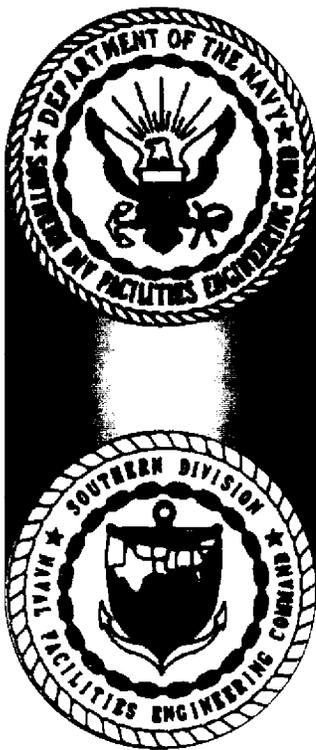


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CNC CHARLESTON
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RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT
ADDENDUM AND CORRECTIVE MEASURES STUDY WORK PLAN AREAS OF CONCERN
569 (AOC 569), 570 (AOC 570) AND 578 (AOC 578) ZONE E CNC CHARLESTON SC
10/1/2003
CH2M HILL

RFI REPORT ADDENDUM AND CMS WORK PLAN

AOCs 569, 570, and 578, Zone E



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

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

CH2M Jones

October 2003

*Revision 1
Contract N62467-99-C-0960*

CH2MHILL TRANSMITTAL

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

From: Dean Williamson/CH2M-Jones

Date: Oct. 2, 2003

Re: Replacement pages for *RFI Report Addendum and CMS Work Plan, AOCs 569, 570, and 578, Zone E, Revision 0* – Originally Submitted on December 30, 2002

We Are Sending You:

X Attached	Under separate cover via	
Shop Drawings	Documents	Tracings
Prints	Specifications	Catalogs
Copy of letter	Other:	

Quantity	Description
2	Replacement pages for <i>RFI Report Addendum and CMS Work Plan, AOCs 569, 570, and 578, Zone E, Revision 0</i> – Originally Submitted on December 30, 2002

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

Copy To:

Dann Spariosu/USEPA, w/att
Rob Harrel/Navy, w/att
Gary Foster/CH2M HILL, w/att

**THE ATTACHED PAGES SHOULD BE INSERTED AS REPLACEMENTS IN THE
RFI REPORT ADDENDUM AND CMS WORK PLAN, AOCs 569, 570, AND 578, ZONE E,
REVISION 0 SUBMITTAL:**

- **REVISED TABLE OF CONTENTS AND ACRONYM LIST**
 - **REVISED PG. 1-3**
 - **REVISED PG. 2-4**
 - **REVISED SECTION 3**
 - **REVISED SECTION 4 (TEXT ONLY)**
 - **PGS. 5-4 THROUGH 5-14**
 - **REVISED TABLE 5-1**
 - **REVISED PGS. 6-1 AND 6-3**
 - **REVISED SECTION 7**
 - **REVISED PGS. 8-1 AND 8-2**
 - **REVISED SECTION 9**
 - **ANALYTICAL DATA SUMMARY (MARCH 2003 SAMPLING) FOR INCLUSION IN
APPENDIX D**
 - **DATA VALIDATION SUMMARY NARRATIVE WITH ATTACHMENT 1, FOR INCLUSION
IN APPENDIX E**
-



CH2MHILL

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December 30, 2002

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

Re: RFI Report Addendum and CMS Work Plan (Revision 0) – AOCs 569, 570, and 578,
Zone E

Dear Mr. Scaturo:

Enclosed are two copies of the RFI Report Addendum and CMS Work Plan (Revision 0) for AOCs 569, 570, and 578 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, should you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

cc: Tim Frederick/Gannett-Fleming, Inc., w/att
Rob Harrell/Navy, w/att
Gary Foster/CH2M HILL, w/att

RFI REPORT ADDENDUM AND CMS WORK PLAN

AOCs 569, 570, and 578, Zone E



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

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

PREPARED BY
CH2M-Jones

October 2003

*Revision 1
Contract N62467-99-C-0960
158814 ZE.PR.09*

Certification Page for RFI Report Addendum and CMS Work Plan (Revision 1) — AOCs 569, 570, and 578, Zone E

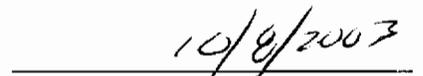
I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina

P.E. No. 21428



Dean Williamson, P.E.



Date

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1 Acronyms and Abbreviations

2	AOC	area of concern
3	AST	aboveground storage tank
4	BCT	BRAC Cleanup Team
5	bls	below land surface
6	BRAC	Base Realignment and Closure Act
7	BRC	background reference concentration
8	BTEX	benzene, toluene, ethylbenzene, and xylene
9	CA	corrective action
10	CMS	corrective measures study
11	CNC	Charleston Naval Complex
12	COC	chemical of concern
13	COPC	chemical of potential concern
14	CPAH	carcinogenic polyaromatic hydrocarbons
15	CRD	Commercial Redevelopment District
16	DAF	dilution attenuation factor
17	EEG	Environmental Enterprise Group
18	EnSafe	EnSafe Inc.
19	EPA	U.S. Environmental Protection Agency
20	FRE	fixed-point risk evaluation
21	HHRA	human health risk assessment
22	HI	hazard index
23	ILCR	incremental lifetime cancer risk
24	IM	interim measure

1 Acronyms and Abbreviations, Continued

2	LUC	land use control
3	µg/L	micrograms per liter
4	µg/kg	micrograms per kilogram
5	mg/kg	milligram per kilogram
6	MCL	maximum contaminant level
7	MCS	media cleanup standards
8	NAVBASE	Naval Base
9	NFA	no further action
10	NFI	no further investigation
11	OWS	oil/water separator
12	PAH	polycyclic aromatic hydrocarbon
13	PCB	polychlorinated biphenyl
14	PCE	tetrachloroethene
15	RAO	remedial action objectives
16	RBC	risk-based concentration
17	RCRA	Resource Conservation and Recovery Act
18	RDA	Redevelopment Agency
19	RFA	RCRA Facility Assessment
20	RFI	RCRA Facility Investigation
21	RGO	remedial goal options
22	RI	remedial investigation
23	SAP	sampling and analysis plan
24	SCDHEC	South Carolina Department of Health and Environmental Control

1 **Acronyms and Abbreviations, Continued**

2	SSL	soil screening level
3	SVOC	semivolatile organic compound
4	SWMU	solid waste management unit
5	TCE	trichloroethene
6	TDS	total dissolved solids
7	TTAL	Treatment Technique Action Level
8	UST	underground storage tank
9	VOC	volatile organic compound
10	UCL ₉₅	95-percent Upper Confidence Limit

1.0 Introduction

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

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

In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation and remediation services at the CNC. This submittal has been prepared by CH2M-Jones to complete the RCRA Facility Investigation (RFI) for Areas of Concern (AOCs) 569, 570 and 578 in Zone E of the CNC. The location of AOCs 569, 570, and 578 in Zone E is shown in Figure 1-1. Figure 1-2 shows an aerial photograph of the site.

1.1 Background

AOC 569 – Former Gas Station and Oil Storage; AOC 570 – Former Coal Storage Area; and AOC 578 – Transportation Shop and Garage

AOC 569 is a former gas station and oil storehouse previously housed in Building 1279 in Zone E of the CNC. The gas station was constructed in 1944 and consisted of two pumps and two 2,500-gallon underground storage tanks (USTs). In 1986, an additional 3,000-gallon UST was installed. During 1992, the site was demolished and the three USTs were removed by the Navy. During the tank closure activities, the tanks were pumped out and removed and the vent lines were filled. Contaminated soil was excavated and confirmatory soil samples were collected from the tank excavation area. The site was then backfilled with soil and resurfaced with asphalt. These activities are documented in *Investigation of Underground Contamination, Charleston Naval Shipyard – Building 1279* (LandRec, 1992), which is included in Appendix F of this report.

