
4 based lubricants, chlorinated solvents and degreasers, and coal or petroleum fuels. Building
5 177 is currently on the site of former Building 37. Building 177 is currently being used for
6 storage and equipment maintenance activities in support of the operations by Detyens
7 Shipyards, Inc.

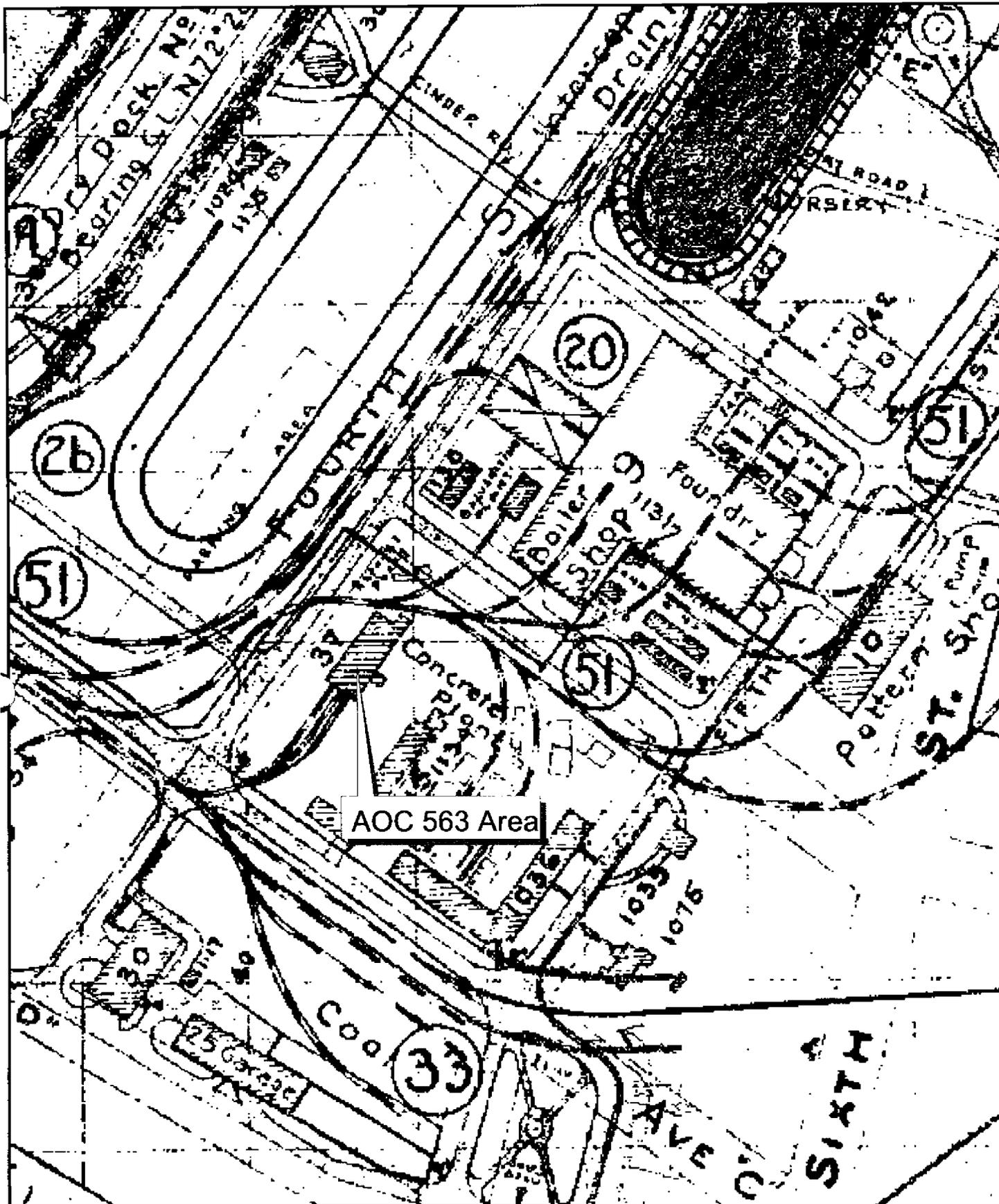
8 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) identified BEQs in surface soils, and
9 aluminum, arsenic, lead, and TCE in shallow groundwater as COCs for the AOC 563 site.
10 Based on an evaluation of the data and site conditions as presented herein, no COCs in soil
11 or groundwater have been identified for this site. Groundwater contamination upgradient
12 of AOC 563 is being addressed as part of the RFI for a new site, AOC 723. No other COCs
13 were identified for any other media at this site.

14 This site is appropriate for continued industrial land use. Because the site is located in the
15 industrial area of the CNC in Zone E, LUCs will be applied that limit future land use of the
16 site to industrial use only.

1 8.0 References

- 2 CH2M-Jones. *Technical Memorandum: A Summary of Inorganic Chemical Concentrations in*
3 *Background Soil and Groundwater at the CNC*. February 2001.
- 4 CH2M-Jones. *RCRA Facility Assessment/RCRA Facility Investigation Work Plan, AOC 723, Zone*
5 *E*. Revision 0. May 9, 2003.
- 6 EnSafe Inc. *Zone E RFI Report, Revision 0, NAVBASE Charleston*. November 1997.
- 7 EnSafe Inc./Allen & Hoshall. *Final RCRA Facility Assessment Report, NAVBASE Charleston*.
8 June 6, 1995a.
- 9 EnSafe Inc./Allen & Hoshall. *Final Zone E RFI Work Plan, Revision 1, NAVBASE Charleston*.
10 June 1995b.
- 11 South Carolina Department of Health and Environmental Control, Final RCRA Part B
12 Permit No. SC0 170 022 560.
- 13 U.S. Environmental Protection Agency. *EPA Soil Screening Guidance: Technical Background*
14 *Document* (Table A-1), EPA/540/R-95/128. May 1996a.
- 15 U.S. Environmental Protection Agency. *EPA Soil Screening Guidance: User's Guide*. EPA/Pub.
16 No. 9355.4-23. July 1996b.
- 17 U.S. Navy. *Oil/Water Separator Data*. September 2000.

Appendix A



— Railroad Line



Figure A-1
 Historic Railroad Lines near the former Building 37
 AOC 563 Area, Zone E
 Charleston Naval Complex

Image from Public Works drawing h606-40(b) December 15, 1939

CH2MHILL

Responses to Comments from Eric F. Cathcart, SCDHEC

Site Specific Comments

AOC 563

SCDHEC Comment 54

Trichloroethene in shallow groundwater at AOC 563 has not been fully delineated both horizontally or vertically. Additional groundwater samples should be proposed.

Navy/EnSafe Response:

The Navy recognizes the TCE problem in shallow groundwater at this site. However, analytical results for shallow monitoring wells to the west at AOCs 569 and 570 do not indicate significant concentrations of TCE. Also, results from shallow wells to the south at AOCs 572 and 573 and from wells to the east at SWMUs 83, 84 and AOC 574 do not indicate elevated concentrations of TCE. Elevated concentrations of TCE have been detected in deep groundwater to the west at AOC 570 (NBCE57003D), consistently exceeding its MCL, but as previously mentioned, this particular constituent has been identified at elevated concentrations at several sites and in deep grid wells throughout the northern portion of Zone E. Analytical results from this area will be evaluated and the Navy will discuss additional well locations with the Project Team.

CH2M-Jones Response:

A focused groundwater investigation, as part of the Corrective Measures Study (CMS) phase is being proposed to obtain additional information about the extent of chlorinated solvent contamination in the vicinity of this site in Zone E.

SCDHEC Comment 55

The first sentence in the third paragraph on page 10.31-18 should be revised. 1,2-Dichloroethene (total) was also detected in shallow groundwater at a concentration exceeding its corresponding tap water RBC.

Navy/EnSafe Response:

This sentence will be revised to include 1,2-Dichloroethene in the Final Zone E RFI Report.

CH2M-Jones Response:

1,2-Dichloroethene was addressed in the risk evaluation in the RFI Report and was not retained as a COC in shallow groundwater at AOC 563 because it did not exceed its drinking water MCL.

Appendix C

Chemicals Detected in Zone E Soil Samples
AOC 563

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
<i>Volatile Organic Compounds (ug/kg)</i>						
Acetone	563SB005	72.00	ND	780000.00	NA	NA
Methylene chloride	563SB001	14.00	10.00	85000.00		
	563SB002	16.00	25.00			
	563SB003	13.00	8.00			
	563SB004	ND	7.00			
	563SB005	ND	8.00			
Trichloroethene	563SB003	2.00	ND	58000.00	NA	NA
<i>Semi-volatile Compounds (ug/kg)</i>						
Benzo(a)anthracene	563SB002	ND	80.00	880.00	NA	NA
	563SB003	100.00	ND			
	563SB007	55.00	47.00			
Benzo(a)pyrene	563SB002	ND	71.00	88.00	NA	NA
	563SB003	110.00	ND			
	563SB007	52.00	61.00			
Benzo(b)fluoranthene	563SB001	54.00	ND	880.00	NA	NA
	563SB002	ND	58.00			
	563SB003	110.00	ND			
	563SB007	72.50	90.00			
	563SB008	40.00	ND			
Benzo(g,h,i)perylene	563SB002	ND	58.00	310000.00	NA	NA
	563SB003	59.00	ND			
	563SB007	47.00	64.00			
Benzo(k)fluoranthene	563SB002	ND	98.00	8800.00	NA	NA
	563SB003	98.00	ND			
	563SB006	45.00	ND			
	563SB007	56.00	95.00			
	563SB008	47.00	ND			
Benzoic acid	563SB006	76.00	ND	31000000.00	NA	NA
Benzyl alcohol	563SB006	39.00	ND	2300000.00	NA	NA
Butylbenzylphthalate	563SB006	7200.00	740.00	1600000.00	NA	NA
Chrysene	563SB001	55.00	ND	88000.00	NA	NA
	563SB002	100.00	ND			
	563SB003	120.00	43.00			
	563SB006	51.00	ND			
	563SB007	68.00	100.00			
	563SB008	49.00	ND			
	563SB009	ND	46.00			
	563SB001	60.00	ND	3100000.00	NA	NA
	563SB002	ND	120.00			
Fluoranthene	563SB003	170.00	51.00			
	563SB006	60.00	ND			
	563SB007	55.50	72.00			
	563SB002	ND	44.00	880.00	NA	NA
	563SB003	57.00	ND			
Indeno(1,2,3-cd)pyrene	563SB007	41.00	53.00			
	563SB001	42.00	ND	310000.00	NA	NA
	563SB002	ND	84.00			
Phenanthrene	563SB003	60.00	ND			

Chemicals Detected in Zone E Soil Samples
AOC 563

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Pyrene	563SB006	40.00	ND			
	563SB001	78.00	ND	230000.00	NA	NA
	563SB002	ND	140.00			
	563SB003	200.00	64.00			
	563SB006	75.00	ND			
	563SB007	76.00	86.00			
	563SB008	49.00	ND			
	563SB009	ND	46.00			
	bis(2-Ethylhexyl)phthalate (BEHP)	563SB001	71.00	ND	4600.00	NA
563SB002		44.00	46.00			
563SB003		140.00	ND			
563SB004		47.00	ND			
563SB006		13000.00	2683.00			
563SB007		3150.00	1400.00			
563SB008		54.00	54.00			
563SB009		100.00	49.00			
Chlorinated Pesticides (ug/kg)						
4,4'-DDD	563SB005	11.00	6.50	2700.00	NA	NA
	563SB008	3.90	ND			
4,4'-DDE	563CB007	8.30	ND	1900.00	NA	NA
	563SB002	ND	5.20			
	563SB003	3.00	ND			
	563SB004	3.10	ND			
	563SB005	30.00	47.00			
	563SB006	8.70	ND			
	563SB007	3.10	ND			
	563SB008	44.00	7.20			
	563SB009	5.70	ND			
4,4'-DDT	563CB007	9.70	ND	1900.00	NA	NA
	563SB002	7.70	ND			
	563SB003	6.20	4.40			
	563SB004	48.00	5.70			
	563SB005	52.00	30.00			
	563SB006	11.00	ND			
	563SB007	12.00	7.50			
	563SB008	20.00	7.00			
	563SB009	7.40	ND			
Endrin aldehyde	563SB008	3.90	ND	2300.00	NA	NA
alpha-Chlordane	563SB002	ND	2.10	490.00	NA	NA
Polychlorinated biphenyls (ug/kg)						
Aroclor-1260	563SB009	ND	190.00	83.00	NA	NA
Dioxin/Dibenzofuran (ng/kg)						
1234678-HpCDD	563CB007	4.70	NS	NA	NA	NA
	563CB008	ND	3.17			
1234678-HpCDF	563CB007	2.05	NS	NA	NA	NA
	563CB006	ND	1.71			
123478-HxCDF	563CB007	2.81	NS	NA	NA	NA
	563CB006	ND	6.67			

Chemicals Detected in Zone E Soil Samples
AOC 563

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
234678-HxCDF	563CB006	ND	6.41	NA	NA	NA
23478-PeCDF	563CB006	ND	3.21	NA	NA	NA
2378-TCDF	563CB007	3.43	NS	NA	NA	NA
	563CB006	ND	9.85			
OCDD	563CB007	102.00	NS	NA	NA	NA
	563CB006	ND	98.80			
OCDF	563CB007	1.48	NS	NA	NA	NA
	563CB006	ND	1.20			
Total Hepta-Dioxins	563CB006	ND	6.51	NA	NA	NA
	563CB007	10.30	NS			
Total Hepta-Furans	563CB006	ND	2.83	NA	NA	NA
	563CB007	2.05	NS			
Total Hexa-Dioxins	563CB007	2.22	NS	NA	NA	NA
Total Hexa-Furans	563CB006	ND	5.78	NA	NA	NA
	563CB007	2.81	NS			
Total Penta-Furans	563CB006	ND	21.80	NA	NA	NA
	563CB007	2.78	NS			
Total Tetra-Furans	563CB006	ND	24.10	NA	NA	NA
	563CB007	3.43	NS			

Inorganic Compounds (mg/kg)

Aluminum (Al)	563SB001	6280.00	9690.00	7800.00	26000.00	41100.00
	563SB002	9220.00	5360.00			
	563SB003	7040.00	5410.00			
	563SB004	12200.00	11400.00			
	563SB005	8790.00	11200.00			
	563SB006	10000.00	10750.00			
	563SB007	9100.00	13100.00			
	563SB008	5480.00	7490.00			
	563SB009	5080.00	6680.00			
Antimony (Sb)	563SB001	ND	0.49	3.10	1.77	1.60
	563SB002	ND	0.53			
	563SB003	0.51	ND			
	563SB004	0.66	ND			
	563SB005	0.54	ND			
	563SB006	0.58	0.59			
	563SB007	0.55	1.20			
Arsenic (As)	563SB001	5.00	9.10	0.43	23.90	19.90
	563SB002	5.60	8.30			
	563SB003	3.90	2.60			
	563SB004	8.00	6.40			
	563SB005	7.10	4.70			
	563SB006	9.90	6.05			
	563SB007	5.15	10.80			
	563SB008	3.30	5.90			
	563SB009	3.00	3.00			
Barium (Ba)	563SB001	20.60	26.80	550.00	130.00	94.10
	563SB002	112.00	32.10			
	563SB003	38.40	26.90			
	563SB004	65.80	50.40			
	563SB005	28.70	44.70			

Chemicals Detected in Zone E Soil Samples
AOC 563

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Beryllium (Be)	563SB006	33.80	33.25			
	563SB007	34.70	33.80			
	563SB008	40.30	64.60			
	563SB009	35.40	37.70			
	563SB001	0.19	0.30	0.15	1.70	2.71
	563SB002	0.28	0.23			
	563SB003	0.30	0.21			
	563SB004	0.39	0.39			
	563SB005	0.27	0.36			
	563SB006	0.41	0.28			
Cadmium (Cd)	563SB007	0.33	0.60			
	563SB008	0.28	0.35			
	563SB009	0.34	0.34			
	563SB001	0.17	0.22	3.90	1.50	0.96
	563SB002	0.12	0.37			
	563SB003	0.28	ND			
	563SB004	0.29	0.26			
	563SB005	0.24	0.16			
	563SB006	0.13	ND			
	563SB001	3280.00	1980.00	NA	NA	NA
Calcium (Ca)	563SB002	1690.00	9500.00			
	563SB003	2780.00	1140.00			
	563SB004	8950.00	2640.00			
	563SB005	2380.00	1570.00			
	563SB006	2000.00	2125.00			
	563SB007	2175.00	2910.00			
	563SB008	2680.00	2600.00			
	563SB009	1360.00	1670.00			
	563SB001	11.90	20.30	39.00	94.60	75.20
	Chromium (Cr)	563SB002	16.70	11.60		
563SB003		8.80	7.30			
563SB004		22.20	20.70			
563SB005		17.40	17.00			
563SB006		21.40	19.10			
563SB007		12.70	27.90			
563SB008		6.40	15.10			
563SB009		6.30	7.20			
563SB001		0.95	1.20	470.00	19.00	14.90
Cobalt (Co)		563SB002	1.10	1.60		
	563SB003	31.80	1.10			
	563SB004	38.30	11.00			
	563SB005	2.00	2.50			
	563SB006	7.20	1.50			
	563SB007	4.05	2.20			
	563SB008	14.90	1.50			
	563SB009	2.20	3.10			
	563SB001	3.80	1.70	310.00	66.00	152.00
	Copper (Cu)	563SB002	3.70	22.10		
563SB003		20.90	3.00			
563SB004		2.50	2.60			
563SB005		2.80	2.10			

Chemicals Detected in Zone E Soil Samples
AOC 563

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *	
Iron (Fe)	563SB006	2.30	1.10				
	563SB007	51.50	3.00				
	563SB008	4.90	3.00				
	563SB009	5.60	4.70				
	563SB001	10600.00	20100.00	2300.00	NA	NA	
	563SB002	11900.00	9440.00				
	563SB003	9750.00	5930.00				
	563SB004	23900.00	21400.00				
	563SB005	17500.00	12800.00				
	563SB006	21600.00	16400.00				
Lead (Pb)	563SB007	10850.00	31800.00				
	563SB008	6500.00	16800.00				
	563SB009	7190.00	6590.00				
	563SB001	19.10	8.40	400.00	265.00	173.00	
	563SB002	11.50	58.30				
	563SB003	23.60	8.10				
	563SB004	11.00	10.80				
	563SB005	10.60	8.40				
	563SB006	13.40	9.50				
	563SB007	29.75	11.60				
Magnesium (Mg)	563SB008	9.40	15.60				
	563SB009	19.70	17.90				
	563SB001	453.00	992.00	NA	NA	NA	
	563SB002	652.00	443.00				
	563SB003	592.00	285.00				
	563SB004	1180.00	970.00				
	563SB005	664.00	783.00				
	563SB006	951.00	871.00				
	563SB007	599.00	1290.00				
	563SB008	286.00	556.00				
Manganese (Mn)	563SB009	277.00	335.00				
	563SB001	32.70	28.90	180.00	302.00	881.00	
	563SB002	19.10	65.10				
	563SB003	63.60	39.70				
	563SB004	36.90	31.30				
	563SB005	39.70	57.00				
	563SB006	26.10	22.45				
	563SB007	55.40	37.70				
	563SB008	79.60	34.70				
	563SB009	115.00	71.70				
Mercury (Hg)	563SB001	0.04	0.05	2.30	2.60	1.59	
	563SB002	0.05	0.07				
	563SB003	0.05	ND				
	563SB004	0.05	0.05				
	563SB007	0.05	ND				
	563SB008	ND	0.05				
	563SB009	ND	0.10				
	Nickel (Ni)	563SB001	2.10	ND	160.00	77.10	57.00
		563SB002	2.50	2.50			
563SB003		5.20	3.40				
563SB004		4.50	2.20				

**Chemicals Detected in Zone E Soil Samples
AOC 563**

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	563SB005	2.80	4.00			
	563SB006	3.20	3.20			
	563SB007	6.00	2.40			
	563SB008	4.60	3.20			
	563SB009	2.80	2.20			
Potassium (K)	563SB002	2070.00	ND	NA	NA	NA
Selenium (Se)	563SB001	0.59	0.61	39.00	1.70	2.40
	563SB003	0.60	ND			
	563SB004	0.74	ND			
	563SB005	0.82	ND			
	563SB006	ND	0.61			
	563SB007	ND	0.63			
	563SB008	ND	0.59			
Sodium (Na)	563SB002	125.00	ND	NA	NA	NA
	563SB003	175.00	ND			
	563CB006	ND	68.60			
	563SB007	147.00	ND			
Vanadium (V)	563SB001	16.80	35.60	55.00	94.30	155.00
	563SB002	16.00	11.80			
	563SB003	12.00	9.00			
	563SB004	29.60	28.00			
	563SB005	26.60	22.90			
	563SB006	34.90	29.50			
	563SB007	18.20	36.90			
	563SB008	10.40	19.10			
	563SB009	8.70	10.50			
Zinc (Zn)	563SB001	14.70	12.20	2300.00	827.00	886.00
	563SB002	15.30	73.10			
	563SB003	18.90	10.90			
	563SB004	15.30	16.40			
	563SB005	12.60	13.80			
	563SB006	19.80	12.85			
	563SB007	34.15	20.90			
	563SB008	12.70	17.30			
	563SB009	24.20	22.10			

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.

Table 10.31.C
 Chemicals Present in Site Samples
 AOC 563 - Groundwater
 NAVBASE - Charleston
 Charleston, SC

Parameter	Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration		Units	Number Exceeding		
								Residential RBC	Reference		Res.	Ref.	
Deep Wells													
Inorganics													
Barium (Ba)		1	1	11.1	11.1	11.1	NA	NA	260	218	UG/L		
Calcium (Ca)	N	1	1	53800	53800	53800	NA	NA	NA	NA	UG/L		
Iron (Fe)	N	1	1	156	156	156	NA	NA	NA	NA	UG/L		
Magnesium (Mg)	N	1	1	11800	11800	11800	NA	NA	NA	NA	UG/L		
Manganese (Mn)		1	1	50.1	50.1	50.1	NA	NA	84	869	UG/L		
Potassium (K)	N	1	1	5940	5940	5940	NA	NA	NA	NA	UG/L		
Sodium (Na)	N	1	1	110000	110000	110000	NA	NA	NA	NA	UG/L		
Shallow Wells													
Inorganics													
Aluminum (Al)	*	2	3	356	22000	11178	125	125	3700	2810	UG/L	1	1
Arsenic (As)	*	3	3	5.8	34.4	22.3	NA	NA	0.045	18.7	UG/L	3	2
Calcium (Ca)	N	2	3	37900	53800	45850	22800	22800	NA	NA	UG/L		
Chromium (Cr)	*	2	3	1.4	42.9	22.15	1	1	18	12.3	UG/L	1	1
Cobalt (Co)		2	3	5	10.9	7.95	2	2	220	2.5	UG/L		2
Copper (Cu)		2	3	3.6	8.8	6.2	2	2	150	NA	UG/L		
Iron (Fe)	N	3	3	129	29000	11763	NA	NA	NA	NA	UG/L		
Lead (Pb)	*	1	3	17.6	17.6	17.6	3	3	15	4.8	UG/L	1	1
Magnesium (Mg)	N	3	3	3630	13200	8837	NA	NA	NA	NA	UG/L		
Manganese (Mn)		3	3	150	334	232	NA	NA	84	2560	UG/L	3	
Nickel (Ni)		3	3	5.1	6.8	6.13	NA	NA	73	15.2	UG/L		
Vanadium (V)	*	2	3	1.4	50.1	25.75	1	1	26	11.4	UG/L	1	1
Semivolatile Organics													
Benzoic acid		1	3	1	1	1	50	50	15000	NA	UG/L		
Volatile Organics													
1,2-Dichloroethene (total)	*	3	3	8	12	10	NA	NA	5.5	NA	UG/L	3	
Toluene		1	3	9	9	9	5	5	75	NA	UG/L		
Trichloroethene	*	1	3	120	120	120	5	5	1.6	NA	UG/L	1	

* - Identified as a COPC
 N - Essential nutrient
 UG/L - micrograms per liter
 SQL - Sample quantitation limit
 NA - Not applicable

**A COMPREHENSIVE REVIEW OF COMMON LABORATORY ARTIFACTS
DETECTED IN ENVIRONMENTAL SAMPLES FROM
THE CHARLESTON NAVAL BASE**

This memo serves as a technical review of possible industrial, laboratory and field sampling uses of common laboratory chemicals that have also been detected in varying media and concentrations at the Charleston Naval Base. The purpose of this memo is to show possible paths of introduction of these chemicals into the environmental samples through various pathways. Heartland Environmental Services, Inc. did an independent literature search to supplement this memo. Heartland's text and references are featured as Attachment A. Since much of the blame for common artifacts in environmental samples is usually placed on the laboratory, a brief discussion on the role of the laboratory is needed.

Under the Resource Conservation Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) investigations, environmental samples are routinely collected by field personnel and sent to analytical laboratories for analysis to determine if contaminants of concern are present and at significant concentrations to pose a risk to either human or ecological assessments. Laboratories selected to analyze environmental samples often go through intensive laboratory auditing processes either by the client's representatives or by individual government agencies or its appointee to assess a laboratory's capabilities. After successful completion of the audit and successful analysis of performance evaluation (PE) samples, the laboratory will become certified or given a stamp of approval. The laboratory then performs laboratory analysis of samples using regulated methods promulgated throughout the United States.

The RCRA methods commonly called SW-846 and the CERCLA methods called CLP, give step by step instructions on how a laboratory must follow the laboratory procedures. Built into these methods are quality controls and standards a laboratory must adhere to in order for data to be acceptable. A laboratory must make every effort to meet these quality control requirements or face the possibility of the data not being acceptable or non compliant by a data validator. When the laboratory has shown through data validation that the data is compliant but unexplainable results show up for chemicals like acetone, methylene chloride, and bis(2-Ethylhexyl)phthalate (BEHP), a more thorough review of the data is needed.

It is the objective of the data user to try to understand the usage of these chemicals. The where and why of common contaminants being detected also needs to be explained before a judgement can be made of the data. In that respect historical data plays a very important role in determining the usefulness of the data and understanding how the laboratory operates supplements that role. But normal standard operating procedures of laboratory and field personnel can lead to contamination of samples with acetone, methylene chloride and BEHP.

Acetone and methylene chloride are parameters listed in USEPA SW-846 method 8260 and USEPA CLP volatile organic analysis method. Both chemicals are used throughout the laboratory in extraction and cleanup solvents (VOA methods do not use extraction and cleanup procedures)

for soils and water samples. Acetone, derived from the oxidation of isopropyl alcohol, is used primarily in industry in paints, varnish, and lacquer solvent. A laboratory will use acetone to dissolve semivolatile compounds for stock standard solutions for method SW-846 8270 and in a solvent solution (300ml 1:1) with either methylene chloride or hexane used in sample quantitative extraction methods for soils. The EPA approved extraction methods that a laboratory uses for soils/solids samples are solid phase, soxhlet, pressurized fluid, and ultrasonic. Analytical clean up procedures, used to help eliminate sample interference and false positives and negatives, such as alumina, florisil, silica, acid-base partition, and sulfur also use acetone as an extraction solvent (100 ml). Specifically to the Charleston Naval Base, acetone is used in extractions of solids for methods 8080A, 8081A, 8082 (pesticides and PCBs) 8141A (organophosphorus pesticides), 8150B (herbicides) and 8270C (semivolatiles).

Methylene chloride, derived from the chlorination of methyl chloride, is used primarily in industry in paint removers and solvent degreasing. A laboratory uses methylene chloride to prepare the Gas Chromatography/ Mass Spectrometry (GC/MS) tuning standard for method 8270, as a solvent solution with acetone (300 ml total solvent at 1:1 for each sample) used in sample quantitative extraction methods for soils and as a stand alone solvent (500 ml) for water samples. The EPA approved extraction methods that a laboratory uses for water samples are liquid-liquid, continuous liquid-liquid, and solid phase. Methylene chloride is used in sample analytical clean up procedures such as alumina, florisil, silica gel, gel permeation, and acid-base partition (100 ml) which help to eliminate interferences.

Methylene chloride is used as a precleaning agent for sodium sulfate which is used after every extraction and cleanup procedure as a drying agent to remove moisture from extracts. Methylene chloride is also used as a rinse for the polytetrafluoroethylene (PTFE) boiling chips needed to help concentrate down the volumes of extraction and cleanup solvents produced for every sample to the correct volume. Both the sodium sulfate and the boiling chips are to be dried in an oven for several hours before usage and stored in glass containers and not plastic to prevent cross contamination from BHEP. Specifically to the Charleston Naval Base, methylene chloride is used in extractions of liquids for methods 8080A, 8081A, 8082 (pesticides and PCBs) 8141A (organophosphorus pesticides), 8150B (herbicides), 8270C (semivolatiles), and 8290 (dioxin). Another possible pathway of methylene chloride contamination according to method 8260A is "Laboratory clothing worn by the analyst should be clean, since clothing previously exposed to methylene chloride fumes during liquid/liquid extraction procedures can contribute to sample contamination." As an additional precaution it is extremely important that air ventilation systems do not lead between the extraction labs and volatile analysis labs as acetone and methylene chloride will contaminate samples.

BEHP is derived from the reaction of 2-ethylhexanol and phthalic anhydride and is used in industry as a plasticizer for many resins and elastomers and as a liquid in vacuum pumps. Laboratories do not use BEHP for any extractions or as a cleanup agent but BEHP can come in

contact with environmental samples in other ways. If sample containers have plastic lids instead of screw caps lined with Teflon septas, possible contamination from phthalates (BEHP) can be seen in the samples. As noted in method 8080A of the USEPA SW-846 Test Methods, other phthalate interferences are discussed as follows " Interferences by phthalate esters can pose a major problem in pesticide determinations when using the electron capture detector. These compounds generally appear in the chromatogram as large late-eluting peaks, especially in the 15% and 50% fractions from Florisil clean-up. Common flexible plastics contain varying amounts of phthalates. These phthalates are easily extracted or leached from such materials during laboratory operations. Cross contamination of clean glassware routinely occurs when plastics are handled during extraction steps, especially when solvent-wetted surfaces are handled. Interferences from phthalates can best be minimized by avoiding contact with any plastic materials. Exhaustive cleanup of reagents and glassware may be required to eliminate background phthalate contamination." Method 8061A (Phthalate Esters by Gas Chromatography) goes into further detail discussing Soxhlet extractors and possible cross contamination in using them. "If Soxhlet extractors are baked in the muffle furnace, care must be taken to ensure that they are dry. Thorough rinsing with hot tap water, followed by deionized water and acetone, is not an adequate decontamination procedure. Even after a Soxhlet extractor was refluxed with acetone for three days, with daily solvent changes, the concentration of bis(2-Ethylhexyl)phthalate was as high as 500 ng per washing. Storage of glassware in the laboratory introduces contamination, even if the glassware is wrapped in aluminum foil. Therefore, any glassware used in Method 8061 should be cleaned immediately prior to use". The method goes on to state that "Florisil and alumina may be contaminated with phthalate esters and, therefore, use of these materials in sample cleanup should be employed cautiously. Washing of these materials prior to use with the solvent(s) used for elution during extract cleanup was helpful, however, heating at 320°C for Florisil and 210°C for alumina is recommended. Phthalate esters were detected in Florisil cartridge method blanks at concentrations ranging from 10 to 460 ng, with 5 phthalate esters in the 105 to 460 ng range. Complete removal of the phthalate esters from Florisil cartridges does not seem possible, and it is therefore desirable to keep the steps involved in sample preparation to a minimum." As with acetone and methylene chloride, BEHP may have pathways of contamination inadvertently leading to environmental samples if extreme caution and care are not taken in the laboratory to prevent them. Pathways of possible contamination do not solely belong to the laboratory. Field sampling procedures need to be scrutinized in depth as well to help eliminate cross contamination.

Field sampling procedures may lead to possible contamination of samples. Plastic sheeting and gloves are routinely used to keep both the sampling area and field personnel contaminate free but caution needs to be taken to prevent cross contamination to samples. Sampling tools such as stainless steel trowels, teflon trowels and teflon tubing should remain covered with aluminum foil until the point of sampling so as not to come in contact with the plastic sheeting. When wearing plastic gloves the sampler needs to use extra caution so that none of the sample comes in contact

with the glove as the sample bottle is being filled and possibly causing a cross contamination with phthalates.

It is also necessary to follow proper sampling decontamination procedures to help prevent cross contamination. Though there are no solvents used for decontamination on the Charleston Naval Base that are listed on the VOA method list, isopropyl alcohol is used as a solvent rinse on sampling equipment as described in the CSAP. Extreme caution needs to be taken when using isopropyl alcohol for decontamination. When using isopropyl alcohol as a rinse after Alconox detergent and DI water wash, the alcohol must be thoroughly rinsed with DI water and allowed to completely dry before additional samples are taken. If too much alcohol is used, or too little DI water for a final rinse, samples can show increased levels of acetone when analyzed.