The materials of concern for AOC 569 are identified in the RCRA Facility Assessment (RFA) (EnSafe/Allen & Hoshall, 1995) and include petroleum hydrocarbons; benzene, toluene, ethylbenzene, and xylene (BTEXs); polycyclic aromatic hydrocarbons (PAHs); volatile

1 organic compounds (VOCs); and heavy metals. The preliminary zoning for the AOC 569
2 area is Commercial Redevelopment District (CRD). The CNC RCRA Permit identified AOC
3 569 as requiring an RFI.

4 AOC 570 is a former coal storage area in Zone E of the CNC. The coal storage facility
5 extended from Building 30 to Sixth Avenue and from Carolina Avenue to Hobson Avenue.
6 The coal storage area operated from 1919 to 1941. The RFA identified the materials of
7 concern at the AOC 570 to be metals. The preliminary zoning for the AOC 570 area is CRD.
8 The CNC RCRA Permit identified AOC 570 as requiring an RFI.

9 AOC 578 is a former transportation shop and garage in Building 25 in Zone E of the CNC.
10 The structure was built in 1940 and was originally used as an automobile garage and then
11 later as a transportation and appliance maintenance shop. Building 25 recently included
12 various facilities, such as an air-conditioning repair shop, a sheet metal shop, two electric
13 shops, a paint shop, a sign shop, a carpenter's shop, a paper shredding area, an electrical
14 maintenance shop, a tool room, and an emergency supply storage area. Currently Building
15 25 is used for equipment storage and as a transportation shop by the Environmental
16 Enterprise Group (EEG).

17 Materials of concern identified in the RCRA Facility Assessment Report (EnSafe/Allen &
18 Hoshall, 1995) at AOC 578 include petroleum hydrocarbons, BTEXs, PAHs, VOCs, acids,
19 and heavy metals. The preliminary zoning for the AOC 578 area is CRD. The CNC RCRA
20 Permit identified AOC 578 as requiring an RFI.

21 Buildings 25 and 30 are scheduled to be demolished as part of a modification and
22 realignment of Hobson Avenue with Avenue D. The modified road will overlay the AOCs
23 569, 570 and 578 area.

24 A review of historical engineering drawings for this site shows that railroad lines were
25 previously located in the immediate vicinity of AOCs 569, 570, and 578 (see Figure C-1).
26 According to historical maps, the railroad lines were either paved over or removed
27 sometime between 1939 and 1955. Railroad lines are currently present adjacent to Building
28 25, as shown in Figure 1-1.

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

1 As part of its redevelopment activities, the CNC Redevelopment Agency (RDA) is planning
2 to modify the pathway of Hobson Avenue in the vicinity of Combined AOC 569. The
3 proposed alignment of this road and the potential impacts on corrective measures were
4 considered during preparation of this report.

5 **1.2 Purpose of the RFI Report Addendum**

6 The purpose of this RFI Report Addendum is to document the results of previous RFI
7 investigations conducted by the Navy/EnSafe team at AOCs 569, 570, and 578. This RFI
8 Report Addendum includes a summary of previous RFI investigations and conclusions, as
9 well as additional investigations conducted by CH2M-Jones during 2002, at AOCs 569, 570,
10 and 578. This RFI Report Addendum also discusses various closeout issues and the findings
11 of previous investigations, existing site conditions, and surrounding area land use.

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

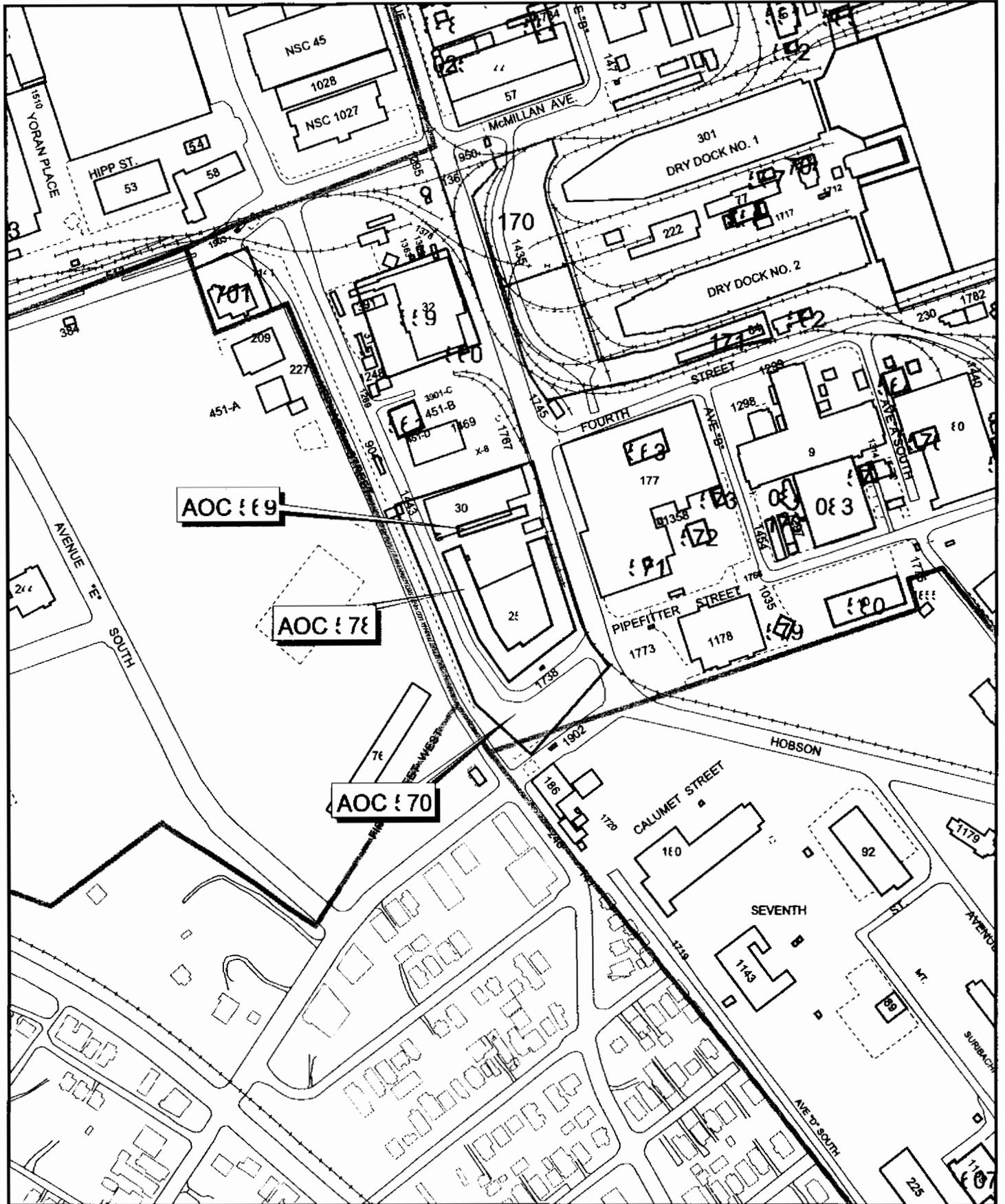
- 14 • Status of the RFI
- 15 • Presence of metals (inorganics) in groundwater
- 16 • Potential linkage to Solid Waste Management Unit (SWMU) 37, Investigated Sanitary
17 Sewers at the CNC
- 18 • Potential linkage to AOC 699, Investigated Storm Sewers at the CNC
- 19 • Potential linkage of AOC 504, Investigated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