A base wide review of the data showed acetone was randomly showing up in samples throughout the Naval Base. To help narrow down the possible routes of exposure of acetone to the samples, a decontamination experiment was conducted in the Fall of 1996 and blind samples were collected and sent to Southwest Laboratories to be analyzed.

Three blind soil samples and one water sample spiked with isopropyl alcohol were sent to the lab to be analyzed using method 8260. The equipment used to collect the sample was a hand auger. One sample was taken following the decontamination procedures listed in the CSAP and after the auger was let to dry. One soil sample was taken following the new EPA decontamination procedures set forward in their August 1996 audit. The audit stated that a smaller amount of DI water (using a squirt bottle filled with DI water to rinse off the alcohol instead of the larger amounts previously used) was to be used. One sample was also taken using a hand auger that was wrapped in tin foil and stored in the field trailer. As an added bonus, one water vial was spiked with a few drops of isopropyl alcohol. A trip blank was also submitted for analysis in case of any carryover contaminants.

The hand auger that was wrapped in foil had acetone detected at 10 ppb with no TICs reported. Using the August 1996 EPA audit decontamination procedures, acetone was detected at 200 ppb with TICs of isopropyl alcohol at 190 ppb. The concentration of isopropyl alcohol is estimated due to the fact that the laboratory is not required to establish instrument calibration criteria on TICs. Using the CSAP decontamination procedures, acetone was detected at 31 ppb with no tentatively identified compounds (TICs). The water spike showed acetone at 2900 and a TIC of isopropyl alcohol at 180000 ppb. The results of the water spike are estimated due to the sample having to be diluted in order for the instrument to properly quantify the results. The concentration of isopropyl alcohol is estimated due to the fact that the laboratory is not required to establish instrument calibration criteria on TICs.

It is apparent that sampling equipment needs to be rinsed heavily with DI water when required to use isopropyl alcohol as a decontamination step, and let it air dry as long as possible to help eliminate the possibility of cross contamination of unwanted acetone. It is not acceptable to have a bucket of DI water at the end of the decontamination line that is used all day without changing the water frequently. This happens far too many times. Isopropyl alcohol builds up and contributes to the cross contamination of samples with acetone.

For the data reviewer the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review state that acetone, methylene chloride and BEHP are common contaminants and certain rules such as the 10X rule need to be followed when evaluating blanks (lab or field) along with the samples. A caveat to this rule is when equipment and rinsate blanks are taken at the beginning of the day in ideal conditions and not after a full day of sampling, say when isopropyl alcohol has saturated the DI water bucket. This causes the reviewer to scrutinize data between blanks and samples that have not been collected by the same procedures.

As stated earlier, a base wide review of the data was performed on acetone, methylene chloride, and BEHP results to determine if there were trends developing that might shed some light on whether the results were site related or due to cross contamination. The quarterly groundwater monitoring program for all of the individual zones was evaluated in depth due to the concerns posed by the project team. All of the well data collected to date was printed out to see if analytical results showed repeated detections of acetone, methylene chloride, and BEHP. A comparison of soil data (soil borings and Direct Push Technology (DPT) in close proximity to monitoring wells was also made to see if possible leaching to groundwater could have occurred. When reviewing possible soil leaching of contaminants, the soil screening levels (SSL) along with history of the site, need to be considered before a final assessment of the data is made. The SSL for acetone is 8000 ppb ($\mu\text{g}/\text{kg}$), methylene chloride is 10 ppb, and BEHP is 11,000 ppb.

The well ID 638001 from Zone G had acetone results that appeared in two of the groundwater monitoring rounds (3rd and 4th) at concentrations of 3 and 7 ppb. Three wells in Zone H show results that appear in multiple rounds. Well ID 009005 had results of acetone of 11.7 and 19 ppb in the 1st and 3rd respectively. Well ID 009009 had results of acetone of 22 and 4 ppb in the 2nd and 4th rounds and well ID 017005 had acetone results of 17.9 and 360 ppb in the 1st and 3rd rounds.

A review of the soil borings near the above mentioned wells showed that boring ID 638004, taken approximately 75 feet from the well, had a second interval acetone result of 120 ppb. Boring IDs GDHSB056 and GDHSB057 which were located approximately 175 ft. from well 009009 had detections of 27 and 17 ppb respectively. Boring ID 009SB005, taken where a well was constructed, did not have a detection for acetone.

A review of the acetone results for DPT samples in Zone A showed no correlation to the nearest well pair 03915 and 15D and the DPT samples taken in Zone F at AOC 607 did not have acetone detections. Four second round groundwater DPT samples were taken in Zone L because of first round detections of acetone in either soil and/or water DPT samples. Samples 037GP001, 037SP002, 037GP002, and 037GP003 in subzone F had detections of 65.8 ppb, 12.9 ppb, 5.63 ppb, and 7.03 ppb respectively. The second round samples for 037GP001 and 037GP003 did not have detections for acetone and sample 037GP002 had a result of 2 ppb.

Sample 037GP032 in subzone C had a first round detection of 683 ppb for acetone. The second round sample had a result of 15 ppb.

A review of the methylene chloride results showed well ID 009007 showing results of 130, 68, and 330 ppb in the 2nd, 3rd and 4th rounds and well ID 017002 showing methylene chloride showing results of 520 and 240 ppb in the 2nd and 3rd rounds. The review of the soil borings collected around the vicinity of those wells showed no detections of methylene chloride. There was also no correlation between the DPT samples collected in Zones A and F and the wells that are in the vicinity of the DPT samples.

A review of the BEHP data shows that in Zone E well ID GDE009 had detections of 2 and 10 ppb for the 1st and 2nd rounds of data and well ID GDE09D had detections of 1 and 5 ppb for the 1st and 2nd rounds. The review of the soil borings for those wells showed non detects. Well ID 663002 in Zone H had detections of 180 and 59 ppb for the 3rd and 4th rounds and one soil boring, 663SB002 had a detection of 131 ppb of BEHP. Well ID 014003 had detections of 5 and 2 ppb for the 1st and 4th rounds. The site 684 soil borings taken around the well showed no detections for BEHP. Well ID 178001 had detections of 530 and 290 ppb in the 2nd and 3rd rounds. The site 178

borings taken around the well showed no detections for BEHP. Well ID GDH06D had BEHP detections of 3.9 and 230 ppb for the 1st and 2nd rounds. Soil boring GDHSB006 did not have detections of BEHP. Well ID GDH09D had detections of 6.9 and 2 ppb in the 2nd and 3rd rounds. The soil borings GDH076, GDH084 and GDH085 did not have detections of BEHP.

Heartland Environmental's task was to investigate the possible uses of methylene chloride at industrial and Department of Defense facilities and the possibility of acetone being a contaminant in isopropyl alcohol. Of particular interest is the information from Fisher Scientific Company that specifies isopropyl alcohol contains .002% (20ppm) of acetone. The type of isopropyl alcohol used at NAVBASE Charleston is the type Fisher's analytical reports discusses. Attachment B includes documentation from various USEPA resources as a supplement to this memo.

Findings regarding trace level methylene chloride and acetone contamination

**Prepared for: Charlie Vernoy, EnSafe
February 9, 1998**

Documentation concerning trace level methylene chloride and acetone contamination in a field investigation is very difficult to discover. Based on the review of many technical publications at several universities in St. Louis and extensive inquiries on the internet using five different databases for searches, Heartland ESI has not been able to discover evidence of prior papers concerning trace level contamination in the field. However, based on our extensive research, we have uncovered several documents which would support EnSafe's supposition that the concentrations of methylene chloride and acetone detected are field/laboratory contaminants.

Methylene chloride, CAS 75-09-2, is most widely used by companies that produce paint strippers, which have been determined to be a major contributor of hazardous waste generation in the Department of Defense. In addition, other companies use methylene chloride to clean metal surfaces. Thru the use of the strippers, it is plausible to ascertain that an uncertain amount of methylene chloride could randomly contaminate field samples without bias for quarterly monitoring. Methylene chloride is also categorized as a common laboratory contaminant that may be present in concentrations less than 25 $\mu\text{g/L}$ or $\mu\text{g/Kg}$ without being outside the technical acceptance criteria. Therefore, based on the presence of methylene chloride at the site in question as a component of paint strippers and cleaners and the allowable presence of methylene chloride in "blank" samples, all trace levels of methylene chloride, (< 100 ppb or < 10X methylene chloride CRQL) should be considered to be a field and/or laboratory contaminant.

The acetone, CAS 97-94-1, detected at the site can be attributed to the isopropanol utilized to decontaminate the sampling equipment. EnSafe used Fisher ACS grade isopropanol, which according to Ms. Deborah Hostetter, Senior Chemical Sales Specialist for Fisher Scientific, contains acetone as a contaminant. Deionized (DI) water rinses after the isopropanol decontamination is critical to insure that the isopropanol has been cleansed from the surface. After a field audit, EnSafe was instructed by the EPA to rinse the equipment with less DI water. If the equipment was not properly decontaminated with enough DI water to completely rid the equipment of isopropanol, traces of acetone would be present in field samples (as noted). Therefore, all trace acetone results (< 100 ppb) can be attributed to the acetone contamination in the isopropanol.

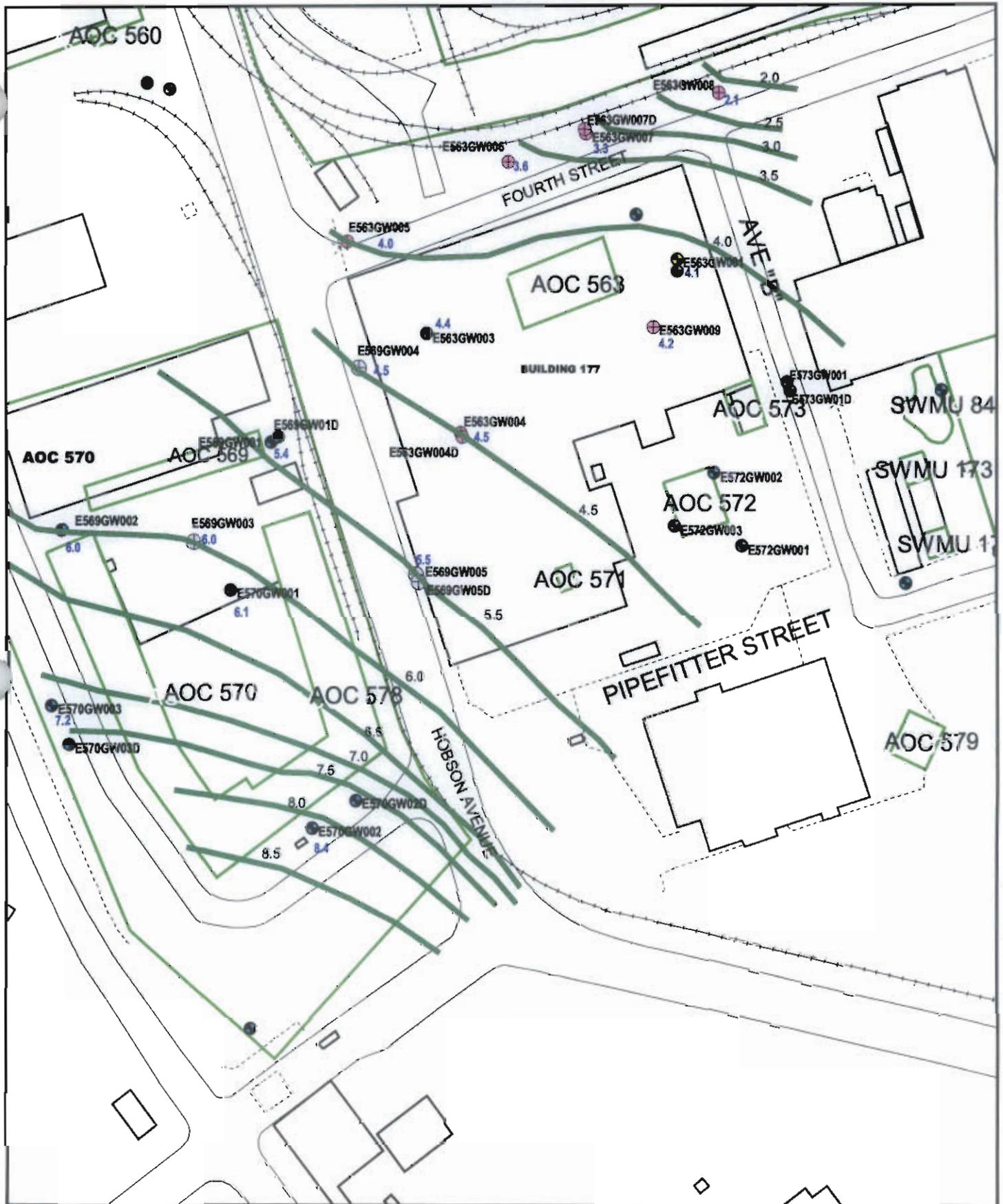
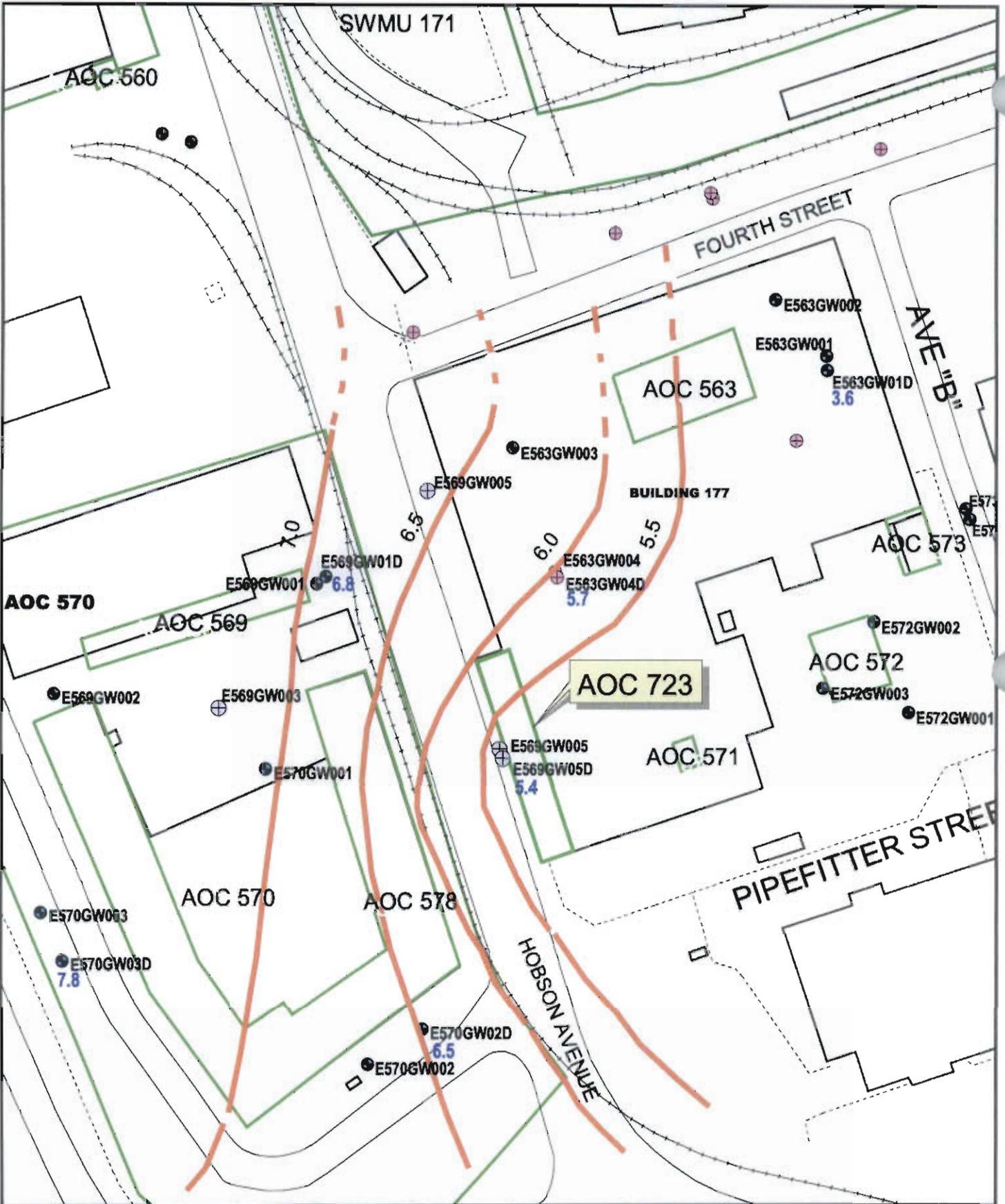


Figure C-1
 Shallow Groundwater Elevation Contours (Nov 2002)
 AOC 563 Area, Zone E
 Charleston Naval Complex

- Shallow Groundwater Contours (measured Nov 2002)
- 5.5 Shallow Groundwater Elevation (Ft. MSL)
- Groundwater Monitor Wells installed during 2002
- Historic RFI Groundwater Monitor Wells
- AOC Boundary
- SWMU Boundary

N

 0 90 180 Feet
 1 inch = 118 feet



- Deep Groundwater Elevation Contours (measured Nov 2002)
- 7.8** Groundwater Elevation (ft above MSL)
- Groundwater Monitor Wells Installed in 2002
- Historic RFI Groundwater Monitor Wells
- AOC Boundary
- SWMU Boundary

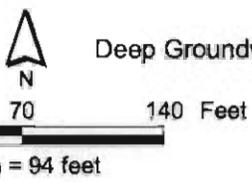


Figure C-2
Deep Groundwater Elevation Contours (Nov. 2002)
AOC 563 Area, Zone E
Charleston Naval Complex

File Path: c:\197\alv\200\hml\... Date: 08 May 2003 14:02 User: SNAJK1

Figure 6-1
 Groundwater Sampling Form

Groundwater Sampling		Sample ID: <u>NBCE563BWC</u>
PROJECT NAME: <u>Naval Base Charleston</u>		JOB NO: <u>2905-08440</u> DATE: <u>3-29-96</u>
WELL NO.: <u>NBCE/563-001</u>	LOCATION: <u>Zone E</u>	
WEATHER CONDITIONS: <u>rainy cool - 60 (inside Bldg 177)</u>		AMBIENT TEMP: <u>approx 60°F</u>
REVIEWED BY: _____		PERSONNEL: <u>J. George H. Suler M. Bart</u>
PURGING DEVICE Type device? <u>Peristaltic Pump</u> How was the device decontaminated? <u>Per CSAP</u> How was the line decontaminated? <u>Per CSAP</u> Which well was previously purged? <u>—</u>		SAMPLING DEVICE Type device? <u>Peristaltic Pump</u> How was the device decontaminated? <u>Per CSAP</u> How was the line decontaminated? <u>Per CSAP</u> Which well was previously sampled? <u>—</u>
INITIAL WELL VOLUME Well diameter (in.) <u>2"</u> Stickup (ft.) <u>Flush Mount</u> Depth to bottom of well from TOC (ft.) <u>13.24</u> Depth to water surface from TOC (ft.) <u>7.70</u> Length of water (ft.) <u>5.54</u> Volume of water (ft.) _____ (gal.) <u>1 g</u> Amount of sediment at bottom of well (ft.) <u>—</u> 3 Volumes of water (gal.) <u>3 g</u>		PURGING Time started <u>1114</u> Finished <u>1207</u> Volume purged <u>5.5 g</u> Comments on Well Recovery <u>Turbid - purged > 5 well c</u> Depth to water (ft.) <u>5.54</u> Completion _____ Additional Comments _____ Sample Collected: Start <u>1215</u> Finish _____
IN-SITU TESTING		Time: <u>1120</u> <u>1128</u> <u>1139</u> <u>1146</u> <u>1156</u> <u>1206</u> _____
		1 2 3 4 5 6 7
Well Volume Purged (gal.)		<u>0.5</u> <u>1.5</u> <u>2.5</u> <u>3.5</u> <u>4.5</u> <u>5.5</u> _____
Turbidity		<u>214</u> <u>263</u> <u>232</u> <u>443</u> <u>437</u> <u>367</u> _____
Odor		<u>—</u> <u>—</u> <u>—</u> <u>—</u> <u>—</u> <u>—</u> _____
pH (units)		<u>6.06</u> <u>6.55</u> <u>6.55</u> <u>6.50</u> <u>6.52</u> <u>6.58</u> _____
Conductivity (micro)		<u>0.426</u> <u>0.416</u> <u>0.402</u> <u>0.408</u> <u>0.434</u> <u>0.453</u> _____
Water Temperature (°C)		<u>20.4</u> <u>21.1</u> <u>21.1</u> <u>21.3</u> <u>21.3</u> <u>21.4</u> _____
Depth to water (ft.)		_____
NOTES: 1 ft. length of 4" → 0.087 ft ³ or 0.65 gal. 1 ft. length 2" = 0.022 ft ³ or 0.18 gal. Turbidity choices: clear, turbid, opaque Revision Date: 8/5/92		

Data Validation Summary - Charleston Naval Complex - Zone E, AOC 563

TO: Sam Natk/CH2MHILL/ATL

FROM: Amy Juchem/CH2MHILL/GNA
Herb Kelly/CH2MHILL/GNA

DATE: March 12, 2003

The purpose of this memorandum is to present the results of the data validation process for the samples collected AOC 563 in Zone E. The samples were collected between the dates of November 18 to November 22, 2002.

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 (total and dissolved) 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

SDG	Station ID	Sample ID	Lab Sample ID	Matrix	Sample Type	LR Type	Date Collected	VOC SW8260B	Total Metals SW6010B	Dissolved Metals SW6010B
70924	E563GW003	563GW003M4	70924001	WG	N		11/18/02	X	X	
70924	E563GW003	563HW003M4	70924002	WG	FD		11/18/02	X	X	
70924	E569GW001	569GW001M4	70924003	WG	N		11/18/02	X	X	
70924	E569GW003	569GW003M4	70924004	WG	N		11/18/02	X	X	
70924	E570GW001	570GW001M4	70924005	WG	N		11/18/02	X	X	
70924	E570GW001	570HW001M4	70924006	WG	FD		11/18/02	X	X	
70924	E570GW03D	570GW03DM4	70924007	WG	N		11/18/02	X	X	
70924	E563GW001	563GW001M4	70924008	WG	N		11/18/02	X		
70924	E563GW002	563GW002M4	70924009	WG	N		11/18/02	X		
70924	E569GW002	569GW002M4	70924010	WG	N		11/18/02	X		
70924	E569GW004	569GW004M4	70924011	WG	N		11/18/02	X		
70924	E569GW005	569GW005M4	70924012	WG	N		11/18/02	X		
70924	E570GW002	570GW002M4	70924013	WG	N		11/18/02	X		
70924	E570GW003	570GW003M4	70924014	WG	N		11/18/02	X		
70924	E563GW01D	563GW01DM4	70924015	WG	N		11/18/02	X		
70924	E569GW01D	569GW01DM4	70924016	WG	N		11/18/02	X		
70924	E569GW05D	569GW05DM4	70924017	WG	N		11/18/02	X		
70924	E570GW02D	570GW02DM4	70924018	WG	N		11/18/02	X		
70924	E570GW004	570GW004M4	70924019	WG	N		11/18/02	X		
70924	FIELDQC	563EW001M4	70924020	WQ	EB		11/18/02	X		
70924	LABQC	1200340133	1200340133	WQ	LB					X

SDG	Station ID	Sample ID	Lab Sample ID	Matrix	Sample Type	LR Type	Date Collected	VOC SW8260B	Total Metals SW6010B	Dissolved Metals SW6010B
70924	E563GW003	563GW003M4MS	1200340136	WG	MS		11/18/02		X	
70924	E563GW003	563GW003M4SD	1200340138	WG	SD		11/18/02			X
70924	LABQC	1200340140	1200340140	WQ	BS				X	
70924	LABQC	1200340683	1200340683	WQ	LB			X		
70924	LABQC	1200340684	1200340684	WQ	BS			X		
70924	E570GW004	570GW004M4MS	1200340685	WG	MS		11/18/02	X		
70924	E570GW004	570GW004M4SD	1200340686	WG	SD		11/18/02	X		
70924	LABQC	1200341025	1200341025	WQ	LB			X		
70924	LABQC	1200341026	1200341026	WQ	BS			X		
70926	E563GW003	563GW003M4	70926001	WG	N		11/18/02			X
70926	E563GW003	563HW003M4	70926002	WG	FD		11/18/02			X
70926	E569GW001	569GW001M4	70926003	WG	N		11/18/02			X
70926	E569GW003	569GW003M4	70926004	WG	N		11/18/02			X
70926	E570GW001	570GW001M4	70926005	WG	N		11/18/02			X
70926	E570GW001	570HW001M4	70926006	WG	FD		11/18/02			X
70926	E570GW03D	570GW03DM4	70926007	WG	N		11/18/02			X
70926	LABQC	1200340133	1200340133	WQ	LB				X	
70926	E563GW003	563GW003M4MS	1200340137	WG	MS		11/18/02			X
70926	E563GW003	563GW003M4SD	1200340139	WG	SD		11/18/02		X	
70926	LABQC	1200340140	1200340140	WQ	BS				X	
71121	E563GW004	563GW004M4	71121001	WG	N		11/22/02	X	X	
71121	E563GW005	563GW005M4	71121002	WG	N		11/21/02	X	X	
71121	E563GW006	563GW006M4	71121003	WG	N		11/21/02	X	X	

SDG	Station ID	Sample ID	Lab Sample ID	Matrix	Sample Type	LR Type	Date Collected	VOC SW8260B	Total Metals SW6010B	Dissolved Metals SW6010B
71121	E563GW006	563GW006M4DL	71121003	WG	LR	DL	11/21/02	X		
71121	E563GW008	563GW008M4	71121004	WG	N		11/21/02	X	X	
71121	E563GW009	563GW009M4	71121005	WG	N		11/22/02	X	X	
71121	E563GW040	563GW04DM4	71121006	WG	N		11/22/02	X	X	
71121	E563GW070	563GW07DM4	71121007	WG	N		11/22/02	X	X	
71121	E563GW007	563GW007M4	71121008	WG	N		11/22/02	X	X	
71121	FIELDQC	563TW001M4	71121009	WQ	TB		11/18/02	X		
71121	FIELDQC	563EW002M4	71121010	WQ	EB		11/22/02	X		
71121	LABQC	1200341498	1200341498	WQ	LB				X	
71121	LABQC	1200341499	1200341499	WQ	BS				X	
71121	E563GW007	563GW007M4MS	1200341500	WG	MS		11/22/02		X	
71121	E563GW007	563GW007M4SD	1200341501	WG	SD		11/22/02		X	
71121	LABQC	1200343193	1200343193	WQ	LB			X		
71121	LABQC	1200343194	1200343194	WQ	BS			X		
71121	E563GW007	563GW007M4MS	1200343201	WG	MS		11/22/02	X		
71121	E563GW007	563GW007M4SD	1200343202	WG	SD		11/22/02	X		
71121	LABQC	1200346362	1200346362	WQ	LB			X		
71121	LABQC	1200346363	1200346363	WQ	BS			X		
71122	E563GW007	563GW007M4MS	1200341897	WG	MS		11/22/02			X
71122	E563GW007	563GW007M4SD	1200341898	WG	SD		11/22/02			X
71122	E563GW004	563GW004M4	71122001	WG	N		11/22/02			X
71122	E563GW005	563GW005M4	71122002	WG	N		11/21/02			X
71122	E563GW006	563GW006M4	71122003	WG	N		11/21/02			X

SDG	Station ID	Sample ID	Lab Sample ID	Matrix	Sample Type	LR Type	Date Collected	VOC SW8260B	Total Metals SW6010B	Dissolved Metals SW6010B
71122	E563GW008	563GW008M4	71122004	WG	N		11/21/02			X
71122	E563GW009	563GW009M4	71122005	WG	N		11/22/02			X
71122	E563GW04D	563GW04DM4	71122006	WG	N		11/22/02			X
71122	E563GW07D	563GW07DM4	71122007	WG	N		11/22/02			X
71122	E563GW007	563GW007M4	71122008	WG	N		11/22/02			X
71122	LABQC	1200341895	1200341895	WQ	LB				X	
71122	LABQC	1200341896	1200341896	WQ	BS				X	

MATRIX CODE

WG - Ground Water
WQ - Water QC Samples

SAMPLE TYPE CODE

BS - Blank Spike
EB - Equipment Blank
FD - Field Duplicate
LB - Laboratory Blank
LR - Laboratory Replicate
N - Native Sample
MS - Matrix Spike
SD - Matrix Spike Duplicate
TB - Trip Blank

LR TYPE

DL - Dilution

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.
- **Field Duplicate Samples** – These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **Internal Standards** – The internal standards (retention time and response) are evaluated for method compliance. The internal standards are used in quantitation of the target parameters and monitor the instrument sensitivity and response for stability during each analysis.

Volatile Organic Compounds (VOC) Analyses

The QA/QC parameters for VOC analyses for all of the samples were within acceptable control limits, except as noted below:

Recoveries - Surrogate, MS/MSD and LCS

All Surrogate, Matrix Spike (MS), Matrix Spike Duplicate (MSD) and Laboratory Control Sample (LCS) recoveries were within acceptable quality control limits, except as noted in Table 2 below.

TABLE 2

Surrogate and MS/MSD Recoveries Out of QC Limits: VOC
Charleston Naval Complex, Zone E, AOC 563, Charleston, SC

SDG	Sample	Parameter	Recovery	Recovery Limits	Associated Samples	Flag
70924	563GW003M4	Dibromofluoromethane (surrogate)	132*	80-120	563GW003M4	Detects only - J
		Bromofluorobenzene (surrogate)	117*	86-115		
70924	563HW003M4	Dibromofluoromethane (surrogate)	132*	80-120	563HW003M4	Detects only - J
		Bromofluorobenzene (surrogate)	116*	86-115		
70924	569GW001M4	Dibromofluoromethane (surrogate)	135*	80-120	569GW001M4	Detects only - J
70924	569GW003M4	Dibromofluoromethane (surrogate)	131*	80-120	569GW003M4	Detects only - J
		Bromofluorobenzene (surrogate)	119*	86-115		
70924	570GW001M4	Dibromofluoromethane (surrogate)	131*	80-120	570GW001M4	Detects only - J
		Bromofluorobenzene (surrogate)	118*	86-115		
70924	570HW001M4	Dibromofluoromethane (surrogate)	133*	80-120	570HW001M4	Detects only - J
		Bromofluorobenzene (surrogate)	118*	86-115		
70924	570GW03DM4	Dibromofluoromethane (surrogate)	134*	80-120	570GW03DM4	Detects only - J
		Bromofluorobenzene (surrogate)	119*	86-115		
70924	563GW001M4	Dibromofluoromethane (surrogate)	136*	80-120	563GW001M4	Detects only - J

TABLE 2

Surrogate and MS/MSD Recoveries Out of QC Limits: VOC
 Charleston Naval Complex, Zone E AOC 563, Charleston, SC

SDG	Sample	Parameter	Recovery	Recovery Limits	Associated Samples	Flag
70924	563GW001M4	Bromofluorobenzene (surrogate)	119*	86-115	563GW001M4	Detects only - J
70924	563GW002M4	Dibromofluoromethane (surrogate)	134*	80-120	563GW002M4	Detects only - J
70924	569GW002M4	Dibromofluoromethane (surrogate)	135*	80-120	569GW002M4	Detects only - J
		Bromofluorobenzene (surrogate)	118*	86-115		
70924	569GW004M4	Dibromofluoromethane (surrogate)	132*	80-120	569GW004M4	Detects only - J
		Bromofluorobenzene (surrogate)	118*	86-115		
70924	569GW005M4	Dibromofluoromethane (surrogate)	134*	80-120	569GW005M4	Detects only - J
		Bromofluorobenzene (surrogate)	115*	86-115		
70924	570GW002M4	Dibromofluoromethane (surrogate)	132*	80-120	570GW002M4	Detects only - J
		Bromofluorobenzene (surrogate)	117*	86-115		
70924	570GW003M4	Dibromofluoromethane (surrogate)	135*	80-120	570GW003M4	Detects only - J
		Bromofluorobenzene (surrogate)	121*	86-115		
70924	563GW01DM4	Dibromofluoromethane (surrogate)	135*	80-120	563GW01DM4	Detects only - J
		Bromofluorobenzene (surrogate)	117*	86-115		
70924	569GW01DM4	Dibromofluoromethane (surrogate)	135*	80-120	569GW01DM4	Detects only - J
		Bromofluorobenzene (surrogate)	118*	86-115		
70924	569GW05DM4	Dibromofluoromethane (surrogate)	136*	80-120	569GW05DM4	Detects only - J
		Bromofluorobenzene (surrogate)	117*	86-115		
70924	570GW02DM4	Dibromofluoromethane (surrogate)	132*	80-120	570GW02DM4	Detects only - J

TABLE 2

Surrogate and MS/MSD Recoveries Out of QC Limits: VOC
 Charleston Naval Complex, Zone E, AOC 563, Charleston, SC

SDG	Sample	Parameter	Recovery	Recovery Limits	Associated Samples	Flag
70924	570GW002DM4	Bromofluorobenzene (surrogate)	123*	86-115	570GW02DM4	Detects only - J
70924	570GW004M4	Dibromofluoromethane (surrogate)	138*	80-120	570GW004M4	Detects only - J
		Bromofluorobenzene (surrogate)	124*	86-115		
70924	563EW001M4	Dibromofluoromethane (surrogate)	136*	80-120	563EW001M4	Detects only - J (EB - No flags applied)
		Bromofluorobenzene (surrogate)	122*	86-115		
70924	570GW004M4 MS/MSD	Chloromethane	57.2* / 64.4*	70-130	570GW004M4	Detects-J; Non-Detects-UJ
		Vinyl chloride	57.2* / 58.6	70-130		
		Vinyl acetate	45.6* / 50.0*	70-130		
		4-Methyl-2-pentanone	66* / 72.8*	70-130		
		2-Chloroethyl vinyl ether	0* / 0*	70-130	570GW004M4	Detects-J; Non-Detects-R
70924	1200340684 LCS	Vinyl acetate	56.8*	70-130	70924011-70924020	Detects-J; Non-Detects-UJ
70924	1200341026 LCS	Vinyl chloride	64.0*	70-130	70924001-70924010	Detects-J; Non-Detects-UJ
		Vinyl acetate	53.6*	70-130		
71121	563GW007M4 MS/MSD	2-Chloroethyl vinyl ether	0* / 0*	70-130	563GW007M4	Detects-J; Non-Detects-R
71121	1200343194 LCS	Bromomethane	144.2*	70-130	71121009, 71121010	Detects only - J
71121	1200346363 LCS	2-Chloroethyl vinyl ether	65.2*	70-130	71121001-71121008, 71121003DL	Detects-J; Non-Detects-UJ

* - out of control limits

Initial and Continuing Calibration Criteria

All initial calibration criteria and continuing calibration criteria were met, except as listed in Table 3.