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

25 **1.3 Report Organization**

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

- 1 **3.0 Interim Measures and UST/AST Removals** – Provides information regarding any
2 interim measures (IMs) or tank removal activities performed at the site.
- 3 **4.0 Summary of Additional Investigations** – Summarizes information, if any, collected
4 after completion of the *Zone E RFI Report, Revision 0* (EnSafe, 1997).
- 5 **5.0 COPC/COC Refinement** – Provides further evaluation of chemicals of potential concern
6 (COPCs) based on RFI and additional data to assess them as chemicals of concern
7 (COCs).
- 8 **6.0 Summary of Information Related to Site Closeout Issues** – Discusses the various site
9 closeout issues that the BRAC Cleanup Team (BCT) agreed to evaluate prior to site
10 closeout.
- 11 **7.0 Recommendations** – Provides recommendations for proceeding with site closure.
- 12 **8.0 CMS Work Plan** – Presents a focused Corrective Measures Study (CMS) Work Plan.
- 13 **9.0 References** – Lists the references used in this document.
- 14 **Appendix A** – Contains excerpts from the *Zone E RFI Report, Revision 0*, including summary
15 of detections of chemicals, field data sheets for groundwater sampling, and Figure A1
16 showing a groundwater flow map for the site vicinity.
- 17 **Appendix B** – Contains responses to SCDHEC comments for AOCs 569, 570, and 578 from
18 the *Zone E RFI Report, Revision 0* (EnSafe, 1997).
- 19 **Appendix C** – Contains Figure C1 showing the site location from the Public Works Map of
20 the Charleston Navy Shipyard dated December 15, 1939, depicting the presence of railroad
21 lines at the site.
- 22 **Appendix D** – Contains analytical results summary for additional soil and groundwater
23 samples.
- 24 **Appendix E** – Contains data validation summaries.
- 25 **Appendix F** – Contains a copy of the UST removal report *Investigation of Underground*
26 *Contamination, Charleston Naval Shipyard – Building 1279* (LandRec, 1992).
- 27 **Appendix G** – Contains UCL₉₅ calculation tables.
- 28 **Appendix H** – Contains the site-specific soil screening level (SSL) calculation spreadsheet.
- 29 All figures and tables appear at the end of their respective sections.



AOC 79

AOC 78

AOC 70

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

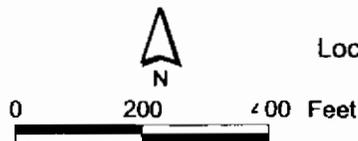
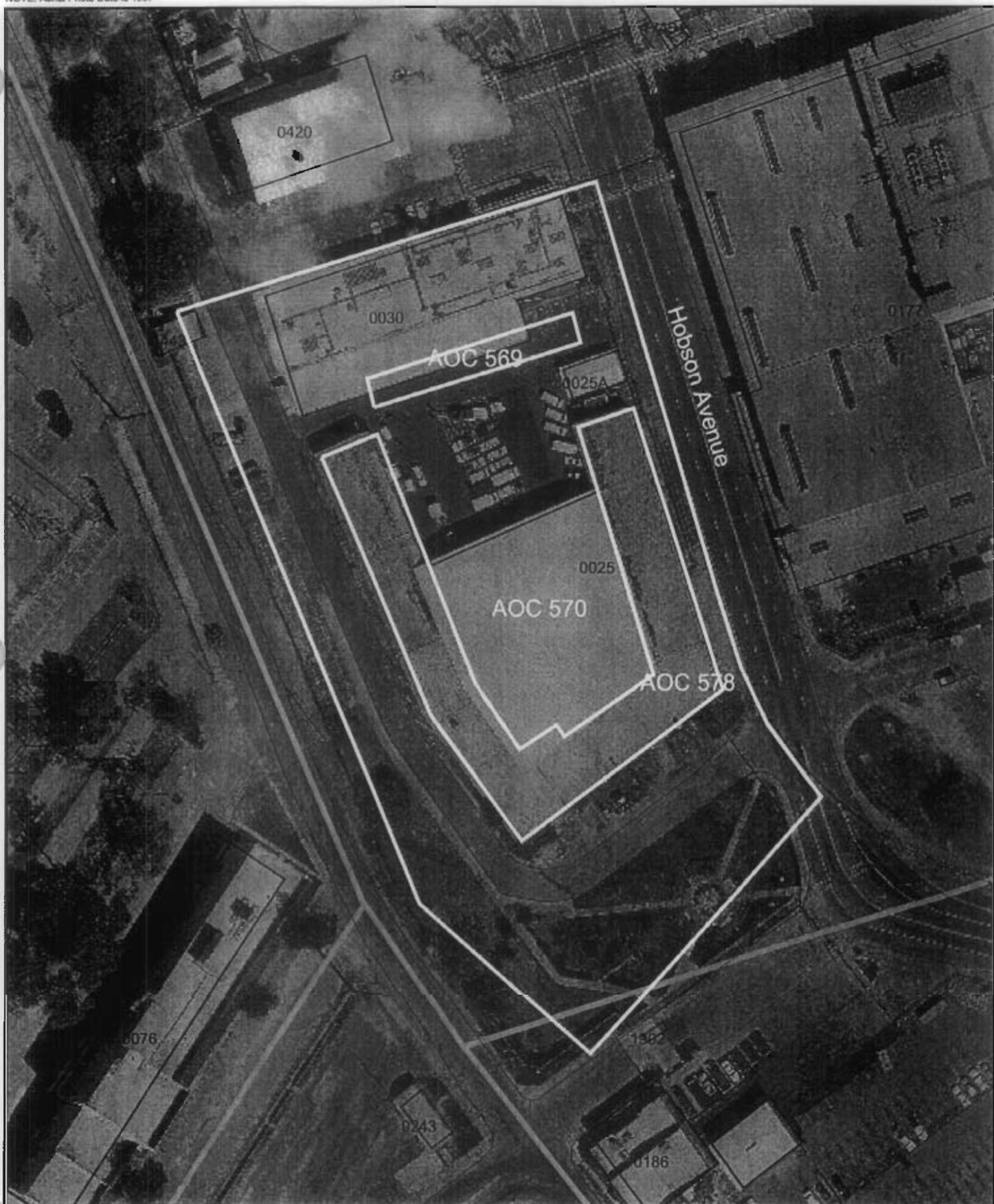


Figure 1-1
Location of AOCs 79, 70, and 78 in Zone E
Charleston Naval Complex

NOTE: Aerial Photo Date is 1997



-  AOCs 569 570 578 Locations
-  Railroads
-  Fence
-  Roads
-  Buildings
-  Zone Boundary

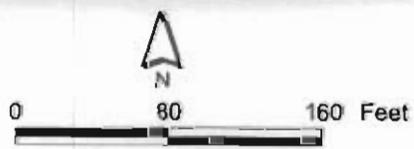


Figure 1-2
Aerial Photograph
AOCs 569, 570, and 578, Zone E
Charleston Naval Complex

2.0 Summary of RFI Conclusions for AOCs 569, 570, and 578

This section summarizes the results and conclusions from the soil and groundwater investigations conducted at AOCs 569, 570, and 578, which were reported in the *Zone E RFI Report, Revision 0* (EnSafe, 1997).

As part of the Zone E RFI, soil and groundwater investigations were conducted at AOCs 569, 570, and 578 from 1996 to 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 COCs at this site is provided in Section 5.0. Figure 2-1 shows RFI soil and groundwater sampling locations. A summary of chemicals detected in site samples is included in Appendix A.

2.1 Soil Sampling and Analysis

The RFI at AOCs 569, 570, and 578 included the collection and analysis of 27 surface and subsurface soil samples collected during two sampling events. Samples from the first sampling event were analyzed for VOCs, semivolatile organic compounds (SVOCs), metals, and pH. Three samples were selected as duplicates and were analyzed for VOCs and SVOCs, as well as herbicides, organophosphorus pesticides, hexavalent chromium, and dioxins. Samples from the second sampling event were analyzed for SVOCs and metals. One duplicate sample was collected during the second sampling event and analyzed for VOCs and SVOCs, as well as herbicides, organophosphorus pesticides, hexavalent chromium, dioxins, and metals.