TABLE 3

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: VOC
Charleston Naval Complex, Zone E, AOC 563, Charleston, SC

Instrument/Calibration Date	Analyte	%Relative Standard Deviation or R ² (ICALY %Difference (CCAL))	Associated Samples
VOA2-CCAL-11/21/02, 1910	Chloromethane	30.4% high	70924011 - 70924020
	Bromomethane	20.7% high	
	Acetone	23.1% high	
	1,1,1-Trichloroethane	30.7% high	
	Carbone tetrachloride	36.9% high	
	1,2-Dichloroethane	37.3% high	
	Bromoform	27.7% high	
VOA2-CCAL-11/22/02, 0634	Bromomethane	29.8% high	70924001 - 70924010
	Acetone	20.2% high	
	Carbon tetrachloride	22.1% high	
VOA5-CCAL-11/27/02, 1953	Bromomethane	28.0% high	71121009, 71121010
	2-Chloroethyl vinyl ether	21.7% low	
VOA5-CCAL-12/02/02, 2006	Chloromethane	23.7% low	71121001-71121008, 71121003DL
	2-Chloroethyl vinyl ether	41.5% low	

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.
- When the percent difference (%D) was low in the continuing calibration standards, detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.

Inorganic Parameters

Quality Control Review

The following list represents the QA/QC measures that are typically reviewed during the data quality evaluation procedure for inorganic parameters.

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Sample preparation, initial calibration blanks/continuing calibration blanks, and equipment blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", in which target parameters have been added prior to digestion/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Field Duplicate Samples** – These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **Pre/Post Digestion Spike (MS/MSD)** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **ICP Interference Check Sample** – This sample verifies the lab's interelement and background correction factors.
- **Initial Calibration Verification** – This parameter ensures that the instrument is capable of producing acceptable quantitative data for the target analyte list to be measured.
- **Continuing Calibration Verification** – This one-point, mid-range parameter establishes that the initial calibration is still valid by checking the performance of the instrument on a continual basis.
- **ICP Serial Dilution** – The serial dilution of samples quantitated by ICP determines whether or not significant physical or chemical interferences exist due to the sample matrix.

Metals Analyses

The QA/QC parameters for the Metals analyses for all of the samples were within acceptable control limits, except as noted below.

Blanks

The Metals target parameters detected in blank samples are listed in Table 4.

TABLE 4

Blank Contamination: Metals

Charleston Naval Complex, Zone E, AOC 563, Charleston, SC

SDG	Lab Sample ID	Sample ID	Sample Type	Parameter	Lab Result	Units	Flag Concentrations
70924	CCB		CCB	Iron	14.9	ug/L	74.5 ug/L
70924	CCB		CCB	Manganese	0.441	ug/L	2.205 ug/L
70924	1200340133	1200340133	LB	Iron	2.42	ug/L	12.1 ug/L
70926	CCB		CCB	Iron	16.8	ug/L	84.0 ug/L
70926	CCB		CCB	Manganese	0.494	ug/L	2.47 ug/L
70926	1200340133	1200340133	LB	Iron	2.42	ug/L	12.1 ug/L
71121	CCB		CCB	Iron	8.09	ug/L	40.45 ug/L
71121	1200341498	1200341498	LB	Iron	6.81	ug/L	34.05 ug/L
71122	CCB		CCB	Iron	20.7	ug/L	102.5 ug/L
71122	CCB		CCB	Manganese	0.383	ug/L	1.915 ug/L
71122	1200341895	1200341895	LB	Iron	4.05	ug/L	20.25 ug/L

If a target parameter was reported in a field sample, and the concentration was below the level determined to be due to blank contamination (5 times the concentration in the associated QC blank samples), it was flagged as "U", not detected. Initial and continuing calibration blanks were also evaluated for possible contamination.

The results qualified due to blank contamination are listed in Attachment 1.

Field Duplicate Samples

All Field Duplicate Samples were within acceptable quality control limits, except as noted in Table 5 below. No flags are applied due to Field Duplicate precision.

TABLE 5
Field Duplicate RPDs Out of QC Limits: Metals
Charleston Naval Complex, Zone E, AOC 563, Charleston, SC

SDG	Sample	Parameter	Native Concentration	Field Duplicate Concentration	RPD	RPD Limits
70924	570GW001M4 / 570HW001M4	Lead, total	218 ug/L	369 ug/L	51.4*	20

* - out of control limits

Total versus Dissolved

All Total versus Dissolved sample comparisons were within acceptable quality control limits, except as noted in Table 6 below. Results are qualified "J" for detects and "UJ" for non-detects if the dissolved value is greater than the total value by more than five percent.

TABLE 6
Total vs Dissolved Out of QC Limits: Metals
Charleston Naval Complex, Zone E, AOC 563, Charleston, SC

SDG	Sample	Parameter	Total Concentration	Dissolved Concentration	RPD	RPD Limits
70924 / 70926	70924003 / 70926003 (569GW001M4)	Iron, total / dissolved	33 ug/L	151 ug/L	128.3*	5
71121 / 71122	71121004 / 71122004 (563GW008M4)	Iron, total / dissolved	13200 ug/L	14100 ug/L	6.6*	5

* - out of control limits

Rejected Data

The majority of rejected data were associated with dilutions (there can only be a single valid result per parameter per sample). However, there were selected results qualified as "R", rejected, due to associated QC parameters out of criteria, such that there is not a valid result for that parameter in each sample. The rejected data are summarized in Table 7 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 7
Data Qualification Summary: Rejected Data
Charleston Naval Complex, Zone E AOC 563, Charleston, SC

SDG	Sample ID	Parameter Class	Parameter	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reason
70924	570GW004M4	VOA	2-Chloroethyl vinyl ether	10	U	10	R	ug/L	MS
71121	563GW007M4	VOA	2-Chloroethyl vinyl ether	10	U	10	R	ug/L	MS

Conclusion

A review of the analytical data submitted regarding the investigation of Zone E, AOC 563, at the Charleston Naval Complex, Charleston, South Carolina by CH2M HILL has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed, and that the analytical results should be considered usable as qualified.

As discussed above, there were specific results that were rejected, in which the data cannot be used. With the exception of these results, 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 563 - Data Validation

Parameter Class	Analytical Method	Parameter	SDG	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
FLTMET	SW6010B	IRON, Dissolved	70926	563GW003M4	70926001	WG	66.3	B	66.3	U	ug/L	BL
FLTMET	SW6010B	IRON, Dissolved	70926	563HW003M4	70926002	WG	74.2	B	74.2	U	ug/L	BL
FLTMET	SW6010B	IRON, Dissolved	70926	569GW001M4	70926003	WG	151	=	151	J	ug/L	TD
FLTMET	SW6010B	IRON, Dissolved	70926	569GW003M4	70926004	WG	36.8	B	36.8	U	ug/L	BL
FLTMET	SW6010B	IRON, Dissolved	70926	570GW001M4	70926005	WG	8	B	8	U	ug/L	BL
FLTMET	SW6010B	IRON, Dissolved	70926	570HW001M4	70926006	WG	4.73	B	4.73	U	ug/L	BL
FLTMET	SW6010B	IRON, Dissolved	71122	563GW004M4	71122001	WG	30	B	30	U	ug/L	BL
FLTMET	SW6010B	IRON, Dissolved	71122	563GW005M4	71122002	WG	20.9	B	20.9	U	ug/L	BL
FLTMET	SW6010B	IRON, Dissolved	71122	563GW008M4	71122004	WG	14100	=	14100	J	ug/L	TD
FLTMET	SW6010B	IRON, Dissolved	71122	563GW009M4	71122005	WG	44.6	B	44.6	U	ug/L	BL
FLTMET	SW6010B	IRON, Dissolved	71122	563GW04DM4	71122006	WG	3.38	B	3.38	U	ug/L	BL
FLTMET	SW6010B	IRON, Dissolved	71122	563GW007M4	71122008	WG	19	B	19	U	ug/L	BL
FLTMET	SW6010B	MANGANESE, Dissolved	71122	563GW04DM4	71122006	WG	8.98	B	8.98	J	ug/L	IB
METAL	SW6010B	IRON, Total	70924	569GW001M4	70924003	WG	33	B	33	UJ	ug/L	BL,TD
METAL	SW6010B	IRON, Total	70924	570GW001M4	70924005	WG	31.4	B	31.4	U	ug/L	BL
METAL	SW6010B	IRON, Total	70924	570HW001M4	70924006	WG	20.5	B	20.5	U	ug/L	BL
METAL	SW6010B	IRON, Total	71121	563GW008M4	71121004	WG	13200	=	13200	J	ug/L	TD
METAL	SW6010B	IRON, Total	71121	563GW009M4	71121005	WG	70.2	B	70.2	J	ug/L	IB
METAL	SW6010B	IRON, Total	71121	563GW04DM4	71121006	WG	82.5	B	82.5	J	ug/L	IB
VOA	SW8260B	1,1,1-TRICHLOROETHANE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	1,1,2,2-TETRACHLOROETHANE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	1,1,2-TRICHLOROETHANE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	1,1-DICHLOROETHANE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	1,1-DICHLOROETHENE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	1,2,3-Trichlorobenzene	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	1,2,4-TRICHLOROBENZENE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	1,2-DICHLOROBENZENE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	1,2-DICHLOROETHANE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL

Attachment 1 - Changed Qualifiers and Results
 Zone E, AOC - Data Validation

Parameter Class	Analytical Method	Parameter	SDG	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
VOA	SW8260B	1,2-Dichloroethene (total)	70924	569GW001M4	70924003	WG	0.66	J	0.66	J	ug/L	SS
VOA	SW8260B	1,2-Dichloroethene (total)	70924	569GW003M4	70924004	WG	0.85	J	0.85	J	ug/L	SS
VOA	SW8260B	1,2-Dichloroethene (total)	70924	570GW03DM4	70924007	WG	6.3	=	6.3	J	ug/L	SS
VOA	SW8260B	1,2-Dichloroethene (total)	70924	563GW001M4	70924008	WG	10.2	=	10.2	J	ug/L	SS
VOA	SW8260B	1,2-Dichloroethene (total)	70924	563GW002M4	70924009	WG	7.6	=	7.6	J	ug/L	SS
VOA	SW8260B	1,2-Dichloroethene (total)	70924	569GW002M4	70924010	WG	1.4	J	1.4	J	ug/L	SS
VOA	SW8260B	1,2-Dichloroethene (total)	70924	569GW004M4	70924011	WG	0.72	J	0.72	J	ug/L	SS
VOA	SW8260B	1,2-Dichloroethene (total)	70924	569GW01DM4	70924016	WG	9.6	=	9.6	J	ug/L	SS
VOA	SW8260B	1,2-Dichloroethene (total)	71121	563GW006M4DL	71121003	WG	8.6	JD	8.6	R	ug/L	DL
VOA	SW8260B	1,2-DICHLOROPROPANE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	1,3-DICHLOROBENZENE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	1,4-DICHLOROBENZENE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	2-Chloroethyl vinyl ether	70924	570GW004M4	70924019	WG	10	U	10	R	ug/L	MS
VOA	SW8260B	2-Chloroethyl vinyl ether	71121	563GW004M4	71121001	WG	10	U	10	UJ	ug/L	CC,BS
VOA	SW8260B	2-Chloroethyl vinyl ether	71121	563GW005M4	71121002	WG	10	U	10	UJ	ug/L	CC,BS
VOA	SW8260B	2-Chloroethyl vinyl ether	71121	563GW006M4	71121003	WG	10	U	10	UJ	ug/L	CC,BS
VOA	SW8260B	2-Chloroethyl vinyl ether	71121	563GW006M4DL	71121003	WG	20	U	20	R	ug/L	DL
VOA	SW8260B	2-Chloroethyl vinyl ether	71121	563GW008M4	71121004	WG	10	U	10	UJ	ug/L	CC,BS
VOA	SW8260B	2-Chloroethyl vinyl ether	71121	563GW009M4	71121005	WG	10	U	10	UJ	ug/L	CC,BS
VOA	SW8260B	2-Chloroethyl vinyl ether	71121	563GW04DM4	71121006	WG	200	U	200	UJ	ug/L	CC,BS
VOA	SW8260B	2-Chloroethyl vinyl ether	71121	563GW07DM4	71121007	WG	10	U	10	UJ	ug/L	CC,BS
VOA	SW8260B	2-Chloroethyl vinyl ether	71121	563GW007M4	71121008	WG	10	U	10	R	ug/L	MS
VOA	SW8260B	2-HEXANONE	71121	563GW006M4DL	71121003	WG	20	U	20	R	ug/L	DL
VOA	SW8260B	ACETONE	70924	563GW003M4	70924001	WG	10.7	=	10.7	J	ug/L	CC,SS
VOA	SW8260B	ACETONE	71121	563GW006M4DL	71121003	WG	20	U	20	R	ug/L	DL
VOA	SW8260B	BENZENE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	BROMODICHLOROMETHANE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	BROMOFORM	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL

Attachment 1 - Changed Qualifiers and Results
Zone E, AOC 563 - Data Validation

Parameter Class	Analytical Method	Parameter	SDG	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
VOA	SW8260B	BROMOMETHANE	71121	563GW006M4DL	71121003	WG	20	U	20	R	ug/L	DL
VOA	SW8260B	CARBON DISULFIDE	70924	569GW004M4	70924011	WG	2.3	J	2.3	J	ug/L	SS
VOA	SW8260B	CARBON DISULFIDE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	CARBON TETRACHLORIDE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	CHLOROBENZENE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	CHLOROETHANE	71121	563GW006M4DL	71121003	WG	20	U	20	R	ug/L	DL
VOA	SW8260B	CHLOROFORM	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	CHLOROMETHANE	70924	570GW004M4	70924019	WG	10	U	10	UJ	ug/L	MS
VOA	SW8260B	CHLOROMETHANE	71121	563GW004M4	71121001	WG	10	U	10	UJ	ug/L	CC
VOA	SW8260B	CHLOROMETHANE	71121	563GW005M4	71121002	WG	10	U	10	UJ	ug/L	CC
VOA	SW8260B	CHLOROMETHANE	71121	563GW006M4	71121003	WG	10	U	10	UJ	ug/L	CC
VOA	SW8260B	CHLOROMETHANE	71121	563GW006M4DL	71121003	WG	20	U	20	R	ug/L	DL
VOA	SW8260B	CHLOROMETHANE	71121	563GW008M4	71121004	WG	10	U	10	UJ	ug/L	CC
VOA	SW8260B	CHLOROMETHANE	71121	563GW009M4	71121005	WG	10	U	10	UJ	ug/L	CC
VOA	SW8260B	CHLOROMETHANE	71121	563GW04DM4	71121006	WG	200	U	200	UJ	ug/L	CC
VOA	SW8260B	CHLOROMETHANE	71121	563GW07DM4	71121007	WG	10	U	10	UJ	ug/L	CC
VOA	SW8260B	CHLOROMETHANE	71121	563GW007M4	71121008	WG	10	U	10	UJ	ug/L	CC
VOA	SW8260B	cis-1,2-DICHLOROETHYLENE	70924	569GW001M4	70924003	WG	0.66	J	0.66	J	ug/L	SS
VOA	SW8260B	cis-1,2-DICHLOROETHYLENE	70924	569GW003M4	70924004	WG	0.85	J	0.85	J	ug/L	SS
VOA	SW8260B	cis-1,2-DICHLOROETHYLENE	70924	570GW03DM4	70924007	WG	5.8	=	5.8	J	ug/L	SS
VOA	SW8260B	cis-1,2-DICHLOROETHYLENE	70924	563GW001M4	70924008	WG	8.3	=	8.3	J	ug/L	SS
VOA	SW8260B	cis-1,2-DICHLOROETHYLENE	70924	563GW002M4	70924009	WG	6.1	=	6.1	J	ug/L	SS
VOA	SW8260B	cis-1,2-DICHLOROETHYLENE	70924	569GW002M4	70924010	WG	1.4	J	1.4	J	ug/L	SS
VOA	SW8260B	cis-1,2-DICHLOROETHYLENE	70924	569GW004M4	70924011	WG	0.72	J	0.72	J	ug/L	SS
VOA	SW8260B	cis-1,2-DICHLOROETHYLENE	70924	569GW01DM4	70924016	WG	8.5	=	8.5	J	ug/L	SS
VOA	SW8260B	cis-1,2-DICHLOROETHYLENE	71121	563GW006M4DL	71121003	WG	8.6	JD	8.6	H	ug/L	DL
VOA	SW8260B	cis-1,3-DICHLOROPROPENE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	DIBROMOCHLOROMETHANE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL

Attachment 1 - Changed Qualifiers and Results
 Zone E, AOC - Data Validation

Parameter Class	Analytical Method	Parameter	SDG	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
VOA	SW8260B	ETHYLBENZENE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	m+p Xylene	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	2-BUTANONE (MEK)	71121	563GW006M4DL	71121003	WG	20	U	20	R	ug/L	DL
VOA	SW8260B	4-METHYL-2-PENTANONE (MIBK)	70924	570GW004M4	70924019	WG	10	U	10	UJ	ug/L	MS
VOA	SW8260B	4-METHYL-2-PENTANONE (MIBK)	71121	563GW006M4DL	71121003	WG	20	U	20	R	ug/L	DL
VOA	SW8260B	METHYLENE CHLORIDE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	o-Xylene	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	STYRENE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	TETRACHLOROETHYLENE(PCE)	70924	563GW003M4	70924001	WG	2.6	J	2.6	J	ug/L	SS
VOA	SW8260B	TETRACHLOROETHYLENE(PCE)	70924	563HW003M4	70924002	WG	2.7	J	2.7	J	ug/L	SS
VOA	SW8260B	TETRACHLOROETHYLENE(PCE)	70924	569GW001M4	70924003	WG	62.5	=	62.5	J	ug/L	SS
VOA	SW8260B	TETRACHLOROETHYLENE(PCE)	70924	569GW003M4	70924004	WG	92.2	=	92.2	J	ug/L	SS
VOA	SW8260B	TETRACHLOROETHYLENE(PCE)	70924	570GW001M4	70924005	WG	3.5	J	3.5	J	ug/L	SS
VOA	SW8260B	TETRACHLOROETHYLENE(PCE)	70924	570HW001M4	70924006	WG	3.7	J	3.7	J	ug/L	SS
VOA	SW8260B	TETRACHLOROETHYLENE(PCE)	70924	563GW002M4	70924009	WG	0.55	J	0.55	J	ug/L	SS
VOA	SW8260B	TETRACHLOROETHYLENE(PCE)	70924	569GW002M4	70924010	WG	7.6	=	7.6	J	ug/L	SS
VOA	SW8260B	TETRACHLOROETHYLENE(PCE)	70924	569GW004M4	70924011	WG	11.7	=	11.7	J	ug/L	SS
VOA	SW8260B	TETRACHLOROETHYLENE(PCE)	70924	569GW005M4	70924012	WG	0.72	J	0.72	J	ug/L	SS
VOA	SW8260B	TETRACHLOROETHYLENE(PCE)	70924	570GW003M4	70924014	WG	0.74	J	0.74	J	ug/L	SS
VOA	SW8260B	TETRACHLOROETHYLENE(PCE)	71121	563GW006M4DL	71121003	WG	3.6	JD	3.6	R	ug/L	DL
VOA	SW8260B	TOLUENE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	trans-1,2-DICHLOROETHENE	70924	570GW03DM4	70924007	WG	0.5	J	0.5	J	ug/L	SS
VOA	SW8260B	trans-1,2-DICHLOROETHENE	70924	563GW001M4	70924008	WG	1.9	J	1.9	J	ug/L	SS
VOA	SW8260B	trans-1,2-DICHLOROETHENE	70924	563GW002M4	70924009	WG	1.4	J	1.4	J	ug/L	SS
VOA	SW8260B	trans-1,2-DICHLOROETHENE	70924	569GW01DM4	70924016	WG	1.1	J	1.1	J	ug/L	SS
VOA	SW8260B	trans-1,2-DICHLOROETHENE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	trans-1,3-DICHLOROPROPENE	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL
VOA	SW8260B	TRICHLOROETHYLENE (TCE)	70924	563GW003M4	70924001	WG	3.2	J	3.2	J	ug/L	SS

Attachment 1 - Changed Qualifiers and Results
Zone E, AOC 563 - Data Validation

Parameter Class	Analytical Method	Parameter	SDG	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
VOA	SW8260B	TRICHLOROETHYLENE (TCE)	70924	563HW003M4	70924002	WG	2.9	J	2.9	J	ug/L	SS
VOA	SW8260B	TRICHLOROETHYLENE (TCE)	70924	569GW001M4	70924003	WG	2.8	J	2.8	J	ug/L	SS
VOA	SW8260B	TRICHLOROETHYLENE (TCE)	70924	569GW003M4	70924004	WG	3.8	J	3.8	J	ug/L	SS
VOA	SW8260B	TRICHLOROETHYLENE (TCE)	70924	570GW03DM4	70924007	WG	4.7	J	4.7	J	ug/L	SS
VOA	SW8260B	TRICHLOROETHYLENE (TCE)	70924	563GW001M4	70924008	WG	7.9	=	7.9	J	ug/L	SS
VOA	SW8260B	TRICHLOROETHYLENE (TCE)	70924	563GW002M4	70924009	WG	5.4	=	5.4	J	ug/L	SS
VOA	SW8260B	TRICHLOROETHYLENE (TCE)	70924	569GW002M4	70924010	WG	4.3	J	4.3	J	ug/L	SS
VOA	SW8260B	TRICHLOROETHYLENE (TCE)	70924	569GW004M4	70924011	WG	0.8	J	0.8	J	ug/L	SS
VOA	SW8260B	TRICHLOROETHYLENE (TCE)	70924	569GW01DM4	70924016	WG	0.44	J	0.44	J	ug/L	SS
VOA	SW8260B	TRICHLOROETHYLENE (TCE)	71121	563GW006M4	71121003	WG	120	E	120	R	ug/L	LR
VOA	SW8260B	Vinyl acetate	70924	563GW003M4	70924001	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	563HW003M4	70924002	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	569GW001M4	70924003	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	569GW003M4	70924004	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	570GW001M4	70924005	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	570HW001M4	70924006	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	570GW03DM4	70924007	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	563GW001M4	70924008	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	563GW002M4	70924009	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	569GW002M4	70924010	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	569GW004M4	70924011	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	569GW005M4	70924012	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	570GW002M4	70924013	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	570GW003M4	70924014	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	563GW01DM4	70924015	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	569GW01DM4	70924016	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	569GW05DM4	70924017	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	Vinyl acetate	70924	570GW02DM4	70924018	WG	10	U	10	UJ	ug/L	BS

Attachment 1 - Changed Qualifiers and Results
 Zone E, AOC - Data Validation

Parameter Class	Analytical Method	Parameter	SDG	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
VOA	SW8260B	Vinyl acetate	70924	570GW004M4	70924019	WG	10	U	10	UJ	ug/L	BS,MS
VOA	SW8260B	Vinyl acetate	71121	563GW006M4DL	71121003	WG	20	U	20	R	ug/L	DL
VOA	SW8260B	VINYL CHLORIDE	70924	563GW003M4	70924001	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	VINYL CHLORIDE	70924	563HW003M4	70924002	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	VINYL CHLORIDE	70924	569GW001M4	70924003	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	VINYL CHLORIDE	70924	569GW003M4	70924004	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	VINYL CHLORIDE	70924	570GW001M4	70924005	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	VINYL CHLORIDE	70924	570HW001M4	70924006	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	VINYL CHLORIDE	70924	570GW03DM4	70924007	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	VINYL CHLORIDE	70924	563GW001M4	70924008	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	VINYL CHLORIDE	70924	563GW002M4	70924009	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	VINYL CHLORIDE	70924	569GW002M4	70924010	WG	10	U	10	UJ	ug/L	BS
VOA	SW8260B	VINYL CHLORIDE	70924	570GW004M4	70924019	WG	10	U	10	UJ	ug/L	MS
VOA	SW8260B	VINYL CHLORIDE	71121	563GW006M4DL	71121003	WG	20	U	20	R	ug/L	DL
VOA	SW8260B	XYLENES, TOTAL	71121	563GW006M4DL	71121003	WG	10	U	10	R	ug/L	DL

M HILL Chain of Custody/ Laboratory Analysis Form

Laboratory: GEL		Project Name: Charleston Navy Complex		Site Name: Zone E, AOC 563		# of containers	3 - 40mL vial, HCl	1 - 250mL HDPE, HNO3	1 - 250mL HDPE, HNO3					Lab Batch/SDG: 711212 / 711222	
Project Number: 158814.PM.04		TAT: 14 day		QA Level: level 3			VOCs (SW8260B)	Total Iron (SW6010B)	Total Manganese (SW6010B)	Dissolved Iron (SW6010B)	Dissolved Manganese				
Project Manager: Tom Beisel		Address: GNV: 3011 SW Williston Rd., Gainesville, FL 32605		ATL: 115 Perimeter Center Place NE, Suite 700, Atlanta, GA 30346-1278											
Send Report To: see last page of COC		EDD: CNC format													
Sample ID		Station ID		Sample Description			Depth	Date & Time		Matrix					Comments
				Begin	End		Collected								
570GW03DM4	E570GW03D					11-18-02 1200	WG	5	X	X	X	X	X		
563GW004M4	E563GW004					11-22-02 1350	WG	5	X	X	X	X	X		
563GW005M4	E563GW005					11-21-02 0825	WG	5	X	X	X	X	X		
563GW006M4	E563GW006					11-21-02 0905	WG	5	X	X	X	X	X		
563GW007M4	E563GW007					11-22-02 1230	WG	5	X	X	X	X	X		
563GW007M4MS	E563GW007					11-22-02 1250	WG	5	X	X	X	X	X	MS	
563GW007M4SD	E563GW007					11-22-02 1230	WG	5	X	X	X	X	X	MSD	
563GW008M4	E563GW008					11-21-02 1000	WG	5	X	X	X	X	X		
563GW009M4	E563GW009					11-22-02 1450	WG	5	X	X	X	X	X		
563GW04DM4	E563GW04D					11-22-02 1410	WG	5	X	X	X	X	X	RCA site	
563GW07DM4	E563GW07D					11-22-02 1255	WG	5	X	X	X	X	X		
563EW001M4	E563EW001	EB1				11-18-02 1000	WQ	3	X					EB	
563TW001M4	E563TW001	TB1				11-22-02	WQ		X					TB	
563EW002M4	E563EW002	EB2				11-22-02 1420	WQ	3	X					EB	
563TW002M4	E563TW002	TB2					WQ		X					TB	
<p>LABS SUPPLIED (11-13-02)</p> <p>NO METALS DE NOT SUPPLIED. SO EB ONLY HAS VOC.</p>										<p>Sampling Complete</p>					

Sampled By: David Wilson	Date/Time: 11-22-02 1600	Requisitioned by: [Signature]	Date/Time: 11-22-02
Additional Samplers: Brian C.			
Received By Lab: [Signature]	Date/Time: 11/22/02 1600	Requisitioned by:	Date/Time:
Received By:	Date/Time:	Shipped Via: UPS FedEx Hand Other Tracking#:	
Remarks:	Temperature:		

Analytical Data Summary, AOC 563 RFIRA, Zone E, CNC

StationID	E563GW001	E563GW002	E563GW003	E563GW003	E563GW004	E563GW005					
SampleID	563GW001M4	563GW002M4	563GW003M4	563HW003M4	563GW004M4	563GW005M4					
DateCollected	11/18/2002	11/18/2002	11/18/2002	11/18/2002	11/22/2002	11/21/2002					
DateExtracted	11/22/2002	11/22/2002	11/22/2002	11/22/2002	12/02/2002	12/02/2002					
DateAnalyzed	11/22/2002	11/22/2002	11/22/2002	11/22/2002	12/02/2002	12/02/2002					
SDGNumber	70924	70924	70924	70924	71121	71121					
Parameter	Units										
Chloromethane	ug/L	10	U	10	U	10	U	10	UJ	10	UJ
Vinyl chloride	ug/L	10	UJ	10	UJ	10	UJ	10	UJ	10	U
Bromomethane	ug/L	10	U	10	U	10	U	10	U	10	U
Chloroethane	ug/L	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethene	ug/L	5	U	5	U	5	U	5	U	5	U
Acetone	ug/L	10	U	10	U	10.7	J	10	U	10	U
Carbon Disulfide	ug/L	5	U	5	U	5	U	5	U	5	U
Methylene Chloride	ug/l	5	U	5	U	5	U	5	U	5	U
trans-1,2-Dichloroethene	ug/L	1.9	J	1.4	J	5	U	5	U	5	U
1,1-Dichloroethane	ug/L	5	U	5	U	5	U	5	U	5	U
Vinyl acetate	ug/L	10	UJ	10	UJ	10	UJ	10	UJ	10	U
Methyl ethyl ketone (2-Butanone)	ug/L	10	U	10	U	10	U	10	U	10	U
cis-1,2-Dichloroethylene	ug/L	8.3	J	6.1	J	5	U	5	U	1.2	J
1,2-Dichloroethene (total)	ug/L	10.2	J	7.6	J	5	U	5	U	1.2	J
Chloroform	ug/L	5	U	5	U	5	U	5	U	5	U
1,1,1-Trichloroethane	ug/L	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	ug/L	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	ug/L	5	U	5	U	5	U	5	U	5	U
Benzene	ug/L	5	U	5	U	5	U	5	U	0.41	J
Trichloroethylene (TCE)	ug/L	7.9	J	5.4	J	3.2	J	2.9	J	71.3	=
1,2-Dichloropropane	ug/L	5	U	5	U	5	U	5	U	5	U
Bromodichloromethane	ug/L	5	U	5	U	5	U	5	U	5	U
2-Chloroethyl vinyl ether	ug/L	10	U	10	U	10	U	10	U	10	UJ
cis-1,3-Dichloropropene	ug/L	5	U	5	U	5	U	5	U	5	U
Methyl isobutyl ketone (4-Methyl-2-	ug/L	10	U	10	U	10	U	10	U	10	U
Toluene	ug/L	5	U	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	ug/L	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	ug/L	5	U	5	U	5	U	5	U	5	U
2-Hexanone	ug/L	10	U	10	U	10	U	10	U	10	U
Tetrachloroethylene (PCE)	ug/L	5	U	0.55	J	2.6	J	2.7	J	0.65	J
Dibromochloromethane	ug/L	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	ug/L	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	ug/L	5	U	5	U	5	U	5	U	0.41	J
m+p Xylene	ug/L	5	U	5	U	5	U	5	U	0.87	J
o-Xylene	ug/L	5	U	5	U	5	U	5	U	0.28	J
Xylenes, Total	ug/L	5	U	5	U	5	U	5	U	1.2	J
Styrene	ug/L	5	U	5	U	5	U	5	U	5	U
Bromoform	ug/L	5	U	5	U	5	U	5	U	5	U

Analytical Data Summary C 563 RFIRA, Zone E, CNC

StationID	E563GW001	E563GW002	E563GW003	E563GW003	E563GW004	E563GW005
SampleID	563GW001M4	563GW002M4	563GW003M4	563HW003M4	563GW004M4	563GW005M4
DateCollected	11/18/2002	11/18/2002	11/18/2002	11/18/2002	11/22/2002	11/21/2002
DateExtracted	11/22/2002	11/22/2002	11/22/2002	11/22/2002	12/02/2002	12/02/2002
DateAnalyzed	11/22/2002	11/22/2002	11/22/2002	11/22/2002	12/02/2002	12/02/2002
SDGNumber	70924	70924	70924	70924	71121	71121
Parameter	Units					
1,1,2,2-Tetrachloroethane	ug/L	5 U	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	ug/L	5 U	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	ug/L	5 U	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	ug/L	5 U	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	ug/L	5 U	5 U	5 U	5 U	5 U
1,2,3-Trichlorobenzene	ug/L	5 U	5 U	5 U	5 U	5 U