RFI activities at this site are described in the *Zone E RFI Report, Revision 0* (EnSafe, 1997). Figure 2-1 shows the locations of the RFI soil borings.

2.1.1 Surface Soil

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

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

- 3 • **VOCs:** No VOCs exceeded the screening criteria in surface soils.
- 4 • **SVOCs:** The RFI reported that among detected SVOC compounds, BEQ concentrations at
5 seven locations exceeded the industrial RBC of 780 µg/kg for benzo(a)pyrene. These
6 sampling locations (with associated BEQ concentrations) are: 569SB005 (1,169 µg/kg),
7 570SB002 (1,891 µg/kg), 570SB004 (1,367 µg/kg), 570SB005 (1,011 µg/kg), 578SB005
8 (1,619 µg/kg), 578SB006 (809 µg/kg), and 570SB012 (3,782 µg/kg). BEQ calculations
9 were performed using the method adopted by the BCT at the time the *Zone E RFI Report,*
10 *Revision 0* (EnSafe, 1997) was written.
- 11 • **Inorganics:** One arsenic detection, E570SB012 (70.9 mg/kg), exceeded both its industrial
12 RBC and the arsenic BRC for surface soils.

13 Figure 2-1 shows RFI soil sample locations.

14 2.1.2 Subsurface Soil

15 During the RFI, subsurface soil detections of organic compounds were compared with
16 generic soil screening levels (SSLs) using a dilution attenuation factor (DAF)=10. Subsurface
17 soil detections of inorganic compounds were compared with generic SSLs (using a DAF=10)
18 and the Zone E BRCs.

19 Detected concentrations of organic and inorganic compounds from subsurface soil samples
20 are as follows:

- 21 • **VOCs:** The RFI reported that acetone, benzene, carbon tetrachloride, ethylbenzene, and
22 xylene exceeded their respective SSLs at a single sample location (569SB005).
- 23 • **SVOCs:** Detected SVOC concentrations did not exceed the screening criteria.
- 24 • **Inorganics:** No inorganic detections exceeded the screening criteria in subsurface soils.

25 2.2 Groundwater

26 The RFI investigation for AOCs 569, 570, and 578 included nine monitoring wells (six
27 shallow and three deep) as shown in Figure 2-1. Groundwater was sampled during six
28 sampling events from 1996 to 1998. During the first, second, and fourth sampling events,
29 groundwater samples were analyzed for VOCs, SVOCs, pesticides/ polychlorinated
30 biphenyls (PCBs), metals, cyanide, chlorides, sulfates, and total dissolved solids (TDS).
31 During the second sampling event, all of the above parameters, except cyanide and
32 pesticides/PCBs, were analyzed. pH was analyzed during the first sampling event. During
33 the fifth sampling event, only VOCs, sulfates, and chlorides were analyzed. During the

1 sixth sampling event, only VOCs and sulfates were analyzed. Two duplicates (one from a
2 shallow monitoring well and one from a deep monitoring well) were collected and
3 analyzed for VOCs, SVOCs, herbicides, hexavalent chromium, organophosphorus
4 pesticides, and dioxins. Detections in groundwater samples were compared with the EPA
5 Region III tap water RBCs, MCLs, and the Zone E BRCs for shallow aquifers.

6 **2.2.1 Shallow Groundwater**

7 Analyte concentrations in shallow groundwater samples were detected as follows at this
8 site:

9 **VOCs:** Among detected analytes, chloroform, tetrachloroethene (PCE) and trichloroethene
10 (TCE) exceeded screening criteria.

- 11 • Chloroform, at a concentration of 2 µg/L at E570GW003, exceeded its tap water RBC of
12 0.15 µg/L. The detection did not exceed the chloroform MCL of 80 µg/L.
- 13 • PCE, at a concentration of 9 µg/L at E569GW002, exceeded its tap water RBC of 1.1
14 µg/L. The detection also exceeded the PCE MCL of 5 µg/L.
- 15 • TCE, at a concentration of 4 µg/L at E569GW002, exceeded its tap water RBC of 1.6
16 µg/L. The detection did not exceed the TCE MCL of 5 µg/L.

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

18 **Inorganics:** The *Zone E RFI Report, Revision 0* reported results for the first sampling event
19 only. Among detected inorganic analytes, seven metals – aluminum, arsenic, beryllium,
20 chromium, iron, lead, and vanadium – exceeded both their respective tap water RBCs and
21 shallow groundwater BRCs.

22 **2.2.2 Deep Groundwater**

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

24 **VOCs:** The RFI reported that among detected analytes, 1,2-dichloroethene (total) and TCE,
25 exceeded the screening criteria.

- 26 • 1,2-dichloroethene (total), at a concentration of 6 µg/L at E570GW03D, exceeded its tap
27 water RBC of 5.5 µg/L. The detection did not exceed the cis-1,2-dichloroethene MCL of
28 70 µg/L.
- 29 • TCE, at a concentration of 11 µg/L at E570GW03D, exceeded its tap water RBC. The
30 detection also exceeded the TCE MCL of 5 µg/L.

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

- 2 • **Inorganics:** Among detected inorganic analytes, thallium, at a concentration of 5.5 µg/L
3 at E569GW01D, exceeded both its tap water RBC of 0.29 µg/L and MCL of 2 µg/L. No
4 deep groundwater BRC was developed for thallium in Zone E during the RFI.

5 **2.3 RFI Human Health Risk Assessment**

6 The *Zone E RFI Report Revision 0* used a fixed-point risk evaluation (FRE) approach at this
7 site. The FRE included site resident and site worker exposure scenarios. The detailed risk
8 assessment for the AOCs 569, 570, and 578 site is presented in Section 10.34.6. of the *Zone E*
9 *RFI Report, Revision 0 (EnSafe, 1997)*.

10 **2.3.1 Soils**

11 Arsenic and BEQs were retained as COCs for surface soil for both the residential and
12 industrial land use scenarios. No COCs were identified for subsurface soils at AOCs 569,
13 570, and 578.