Analytical Data Summary, AOC 563 RFIRA, Zone E, CNC

StationID	E563GW006	E563GW007	E563GW008	E563GW009	E563GW01D
SampleID	563GW006M4	563GW007M4	563GW008M4	563GW009M4	563GW01DM4
DateCollected	11/21/2002	11/22/2002	11/21/2002	11/22/2002	11/18/2002
DateExtracted	12/03/2002	12/03/2002	12/02/2002	12/03/2002	11/21/2002
DateAnalyzed	12/03/2002	12/03/2002	12/02/2002	12/03/2002	11/21/2002
SDGNumber	71121	71121	71121	71121	70924

Parameter	Units	E563GW006		E563GW007		E563GW008		E563GW009		E563GW01D	
Chloromethane	ug/L	10	UJ	10	UJ	10	UJ	10	UJ	10	U
Vinyl chloride	ug/L	10	U								
Bromomethane	ug/L	10	U								
Chloroethane	ug/L	10	U								
1,1-Dichloroethene	ug/L	5	U	5	U	5	U	5	U	5	U
Acetone	ug/L	10	U								
Carbon Disulfide	ug/L	5	U	5	U	5	U	5	U	5	U
Methylene Chloride	ug/L	5	U	5	U	5	U	5	U	5	U
trans-1,2-Dichloroethene	ug/L	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethane	ug/L	5	U	5	U	5	U	5	U	5	U
Vinyl acetate	ug/L	10	U	10	U	10	U	10	U	10	UJ
Methyl ethyl ketone (2-Butanone)	ug/L	10	U								
cis-1,2-Dichloroethylene	ug/L	9.6	=	5	U	5	U	0.74	J	5	U
1,2-Dichloroethene (total)	ug/L	9.6	=	5	U	5	U	0.74	J	5	U
Chloroform	ug/L	5	U	5	U	5	U	5	U	5	U
1,1,1-Trichloroethane	ug/L	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	ug/L	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	ug/L	5	U	5	U	5	U	5	U	5	U
Benzene	ug/L	5	U	5	U	5	U	5	U	5	U
Trichloroethylene (TCE)	ug/L	110	=	2.4	J	1.3	J	5	=	5	U
1,2-Dichloropropane	ug/L	5	U	5	U	5	U	5	U	5	U
Bromodichloromethane	ug/L	5	U	5	U	5	U	5	U	5	U
2-Chloroethyl vinyl ether	ug/L	10	UJ	10	U	10	UJ	10	UJ	10	U
cis-1,3-Dichloropropene	ug/L	5	U	5	U	5	U	5	U	5	U
Methyl isobutyl ketone (4-Methyl-2-	ug/L	10	U								
Toluene	ug/L	5	U	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	ug/L	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	ug/L	5	U	5	U	5	U	5	U	5	U
2-Hexanone	ug/L	10	U								
Tetrachloroethylene (PCE)	ug/L	4.2	J	5	U	0.84	J	5	U	5	U
Dibromochloromethane	ug/L	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	ug/L	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	ug/L	0.31	J	0.22	J	0.29	J	5	U	5	U
m+p Xylene	ug/L	0.64	J	5	U	0.63	J	5	U	5	U
o-Xylene	ug/L	5	U	5	U	5	U	5	U	5	U
Xylenes, Total	ug/L	0.64	J	5	U	0.63	J	5	U	5	U
Styrene	ug/L	5	U	5	U	5	U	5	U	5	U
Bromoform	ug/L	5	U	5	U	5	U	5	U	5	U

Analytical Data Summary - JC 563 RFIRA, Zone E, CNC

StationID	E563GW006	E563GW007	E563GW008	E563GW009	E563GW01D		
SampleID	563GW006M4	563GW007M4	563GW008M4	563GW009M4	563GW01DM4		
DateCollected	11/21/2002	11/22/2002	11/21/2002	11/22/2002	11/18/2002		
DateExtracted	12/03/2002	12/03/2002	12/02/2002	12/03/2002	11/21/2002		
DateAnalyzed	12/03/2002	12/03/2002	12/02/2002	12/03/2002	11/21/2002		
SDGNumber	71121	71121	71121	71121	70924		
Parameter	Units						
1,1,2,2-Tetrachloroethane	ug/L	5	U	5	U	5	U
1,3-Dichlorobenzene	ug/L	5	U	5	U	5	U
1,4-Dichlorobenzene	ug/L	5	U	5	U	5	U
1,2-Dichlorobenzene	ug/L	5	U	5	U	5	U
1,2,4-Trichlorobenzene	ug/L	5	U	5	U	5	U
1,2,3-Trichlorobenzene	ug/L	5	U	5	U	5	U

Analytical Data Summary, AOC 563 RFIRA, Zone E, CNC

	StationID	E563GW04D		E563GW07D		E569GW001		E569GW002	
	SampleID	563GW04DM4		563GW07DM4		569GW001M4		569GW002M4	
	DateCollected	11/22/2002		11/22/2002		11/18/2002		11/18/2002	
	DateExtracted	12/03/2002		12/03/2002		11/22/2002		11/22/2002	
	DateAnalyzed	12/03/2002		12/03/2002		11/22/2002		11/22/2002	
	SDGNumber	71121		71121		70924		70924	
Parameter	Units								
Chloromethane	ug/L	200	UJ	10	UJ	10	U	10	U
Vinyl chloride	ug/L	200	U	10	U	10	UJ	10	UJ
Bromomethane	ug/L	200	U	10	U	10	U	10	U
Chloroethane	ug/L	200	U	10	U	10	U	10	U
1,1-Dichloroethene	ug/L	100	U	5	U	5	U	5	U
Acetone	ug/L	200	U	10	U	10	U	10	U
Carbon Disulfide	ug/L	100	U	5	U	5	U	5	U
Methylene Chloride	ug/L	100	U	5	U	5	U	5	U
trans-1,2-Dichloroethene	ug/L	100	U	5	U	5	U	5	U
1,1-Dichloroethane	ug/L	100	U	5	U	5	U	5	U
Vinyl acetate	ug/L	200	U	10	U	10	UJ	10	UJ
Methyl ethyl ketone (2-Butanone)	ug/L	200	U	10	U	10	U	10	U
cis-1,2-Dichloroethylene	ug/L	145	=	7.5	=	0.66	J	1.4	J
1,2-Dichloroethene (total)	ug/L	145	=	7.5	=	0.66	J	1.4	J
Chloroform	ug/L	100	U	5	U	5	U	5	U
1,1,1-Trichloroethane	ug/L	100	U	5	U	5	U	5	U
Carbon Tetrachloride	ug/L	100	U	5	U	5	U	5	U
1,2-Dichloroethane	ug/L	100	U	5	U	5	U	5	U
Benzene	ug/L	100	U	5	U	5	U	5	U
Trichloroethylene (TCE)	ug/L	1700	=	46.7	=	2.8	J	4.3	J
1,2-Dichloropropane	ug/L	100	U	5	U	5	U	5	U
Bromodichloromethane	ug/L	100	U	5	U	5	U	5	U
2-Chloroethyl vinyl ether	ug/L	200	UJ	10	UJ	10	U	10	U
cis-1,3-Dichloropropene	ug/L	100	U	5	U	5	U	5	U
Methyl isobutyl ketone (4-Methyl-2-	ug/L	200	U	10	U	10	U	10	U
Toluene	ug/L	100	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	ug/L	100	U	5	U	5	U	5	U
1,1,2-Trichloroethane	ug/L	100	U	5	U	5	U	5	U
2-Hexanone	ug/L	200	U	10	U	10	U	10	U
Tetrachloroethylene (PCE)	ug/L	100	U	0.89	J	62.5	J	7.6	J
Dibromochloromethane	ug/L	100	U	5	U	5	U	5	U
Chlorobenzene	ug/L	100	U	5	U	5	U	5	U
Ethylbenzene	ug/L	100	U	5	U	5	U	5	U
m+p Xylene	ug/L	100	U	5	U	5	U	5	U
o-Xylene	ug/L	100	U	5	U	5	U	5	U
Xylenes, Total	ug/L	100	U	5	U	5	U	5	U
Styrene	ug/L	100	U	5	U	5	U	5	U
Brom... m	ug/L	100	U	-	U	5	U	5	U

Analytical Data Summary, C 563 RFIRA, Zone E, CNC

	StationID	E563GW04D	E563GW07D	E569GW001	E569GW002
	SampleID	563GW04DM4	563GW07DM4	569GW001M4	569GW002M4
	DateCollected	11/22/2002	11/22/2002	11/18/2002	11/18/2002
	DateExtracted	12/03/2002	12/03/2002	11/22/2002	11/22/2002
	DateAnalyzed	12/03/2002	12/03/2002	11/22/2002	11/22/2002
	SDGNumber	71121	71121	70924	70924
Parameter	Units				
1,1,2,2-Tetrachloroethane	ug/L	100 U	5 U	5 U	5 U
1,3-Dichlorobenzene	ug/L	100 U	5 U	5 U	5 U
1,4-Dichlorobenzene	ug/L	100 U	5 U	5 U	5 U
1,2-Dichlorobenzene	ug/L	100 U	5 U	5 U	5 U
2,4-Trichlorobenzene	ug/L	100 U	5 U	5 U	5 U
2,3-Trichlorobenzene	ug/L	100 U	5 U	5 U	5 U

Analytical Data Summary, AOC 563 RFIRA, Zone E, CNC

StationID	E569GW003	E569GW004	E569GW005	E569GW01D
SampleID	569GW003M4	569GW004M4	569GW005M4	569GW01DM4
DateCollected	11/18/2002	11/18/2002	11/18/2002	11/18/2002
DateExtracted	11/22/2002	11/22/2002	11/22/2002	11/21/2002
DateAnalyzed	11/22/2002	11/22/2002	11/22/2002	11/21/2002
SDGNumber	70924	70924	70924	70924

Parameter	Units	E569GW003		E569GW004		E569GW005		E569GW01D	
Chloromethane	ug/L	10	U	10	U	10	U	10	U
Vinyl chloride	ug/L	10	UJ	10	U	10	U	10	U
Bromomethane	ug/L	10	U	10	U	10	U	10	U
Chloroethane	ug/L	10	U	10	U	10	U	10	U
1,1-Dichloroethene	ug/L	5	U	5	U	5	U	5	U
Acetone	ug/L	10	U	10	U	10	U	10	U
Carbon Disulfide	ug/L	5	U	2.3	J	5	U	5	U
Methylene Chloride	ug/L	5	U	5	U	5	U	5	U
trans-1,2-Dichloroethene	ug/L	5	U	5	U	5	U	1.1	J
1,1-Dichloroethane	ug/L	5	U	5	U	5	U	5	U
Vinyl acetate	ug/L	10	UJ	10	UJ	10	UJ	10	UJ
Methyl ethyl ketone (2-Butanone)	ug/L	10	U	10	U	10	U	10	U
cis-1,2-Dichloroethylene	ug/L	0.85	J	0.72	J	5	U	8.5	J
1,2-Dichloroethene (total)	ug/L	0.85	J	0.72	J	5	U	9.6	J
Chloroform	ug/L	5	U	5	U	5	U	5	U
1,1,1-Trichloroethane	ug/L	5	U	5	U	5	U	5	U
Carbon Tetrachloride	ug/L	5	U	5	U	5	U	5	U
1,2-Dichloroethane	ug/L	5	U	5	U	5	U	5	U
Benzene	ug/L	5	U	5	U	5	U	5	U
Trichloroethylene (TCE)	ug/L	3.8	J	0.8	J	5	U	0.44	J
1,2-Dichloropropane	ug/L	5	U	5	U	5	U	5	U
Bromodichloromethane	ug/L	5	U	5	U	5	U	5	U
2-Chloroethyl vinyl ether	ug/L	10	U	10	U	10	U	10	U
cis-1,3-Dichloropropene	ug/L	5	U	5	U	5	U	5	U
Methyl isobutyl ketone (4-Methyl-2-	ug/L	10	U	10	U	10	U	10	U
Toluene	ug/L	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	ug/L	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	ug/L	5	U	5	U	5	U	5	U
2-Hexanone	ug/L	10	U	10	U	10	U	10	U
Tetrachloroethylene (PCE)	ug/L	92.2	J	11.7	J	0.72	J	5	U
Dibromochloromethane	ug/L	5	U	5	U	5	U	5	U
Chlorobenzene	ug/L	5	U	5	U	5	U	5	U
Ethylbenzene	ug/L	5	U	5	U	5	U	5	U
m+p Xylene	ug/L	5	U	5	U	5	U	5	U
o-Xylene	ug/L	5	U	5	U	5	U	5	U
Xylenes, Total	ug/L	5	U	5	U	5	U	5	U
Styrene	ug/L	5	U	5	U	5	U	5	U
Bromoform	ug/L	5	U	5	U	5	U	5	U

Analytical Data Summary, JC 563 RFIRA, Zone E, CNC

	StationID	E569GW003	E569GW004	E569GW005	E569GW01D
	SampleID	569GW003M4	569GW004M4	569GW005M4	569GW01DM4
	DateCollected	11/18/2002	11/18/2002	11/18/2002	11/18/2002
	DateExtracted	11/22/2002	11/22/2002	11/22/2002	11/21/2002
	DateAnalyzed	11/22/2002	11/22/2002	11/22/2002	11/21/2002
	SDGNumber	70924	70924	70924	70924
Parameter	Units				
1,1,2,2-Tetrachloroethane	ug/L	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	ug/L	5 U	5 U	5 U	5 U
1,4-Dichlorobenzene	ug/L	5 U	5 U	5 U	5 U
1,2-Dichlorobenzene	ug/L	5 U	5 U	5 U	5 U
1,2,4-Trichlorobenzene	ug/L	5 U	5 U	5 U	5 U
1,2,3-Trichlorobenzene	ug/l	5 U	5 U	5 U	5 U

Analytical Data Summary, AOC 563 RFIRA, Zone E, CNC

StationID	E569GW05D	E570GW001	E570GW001	E570GW002
SampleID	569GW05DM4	570GW001M4	570HW001M4	570GW002M4
DateCollected	11/18/2002	11/18/2002	11/18/2002	11/18/2002
DateExtracted	11/21/2002	11/22/2002	11/22/2002	11/22/2002
DateAnalyzed	11/21/2002	11/22/2002	11/22/2002	11/22/2002
SDGNumber	70924	70924	70924	70924
Parameter	Units			
Chloromethane	ug/L	10 U	10 U	10 U
Vinyl chloride	ug/L	10 U	10 UJ	10 UJ
Bromomethane	ug/L	10 U	10 U	10 U
Chloroethane	ug/L	10 U	10 U	10 U
1,1-Dichloroethene	ug/L	5 U	5 U	5 U
Acetone	ug/L	10 U	10 U	10 U
Carbon Disulfide	ug/L	5 U	5 U	5 U
Methylene Chloride	ug/L	5 U	5 U	5 U
trans-1,2-Dichloroethene	ug/L	5 U	5 U	5 U
1,1-Dichloroethane	ug/L	5 U	5 U	5 U
Vinyl acetate	ug/L	10 UJ	10 UJ	10 UJ
Methyl ethyl ketone (2-Butanone)	ug/L	10 U	10 U	10 U
cis-1,2-Dichloroethylene	ug/L	5 U	5 U	5 U
1,2-Dichloroethene (total)	ug/L	5 U	5 U	5 U
Chloroform	ug/L	5 U	5 U	5 U
1,1,1-Trichloroethane	ug/L	5 U	5 U	5 U
Carbon Tetrachloride	ug/L	5 U	5 U	5 U
1,2-Dichloroethane	ug/L	5 U	5 U	5 U
Benzene	ug/L	5 U	5 U	5 U
Trichloroethylene (TCE)	ug/L	5 U	5 U	5 U
1,2-Dichloropropane	ug/L	5 U	5 U	5 U
Bromodichloromethane	ug/L	5 U	5 U	5 U
2-Chloroethyl vinyl ether	ug/L	10 U	10 U	10 U
cis-1,3-Dichloropropene	ug/L	5 U	5 U	5 U
Methyl isobutyl ketone (4-Methyl-2-	ug/L	10 U	10 U	10 U
Toluene	ug/L	5 U	5 U	5 U
trans-1,3-Dichloropropene	ug/L	5 U	5 U	5 U
1,1,2-Trichloroethane	ug/L	5 U	5 U	5 U
2-Hexanone	ug/L	10 U	10 U	10 U
Tetrachloroethylene (PCE)	ug/L	5 U	3.5 U	3.7 U
Dibromochloromethane	ug/L	5 U	5 U	5 U
Chlorobenzene	ug/L	5 U	5 U	5 U
Ethylbenzene	ug/L	5 U	5 U	5 U
m+p Xylene	ug/L	5 U	5 U	5 U
o-Xylene	ug/L	5 U	5 U	5 U
Xylenes, Total	ug/L	5 U	5 U	5 U
Styrene	ug/L	5 U	5 U	5 U
Bromoform	ug/L	5 U	5 U	5 U

Analytical Data Summary, JC 563 RFIRA, Zone E, CNC

StationID	E569GW05D	E570GW001	E570GW001	E570GW002
SampleID	569GW05DM4	570GW001M4	570HW001M4	570GW002M4
DateCollected	11/18/2002	11/18/2002	11/18/2002	11/18/2002
DateExtracted	11/21/2002	11/22/2002	11/22/2002	11/22/2002
DateAnalyzed	11/21/2002	11/22/2002	11/22/2002	11/22/2002
SDGNumber	70924	70924	70924	70924
Parameter	Units			
1,1,2,2-Tetrachloroethane	ug/L	5 U	5 U	5 U
1,3-Dichlorobenzene	ug/L	5 U	5 U	5 U
1,4-Dichlorobenzene	ug/L	5 U	5 U	5 U
1,2-Dichlorobenzene	ug/L	5 U	5 U	5 U
1,2,4-Trichlorobenzene	ug/L	5 U	5 U	5 U
1,2,3-Trichlorobenzene	ug/L	5 U	5 U	5 U

Analytical Data Summary, AOC 563 RFIRA, Zone E, CNC

StationID	E570GW003	E570GW004	E570GW02D	E570GW03D
SampleID	570GW003M4	570GW004M4	570GW02DM4	570GW03DM4
DateCollected	11/18/2002	11/18/2002	11/18/2002	11/18/2002
DateExtracted	11/21/2002	11/21/2002	11/21/2002	11/22/2002
DateAnalyzed	11/21/2002	11/21/2002	11/21/2002	11/22/2002
SDGNumber	70924	70924	70924	70924

Parameter	Units	E570GW003		E570GW004		E570GW02D		E570GW03D	
Chloromethane	ug/L	10	U	10	UJ	10	U	10	U
Vinyl chloride	ug/L	10	U	10	UJ	10	U	10	UJ
Bromomethane	ug/L	10	U	10	U	10	U	10	U
Chloroethane	ug/L	10	U	10	U	10	U	10	U
1,1-Dichloroethene	ug/L	5	U	5	U	5	U	5	U
Acetone	ug/L	10	U	10	U	10	U	10	U
Carbon Disulfide	ug/L	5	U	5	U	5	U	5	U
Methylene Chloride	ug/L	5	U	5	U	5	U	5	U
trans-1,2-Dichloroethene	ug/L	5	U	5	U	5	U	0.5	J
1,1-Dichloroethane	ug/L	5	U	5	U	5	U	5	U
Vinyl acetate	ug/L	10	UJ	10	UJ	10	UJ	10	UJ
Methyl ethyl ketone (2-Butanone)	ug/L	10	U	10	U	10	U	10	U
cis-1,2-Dichloroethylene	ug/L	5	U	5	U	5	U	5.8	J
1,2-Dichloroethene (total)	ug/L	5	U	5	U	5	U	6.3	J
Chloroform	ug/L	5	U	5	U	5	U	5	U
1,1,1-Trichloroethane	ug/L	5	U	5	U	5	U	5	U
Carbon Tetrachloride	ug/L	5	U	5	U	5	U	5	U
1,2-Dichloroethane	ug/L	5	U	5	U	5	U	5	U
Benzene	ug/L	5	U	5	U	5	U	5	U
Trichloroethylene (TCE)	ug/L	5	U	5	U	5	U	4.7	J
1,2-Dichloropropane	ug/L	5	U	5	U	5	U	5	U
Bromodichloromethane	ug/L	5	U	5	U	5	U	5	U
2-Chloroethyl vinyl ether	ug/L	10	U	10	R	10	U	10	U
cis-1,3-Dichloropropene	ug/L	5	U	5	U	5	U	5	U
Methyl isobutyl ketone (4-Methyl-2-	ug/L	10	U	10	UJ	10	U	10	U
Toluene	ug/L	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	ug/L	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	ug/L	5	U	5	U	5	U	5	U
2-Hexanone	ug/L	10	U	10	U	10	U	10	U
Tetrachloroethylene (PCE)	ug/L	0.74	J	5	U	5	U	5	U
Dibromochloromethane	ug/L	5	U	5	U	5	U	5	U
Chlorobenzene	ug/L	5	U	5	U	5	U	5	U
Ethylbenzene	ug/L	5	U	5	U	5	U	5	U
m+p Xylene	ug/L	5	U	5	U	5	U	5	U
o Xylene	ug/L	5	U	5	U	5	U	5	U
Xylenes, Total	ug/L	5	U	5	U	5	U	5	U
Styrene	ug/L	5	U	5	U	5	U	5	U
Bromoform	ug/L	5	U	5	U	5	U	5	U

Analytical Data Summary, AOC 563 RFIRA, Zone E, CNC

	StationID	E570GW003	E570GW004	E570GW02D	E570GW03D
	SampleID	570GW003M4	570GW004M4	570GW02DM4	570GW03DM4
	DateCollected	11/18/2002	11/18/2002	11/18/2002	11/18/2002
	DateExtracted	11/21/2002	11/21/2002	11/21/2002	11/22/2002
	DateAnalyzed	11/21/2002	11/21/2002	11/21/2002	11/22/2002
	SDGNumber	70924	70924	70924	70924
Parameter	Units				
1,1,2,2-Tetrachloroethane	ug/L	5 U	5 U	5 U	5 U
1,3-Dichlorobenzene	ug/L	5 U	5 U	5 U	5 U
4-Dichlorobenzene	ug/L	5 U	5 U	5 U	5 U
2-Dichlorobenzene	ug/L	5 U	5 U	5 U	5 U
2,4-Trichlorobenzene	ug/L	5 U	5 U	5 U	5 U
2,3-Trichlorobenzene	ug/L	5 U	5 U	5 U	5 U

AOC 563, Zone E, CNC

StationID	SampleID	DateCollected	Iron (ug/L)	Manganese (ug/L)
E563GW003	563GW003M4	11/18/2002	= 218	= 198
E563GW003	563HW003M4	11/18/2002	= 369	= 205
E563GW004	563GW004M4	11/22/2002	= 1070	= 95.7
E563GW005	563GW005M4	11/21/2002	= 1460	= 161
E563GW006	563GW006M4	11/21/2002	= 2990	= 76.5
E563GW007	563GW007M4	11/22/2002	= 208	= 62.4
E563GW008	563GW008M4	11/21/2002	J 13200	= 153
E563GW009	563GW009M4	11/22/2002	J 70.2	= 38.6
E563GW04D	563GW04DM4	11/22/2002	J 82.5	= 68.7
E563GW07D	563GW07DM4	11/22/2002	= 1390	= 270
E569GW001	569GW001M4	11/18/2002	UJ 33	= 260
E569GW003	569GW003M4	11/18/2002	= 103	= 198
E570GW001	570GW001M4	11/18/2002	U 31.4	= 641
E570GW001	570HW001M4	11/18/2002	U 20.5	= 641
E570GW03D	570GW03DM4	11/18/2002	= 299	= 36.7

AOC 563 . ZONE E, CNC

StationID	SampleID	DateCollected	Iron, Dissolved (ug/L)	Manganese, Dissolved (ug/L)
E563GW003	563GW003M4	11/18/2002	U 66.3	= 197
E563GW003	563HW003M4	11/18/2002	U 74.2	= 195
E563GW004	563GW004M4	11/22/2002	U 30	= 94.4
E563GW005	563GW005M4	11/21/2002	U 20.9	= 141
E563GW006	563GW006M4	11/21/2002	= 580	= 71.7
E563GW007	563GW007M4	11/22/2002	U 19	= 61.3
E563GW008	563GW008M4	11/21/2002	J 14100	= 152
E563GW009	563GW009M4	11/22/2002	U 44.6	= 40.1
E563GW04D	563GW04DM4	11/22/2002	U 3.38	J 8.98
E563GW07D	563GW07DM4	11/22/2002	= 370	= 266
E569GW001	569GW001M4	11/18/2002	J 151	= 263
E569GW003	569GW003M4	11/18/2002	U 36.8	= 190
E570GW001	570GW001M4	11/18/2002	U 8	= 666
E570GW001	570HW001M4	11/18/2002	U 4.73	= 646
E570GW03D	570GW03DM4	11/18/2002	= 212	= 30.9

CH2MHILL TRANSMITTAL

To: Jerry Stamps
South Carolina Department of Health
and Environmental Control
Bureau of Land and Waste
Management
2600 Bull Street
Columbia, SC 29201

From: Sam Naik/CH2M-Jones
(770) 604-9182 ext. 255

Date: April 22, 2003

Re: CH2M-Jones' Responses to Comments by SCDHEC regarding the *RFI Report Addendum and CMS Work Plan, AOC 563, Zone E, Revision 0*

Quantity	Description
4	CH2M-Jones' Responses to Comments by SCDHEC regarding the <i>RFI Report and CMS Work Plan, AOC 563, Zone E, Revision 0</i> – Originally Submitted on October 17, 2002

If material received is not as listed, please notify us at once.

Remarks:

Copy To:

Dann Spariosu/USEPA, w/att
Rob Harrell/Navy, w/att
Dean Williamson/CH2M-Jones, w/att
Gary Foster/CH2M-Jones, w/att

Hydrogeology Comments Prepared by Mansour Malik

1. Section 1.1 Background: The report failed to mention the existing two paint booths inside Building 177 and how the activities of their operation may have affected AOC 563. The site operation history must include all relative activities that would impact the environmental setting of the site. The text must be revised to reflect those facts.

CH2M-Jones Response:

AOC 563 is former Building 37, a locomotive maintenance house constructed in 1913 and used until 1939. According to the Final Zone E RFA Report (EnSafe, 1995), probable maintenance activities at Building 37 involved petroleum-based lubricants, chlorinated solvents and degreasers, and coal or petroleum fuels. Building 177 was built over the site of former Building 37 in 1955.

The existing paint booths inside Building 177 are not related to the historic site operations at Building 37 (AOC 563). The need for the identification of an AOC at Building 177 so that an RFI can be conducted has been evaluated by the previous CNC BCT based on operations conducted at this facility. Such assignment of an AOC had not been made during the initial RFI. The Navy/CH2M-Jones team recently recommended identification of the older paint booth on the southeastern side of Building 177 as a new AOC, and this location has been identified as AOC 723 for inclusion in the RCRA Part B permit for the CNC.

An RFA and RFI are being planned for AOC 723 during 2003, and the impact of the old paint booth operation on the southwestern side of Building 177 and related site COPCs will be evaluated and discussed in the RFI Report for AOC 723.

2. The Division of Hydrogeology believes that the shallow groundwater source of contamination has not been fully investigated and the extent of the contamination is yet to be delineated. The Navy must delineate the vertical and horizontal extent of the plume using all available information from the existing and to-be-installed monitoring wells as well as the DPTs on site.

CH2M-Jones Response:

Additional shallow and deep groundwater monitoring wells were installed during November 2002 and sampled by the Navy/CH2M-Jones team to provide additional information on the nature and extent of groundwater contamination in the vicinity of AOC 563. Analytical results from this sampling effort will be presented and discussed in the Revision 1 of the RFI Report Addendum/CMS Work Plan (RFIRA/CMSWP) for AOC 563.

3. Because only one deep monitoring well exists on site (E563GW010) at the present time, the 1,2 Dichloroethene (1,2-DCE) detection in the deep groundwater is not satisfactorily addressed. This RFI report neither identified a possible contamination source nor has it discussed the steps the Navy has taken to investigate such a potential source in the deep groundwater. The installation and monitoring of the newly added deep wells E563GW 04D and 07D will enhance delineation in the deep groundwater.

CH2M-Jones Response:

As indicated in the comment, two deep wells E563GW04D and E563GW07D were installed during November 2002. These wells were analyzed for VOCs. Analytical results from this sampling event will be presented in Rev 1 of the RFIRA/CMSWP for AOC 563.

4. The groundwater data in the report ignored the Direct Push (DPTs) results. The Geographic information system (GIS) recorded a TCE concentration of 168 :g/L at 699GP022 sample (E1a) dated 07/23/1997 and 24.1 :g/L of TCE at 037GP045. The text must be revised to include this information together with the information that might result from the newly installed wells.

CH2M-Jones Response:

The text in Revision 1 of this RFIRA/CMSWP will be updated to include a discussion of these detections.

5. Section 8.3: CMS Work Plan: The CMS suggested a Monitoring Natural Attenuation (MNA) with Land Use Controls (LUCs) as a potential remedy. The Division of Hydrogeology would like to refer the Navy to the US EPA Guidance Seminars Monitored Natural Attenuation for Groundwater EPA/625/K-98/001 and the Interim Final OWSER Directive 9200.4-17 Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. Among many steps the Navy should take are the following:

- a. All monitored natural attenuation requests must be accompanied by the site-specific characterization data and analysis.
- b. Identification of the mechanisms responsible for the attenuation.
- c. Demonstration that MNA will achieve site-specific remedial objectives within a reasonable time frame as compared to other methods.
- d. Demonstration that off-site migration of groundwater with hazardous constituents in concentrations above an established maximum contaminant level (MCL) or above a site-specific background concentrations is not occurring.
- e. Identification of any transformation products that are more toxic than the parent contaminant.
- f. Identification of any transfer of contaminants from one medium to another.

CH2M-Jones Response:

Monitored natural attenuation (MNA) has been mentioned in the RFIRA/CMSWP as a potential remedy. The CMS Report will address the final remedy chosen for the site. Should MNA be the chosen remedy, the information requested above will be provided in the CMS Report.

6. The report lacks the following items and the Navy should include them:
 - a. A potentiometric map showing all the existing monitoring wells and the groundwater geoprobe locations.

CH2M-Jones Response:

A shallow groundwater potentiometric map has been included in Appendix A of the Revision 0 RFIRA/CMSWP.

- b. A deep groundwater flow map.

CH2M-Jones Response:

A deep groundwater flow map will be included in Appendix A of the Revision 1 of this RFIRA/CMSWP.

- c. The required well logs including the groundwater geoprobes.

CH2M-Jones Response:

Well logs for the groundwater monitoring wells installed during the RFI are included in Appendix A of the Zone E RFI Report, Revision 0 (EnSafe, 1997).

- d. Geologic cross sections figures.

CH2M-Jones Response:

Geologic cross sections in this area of Zone E have been provided in Figures 2-4A and 2-4B of the Zone E RFI Report, Revision 0 (EnSafe, 1997). If a more localized geologic cross-section is found necessary for the CMS, it will be provided as part of the CMS Report for AOC 563.

- e. Chain of custody forms and data validation

CH2M-Jones Response:

Data validation reports for the November 2002 sampling will be included in Revision 1 of the RFIRA/CMSWP. Data validation reports and chain of custody forms for the initial RFI sampling efforts have been provided in Appendix I of the Zone E RFI Report, Revision 0 (EnSafe, 1997). Chain of custody forms for the November 2002 sampling will be provided in the Revision 1 of the RFIRA/CMSWP.

7. Reference to the Sampling and Analysis Plan dated October 31, 2002 Section 3.3 Groundwater Sampling and Analysis Plan stated, "and samples will be collected from these new wells in order to verify the presence of VOCs in the vicinity of the site and assess geochemical conditions". The Division of Hydrogeology wants to remind the Navy that all analyzed VOCs must be reported in the final report of findings.

CH2M-Jones Response:

This data will be included in Revision 1 of this RFIRA/CMSWP.

Conclusion:

It may be premature to conduct a CMS prior to receipt of analytical data from the new six shallow and deep wells. The Navy must incorporate data generated by the October 31, 2002 SAP into the CMS.

The CMS report should consider the present conditions of the site and evaluate all data that has been generated. The CMS report must evaluate and propose remedial measures for both shallow and deep groundwater if warranted.

It is strongly recommended that in situ remediation in areas of elevated contamination be considered.

CH2M-Jones Response:

Comment noted. Data generated from the November 2002 sampling event will be included in Revision 1 of the RFIRA/CMSWP.