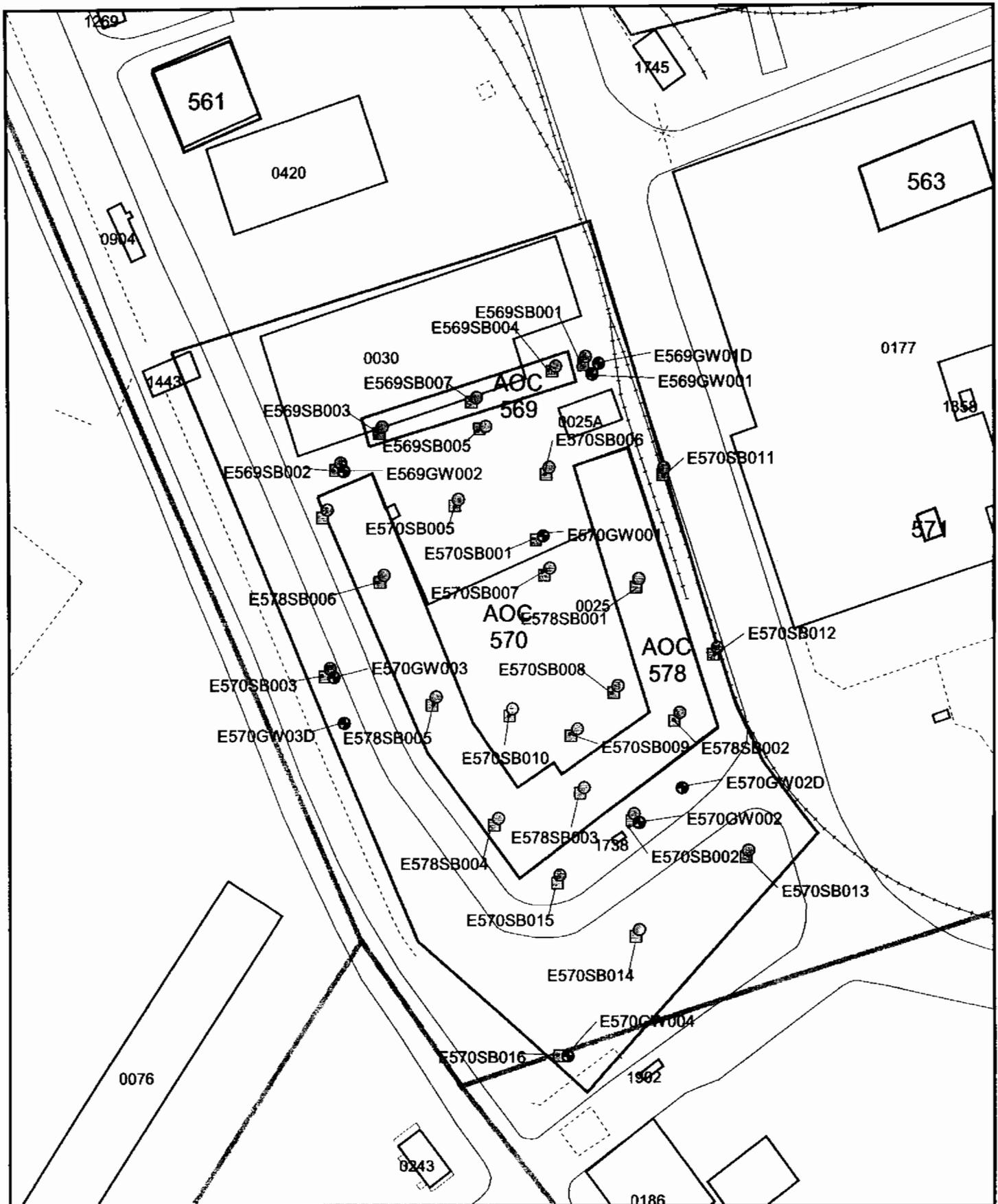
14 **2.3.2 Groundwater**

15 Aluminum, arsenic, beryllium, chromium, lead, thallium, vanadium, chloroform, PCE, and
16 TCE were retained as shallow groundwater COCs.

17 Thallium, 1,2-dichloroethene, and TCE were retained as deep groundwater COCs.

18 **2.4 RFI Conclusions and Recommendations**

19 The *Zone E RFI Report, Revision 0* recommended that a CMS be conducted at AOCs 569, 570,
20 and 578 for surface soil and shallow and deep groundwater to address the analytes
21 identified as COCs in the previous sections.



- Groundwater Monitoring Well
- Surface Soil
- ▣ Subsurface Soil
- ∧ Railroads
- ∨ Fence
- ∟ Roads
- AOC Boundary
- ▭ SWMU Boundary
- ▭ Buildings
- ▭ Zone Boundary

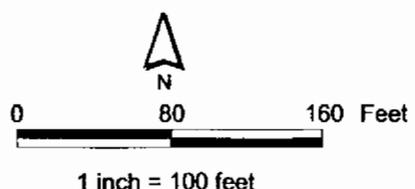


Figure 2-1
RFI Sampling Locations
AOCs 569, 570, and 578, Zone E
Charleston Naval Complex

3.0 Summary of Interim Measures and UST/AST Removals at AOCs 569, 570 and 578

3.1 UST/AST Removals

During 1992, three USTs at AOC 569 were removed by the Navy. During the tank closure activities, the tanks were pumped out and removed and the vent lines were filled. Contaminated soil was excavated and confirmatory soil samples were collected from the tank excavation area. The site was then backfilled with clean soil and resurfaced with asphalt. These activities are documented in a report titled *Investigation of Underground Contamination, Charleston Naval Shipyard – Building 1279* (LandRec, 1992). A copy of this report is included in Appendix F of this report.

3.2 Interim Measures

No RCRA Corrective Action Interim Measures (IMs) have been implemented at AOC 569. An IM involving soil excavation and offsite disposal was considered to address the presence of VOCs at concentrations that exceeded their respective SSLs in subsurface soil at boring E569SB005. Confirmatory sampling was conducted in the vicinity of this boring to confirm the presence and extent of the SSL exceedances. An Interim Measure Work Plan (IMWP) was prepared and submitted to the EPA by CH2M-Jones during February 2003, to outline the approach to sampling and removing soils contaminated with VOCs (primarily BTEX) around E569SB005. After approval of the IMWP, the sampling and analysis were completed. Based on this additional sampling and analysis, it was determined that an IM to address these SSL exceedances was not necessary.

The additional delineation sampling of soil and groundwater was conducted by the Navy/CH2M-Jones team during April 2002 is described in Section 4.0.

Based on the analytical results of the soil sampling conducted during April 2002, benzene, BEQs, and ethylbenzene were identified as surface soil COPCs and benzene, toluene, ethylbenzene and total xylenes were identified as subsurface soil COPCs. The nature and occurrence of these chemicals are further discussed in Section 5.0.

The conclusion that an IM was not warranted for these VOCs in soil was based on comparison of the concentrations to site-specific SSLs. Site-specific SSLs were calculated for

1 benzene, ethylbenzene, toluene and total xylenes for both the paved and unpaved scenarios
2 and presented in the AOC 569 IMWP (CH2M-Jones, 2003). Table H-1 included in Appendix
3 H shows the parameters used in the calculation of these site-specific SSLs. During March
4 2003 pre-excavation delineation soil samples were collected around E569SB005 at locations
5 proposed in the IMWP. These sampling locations and the proposed excavation location are
6 shown in Figure 3-1. Soil samples were collected from three depth intervals (0-1 ft, 1-3 ft
7 and 3-5 ft below land surface (bls)). The validated analytical results report and data
8 validation summaries for the March 2003 sampling effort are included in Appendices D
9 and E, respectively.

10 Table 3-1 shows analytical results from the pre-excavation delineation sampling of March
11 2003. The detections of benzene, ethylbenzene, toluene and total xylenes from this
12 sampling were compared with site-specific SSLs for the paved and unpaved scenarios. As
13 presented in Table 3-1, only benzene detections exceeded the site-specific SSLs. One
14 benzene detection of 0.437 mg/kg in the surface soil sample from soil boring location
15 E569SB008 exceeded the site-specific SSL (unpaved scenario) of 0.078 mg/kg. Two benzene
16 detections in subsurface soil samples (from the 3-5 ft below land surface (bls) depth
17 interval) of 1.95 mg/kg and 0.805 mg/kg from E569SB008 and E569SB010, respectively,
18 exceeded the site-specific SSLs of 0.078 mg/kg (for the unpaved scenario) and 1.04 mg/kg
19 (for the paved scenario).

20 The sample locations showing the benzene exceedances of the SSLs are currently paved and
21 expected to remain paved. Also, these locations are not expected to be impacted during the
22 proposed realignment of Hobson Avenue. Additionally, as indicated in the response to
23 EPA's comments on the RFI Report Addendum and CMS Work Plan for AOCs 569, 570 and
24 578 (CH2M-Jones, 2002), the proposed construction activities related to the realignment of
25 Hobson Avenue would not impact this area. Figure I-1, which shows the proposed
26 realignment footprint in relation to soil boring locations at AOCs 569, 570 and 578, is
27 included in Appendix I, along with a brief discussion about soil boring locations that would
28 be potentially impacted by this realignment. This area is expected to undergo LUCs. There
29 is no direct exposure concern from these soils as long as LUCs are maintained to ensure that
30 the soils are covered with pavement/buildings. Based on these observations, the
31 Navy/CH2M-Jones team recommended that no soil excavation be conducted at this site.
32 Additional discussion on the occurrence of benzene, ethylbenzene, toluene, and total
33 xylenes, along with the screening of COPCs at E569SB005, are included in Sections 4.0 and
34 5.0.

1 **4.0 Summary of Additional Investigations**

2 This section summarizes the results and conclusions from additional soil and groundwater
3 investigations conducted at AOCs 569, 570, and 578 by CH2M-Jones during March and
4 April 2002, to further delineate the nature and extent of antimony, benzene, chromium,
5 ethylbenzene, lead, toluene, thallium and xylenes in soils, along with PCE and TCE in
6 groundwater. These investigations were prompted by a comparison of detected
7 concentrations from the initial RFI soil sampling data provided in the *Zone E RFI Report*,
8 *Revision 0* (EnSafe, 1997), with screening criteria for unrestricted land use.

9 A sampling and analysis plan (SAP) for AOCs 569, 570, and 578 was prepared by CH2M-
10 Jones and submitted to SCDHEC during February 2002. The soil sampling was conducted
11 during April 2002. Groundwater sampling was conducted during March and April 2002.
12 Analytical results and data validation summaries from these sampling events are included
13 in Appendices D and E, respectively.

14 **4.1 Soil Sampling and Analysis**

15 Three RFI soil boring locations E569SB004 (which showed elevated thallium concentrations
16 in subsurface soil), E569SB005 (which showed elevated BTEX and carbon tetrachloride
17 concentrations in subsurface soil), and E578SB001 (which showed elevated antimony,
18 chromium, and lead) were resampled during April 2002 to verify these elevated
19 concentrations, and the new borings were respectively identified as E569SB004b,
20 E569SB005b, and E578SB001b. At these resampling locations, surface and subsurface
21 samples were collected from the 0 to 1 ft bls and 3 to 5 ft bls depth intervals. Figure 4-1
22 shows locations where soil sampling was conducted. Table 4-1 shows a summary of
23 detected concentrations from this sampling event.

24 **4.1.1 Surface Soil**

25 Surface soil detections of organic compounds were evaluated against the EPA Region III
26 residential RBCs (with an HI=0.1 for noncarcinogens). VOC detections were screened
27 against SSLs with DAF = 1, as agreed to by the BCT team. Surface soil detections of
28 inorganic compounds were evaluated against the EPA Region III residential RBCs (HI=0.1
29 for noncarcinogens) and the range of Zone E background grid samples.

1 Figure 4-1 shows the detected concentrations of chemicals in soil at the site. Detected
2 concentrations of organic and inorganic analytes exceeding their respective screening
3 criteria were as follows:

- 4 • **VOCs:** Benzene at E569SB005b exceeded its SSL of 0.002 milligrams per kilogram
5 (mg/kg) at a concentration of 0.68 mg/kg.
- 6 • Ethylbenzene at E569SB005b exceeded its SSL of 0.700 mg/kg at a concentration of 1.53
7 mg/kg.
- 8 • **Inorganics:** Antimony, chromium and lead were detected in soil samples from
9 E578SB001b and thallium was detected in the sample from E578SB004b. None of the
10 detections exceeded screening criteria for surface soils.

11 **4.1.2 Subsurface Soil**

12 Subsurface soil detections were compared with generic SSLs (using a DAF=10). VOC
13 detections were screened against SSLs with DAF = 1, as agreed to by the BCT team.

14 Subsurface soil detections of inorganic compounds were also compared with the range of
15 concentrations in Zone E grid samples.

16 Detected concentrations of organic and inorganic compounds from subsurface soil samples
17 exceeding their respective criteria are as follows:

18 **VOCs:**

- 19 • Benzene at E569SB005b exceeded its SSL of 0.002 mg/kg at a concentration of 0.428
20 mg/kg.
- 21 • Ethylbenzene at E569SB005b exceeded its SSL of 0.700 mg/kg at a concentration of 19.3
22 mg/kg.
- 23 • Toluene at E569SB005b exceeded its SSL of 0.006 mg/kg at a concentration of 3.17
24 mg/kg.
- 25 • Xylenes (Total) at E569SB005b exceeded its SSL of 9 mg/kg at a concentration of 44.2
26 mg/kg.

27 **Inorganics:**

- 28 • Lead at a concentration of 406 mg/kg at E578SB001b exceeded its SSL of 400 mg/kg.

29 No other inorganics exceeded the screening criteria in subsurface soils.

1 **4.1.3 Groundwater**

2 Three shallow wells, E569GW003, E569GW004, and E569GW005, and one deep well,
3 E569GW05D, were installed and sampled for VOCs during March 2002. The three existing
4 wells, E569GW001, E569GW002, and E570GW03D had not been sampled since 1997. For
5 that reason, the wells were sampled for VOCs during April 2002. Detections in
6 groundwater samples were compared with the MCLs. Figures 4-2 and 4-3 show the VOC
7 detections in groundwater at AOCs 569, 570, and 578. Table 4-2 shows detected
8 concentrations of VOCs from this sampling event.

9 VOCs detected in the groundwater samples were 1,2-dichloroethene (1,2-DCE), TCE and
10 PCE. Detected concentrations of VOCs exceeding their respective criteria during this
11 sampling event are as follows:

12 **VOCs:**

- 13 • PCE at E569GW001, E570GW001, E569GW003 and E569GW004 exceeded its MCL of 5
14 $\mu\text{g}/\text{L}$ at concentrations of 18.9 $\mu\text{g}/\text{L}$, 46.5 $\mu\text{g}/\text{L}$, 20.6 $\mu\text{g}/\text{L}$ and 5.9 $\mu\text{g}/\text{L}$ respectively.
- 15 • TCE at E570GW03D exceeded its MCL of 5 $\mu\text{g}/\text{L}$ at a concentration of 8 $\mu\text{g}/\text{L}$.

16 **4.2 Summary**

17 Based on the additional sampling, the following COPCs have been identified: benzene and
18 ethylbenzene in surface soil; lead, benzene, ethylbenzene, toluene and xylenes in subsurface
19 soil; PCE in shallow groundwater; and TCE in deep groundwater.

TABLE 4-1

Detected Concentrations of Antimony, Chromium, Lead, Benzene, Ethylbenzene, Toluene, and Total Xylenes in Surface and Subsurface Soil, April 2002

RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Region III Residential		Zone E Background Range of Conc.
					RBC	SSL ^a	
Antimony	Surface Soil				3.1	2.5	0.50 – 7.4
	E578SB001b	578SB00101b	1.07	J			
	Subsurface Soil				3.1	2.5	0.52 – 1.6
	E578SB001b	578SB00102b	1.24	J			
Chromium	Surface Soil				23	19	2.3 – 567
	E578SB001b	578SB00101b	31.8	=			
	Subsurface Soil				23	19	1.6 – 75
E578SB001b	578SB00102b	26.6	=				
Lead	Surface Soil				400	400	1.0 – 400
	E578SB001b	578SB00101b	301	J			
	Subsurface Soil				400	400	1.8 – 322
E578SB001b	578SB00102b	406	J				
Benzene	Surface Soil				12	DAF = 1 0.002	NA
	E569SB005b	569SB00501b	0.68	=			
	Subsurface Soil						NA
E569SB005b	569SB00502b	0.428	J				
Ethylbenzene	Surface Soil				780	DAF = 1 0.7	NA
	E569SB005b	569SB00501b	1.53	=			
	Subsurface Soil						NA
E569SB005b	569SB00502b	19.3	=				
Toluene	Surface Soil				1,600	DAF = 1 0.6	NA
	E569SB005b	569SB00501b	0.093	J			
	Subsurface Soil						NA
E569SB005b	569SB00502b	3.17	=				
Xylenes (Total)	Surface Soil				16,000	DAF = 1 9	NA
	E569SB005b	569SB00501b	0.207	J			
	Subsurface Soil						NA
E569SB005b	569SB00502b	44.2	=				

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

a SSLs with DAF=10 unless otherwise indicated

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

U Indicates that the concentration was not detected.

NA Screening criteria not available for the referenced compound.

TABLE 4-2

Tetrachloroethene (PCE), Trichloroethene (TCE), cis 1,2-Dichloroethene, 1,2-Dichloroethene (total), and 1,2-Dichlorobenzene
 Detections in Groundwater, March – April 2002 Sampling Event
 RFI Report Addendum, AOCs 569, 570 and 578, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Tetrachloroethene		Trichloroethene		cis 1,2- Dichloroethene		1-2- Dichloroethene (total)		1,2- Dichlorobenzene	
		Result (µg/L)	Qualifier	Result (µg/L)	Qualifier	Result (µg/L)	Qualifier	Result (µg/L)	Qualifier	Result (µg/L)	Qualifier
MCL		5		5		70		70		600	
EPA Region III Tap Water RBC (HI=0.1)		1.1		1.6		6.1		5.5		55	
E569GW003	3/6/2002	20.6	=	2.4	J	0.9	J	0.9	J	0.44	U
E569GW004	3/6/2002	5.9	=	0.45	J	5	U	5	U	5	U
E569GW005	3/6/2002	1.1	J	5	U	5	U	5	U	5	U
E569GW05D	3/6/2002	5	U	5	U	5	U	5	U	5	U
E569GW001	4/16/2002	18.9	=	4.7	J	0.92	J	0.92	J	5	U
E569GW002	4/16/2002	2.1	J	1	J	0.34	J	0.34	J	5	U
E570GW001	4/16/2002	46.5	=	2.3	J	0.36	J	0.36	J	5	U
E570GW03D	4/16/2002	5	U	8	=	5.8	=	6.3	=	5	U

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

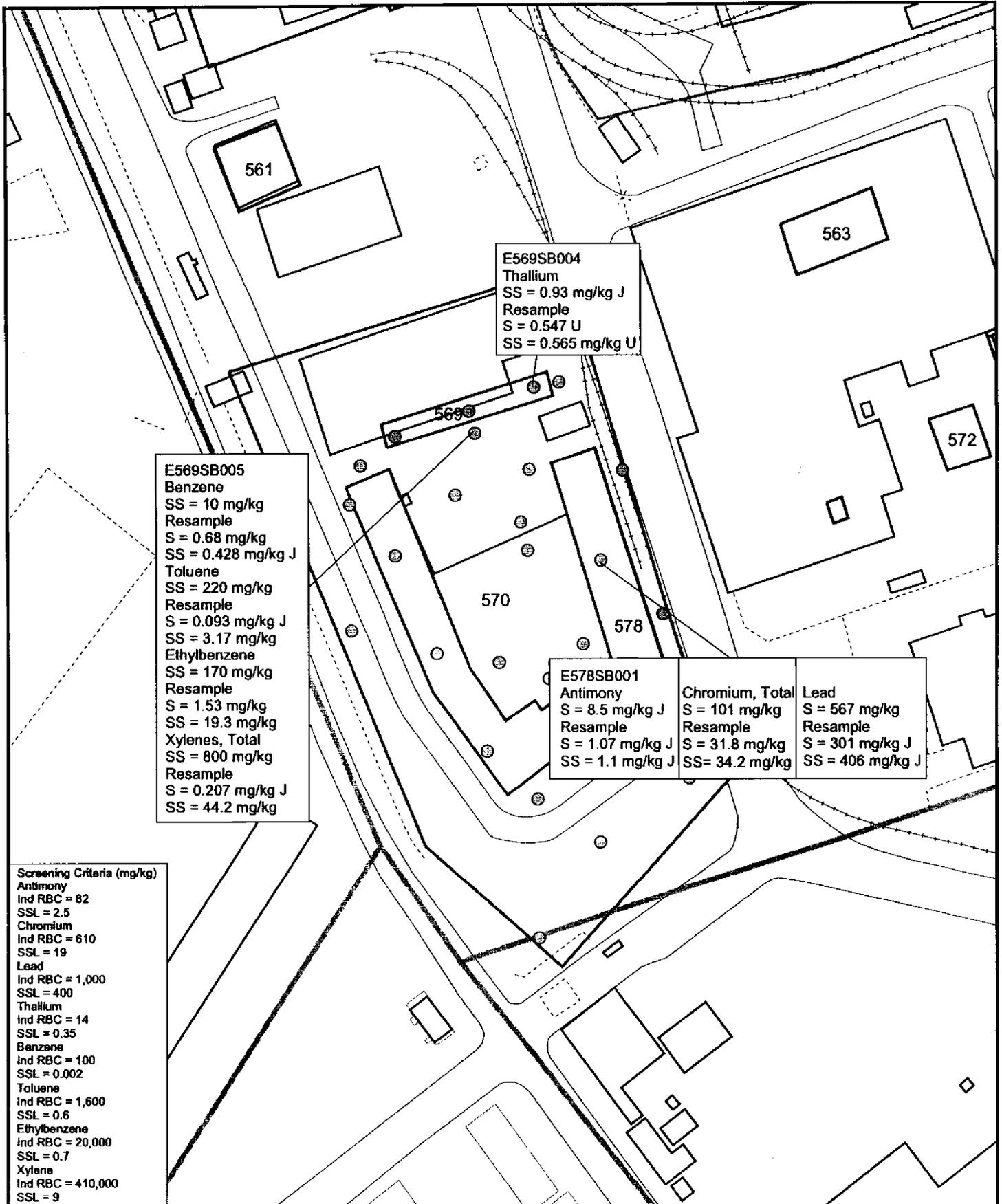
= Indicates that the analyte is detected at the concentration shown.

HI Hazard index

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.

µg/L Micrograms per liter

U Indicates analyte not detected above laboratory detection limit.



- Soil Boring
- ⋈ Fence
- ⋈ Railroads
- ⋈ Roads
- AOC Boundary

- Buildings
- ▭ Zone Boundary
- S- Surface Soil Sample
- SS- Subsurface Soil Sample

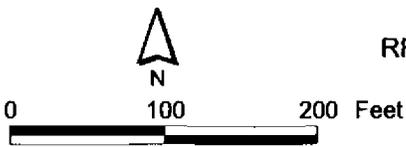


Figure 4-1
RFI and April 2002 Soil Sampling Results
AOCs 569, 570, and 578, Zone E
Charleston Naval Complex

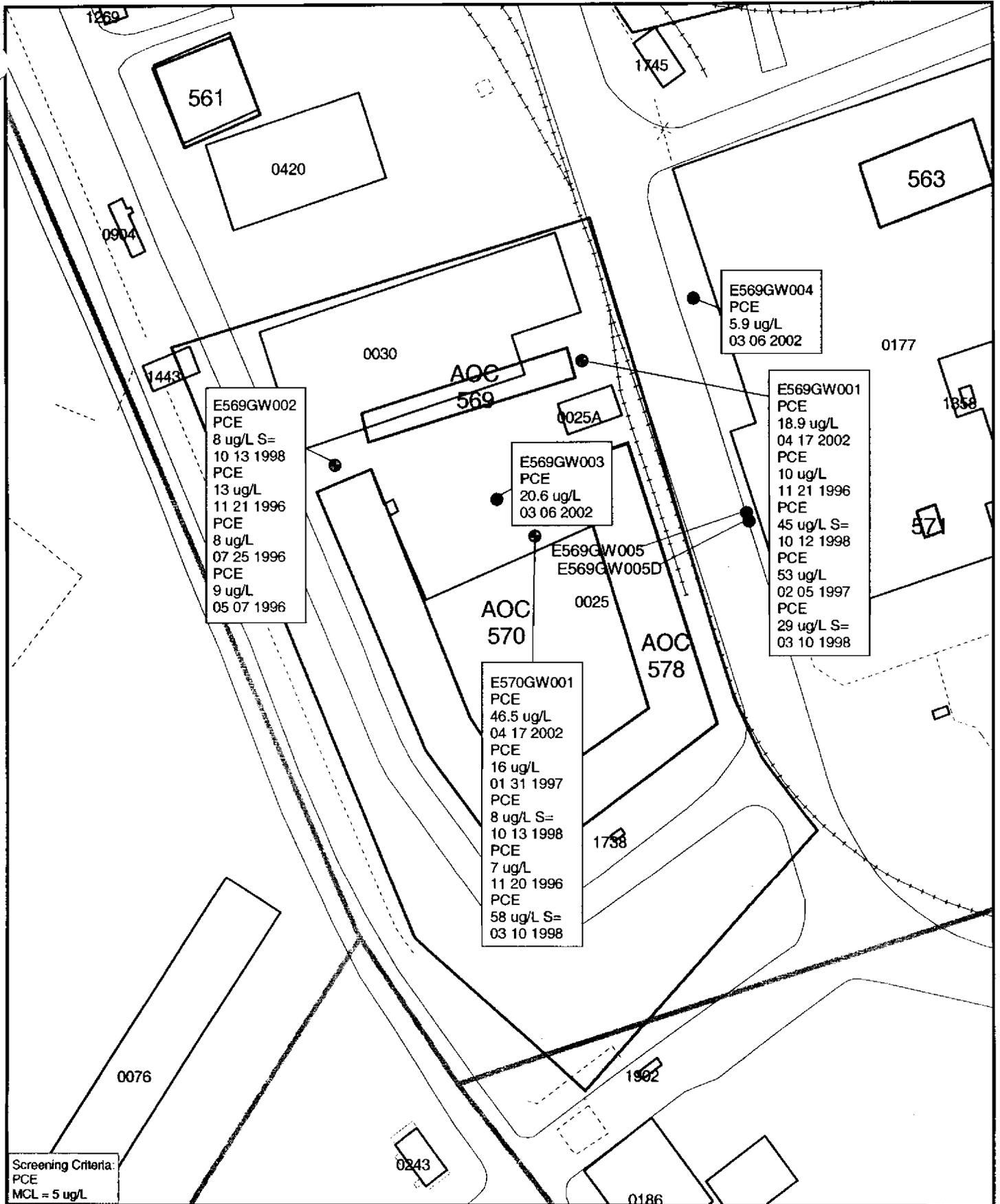
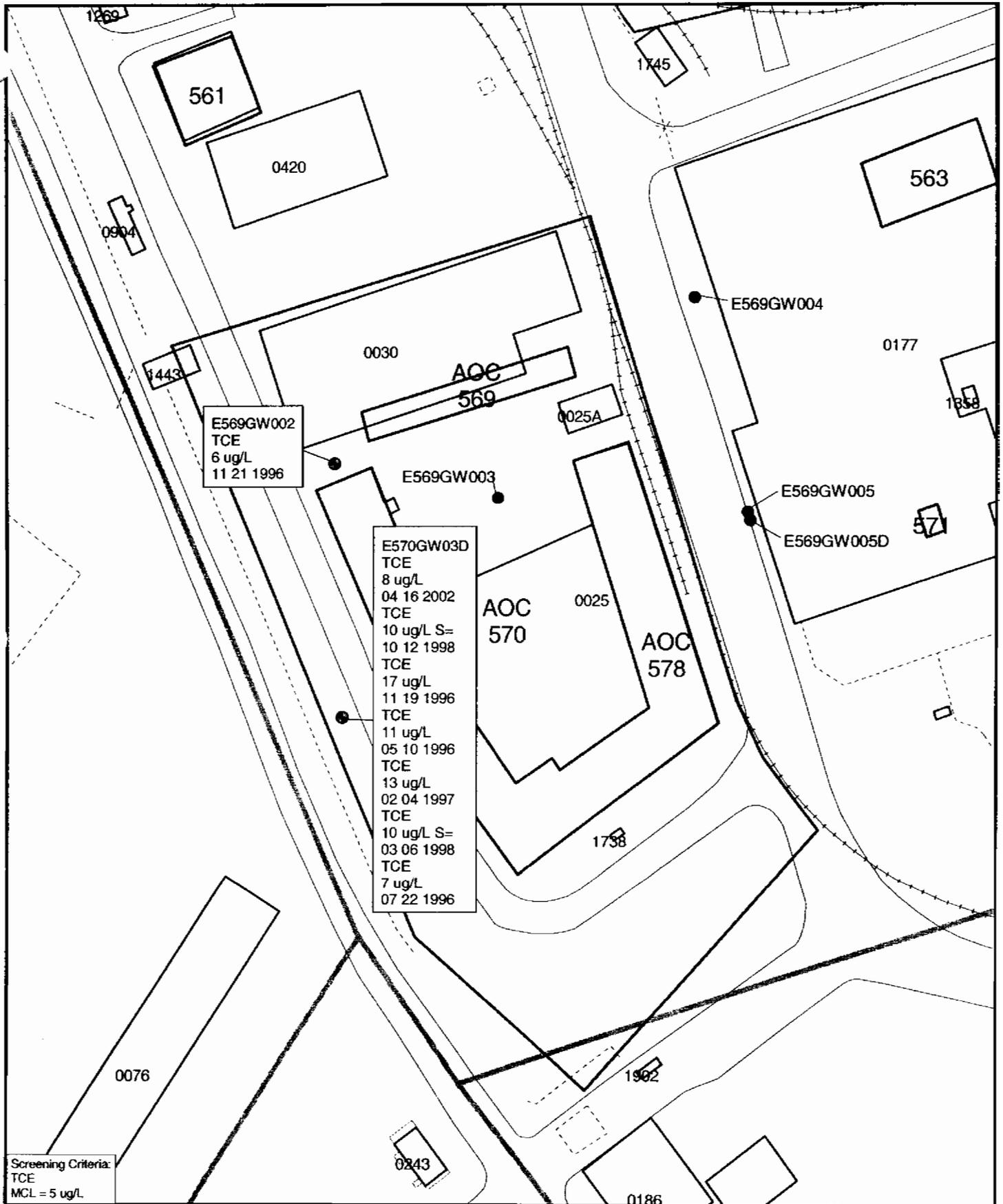


Figure 4-2
Groundwater PCE Exceedances and
March 2002 Monitoring Well Locations
AOCs 569, 570 and 578
Charleston Naval Complex



● Groundwater Monitoring Well
 ● Groundwater Monitoring Well, March 2002 Installation
 ⚡ Railroads
 - Fence
 - Roads
 □ AOC Boundary
 □ SWMU Boundary
 □ Buildings
 □ Zone Boundary

0 80 160 Feet

Figure 4-3
 Groundwater TCE Exceedances and
 March 2002 Monitoring Well Locations
 AOCs 569, 570, and 578
 Charleston Naval Complex

1 **5.0 COPC/COC Refinement**

2 The *Zone E RFI Report, Revision 0* identified arsenic and BEQs as surface soil COCs for both
3 the unrestricted and industrial land use scenario; aluminum, arsenic, beryllium, chromium,
4 lead, thallium, vanadium, chloroform, PCE, and TCE as shallow groundwater COCs; and
5 1,2-dichloroethene (total), TCE, and thallium as deep groundwater COCs for AOCs 569,
6 570, and 578. The RFI did not identify any COCs for subsurface soil.

7 The nature of occurrence and the relevance of these chemicals at these sites are further
8 discussed below. Tables 5-1 and 5-2 show the detected concentrations of these chemicals.

9 In addition to the original screening criteria, current screening criteria for Zone E includes
10 comparing VOC concentrations in soil to SSLs with a DAF of 1. The results of this screening
11 are also discussed in this section.

12 Additional delineation sampling conducted at the site by CH2M-Jones during March and
13 April 2002 indicated one exceedance of lead above its SSL in the subsurface soil sample
14 from E578SB001b. Lead detections at the site are also discussed in this section.

15 **5.1 Soils**

16 **5.1.1 Arsenic**

17 Arsenic was detected in all 27 surface soil samples collected from AOCs 569, 570, and 578
18 with concentrations ranging from 0.87 mg/kg to 70.9 mg/kg. All of these values exceed the
19 EPA region III residential RBC of 0.43 mg/kg, at HI = 0.1. Arsenic concentrations in 18
20 samples were equal to or greater than the industrial RBC of 3.8 mg/kg. One sample (70.9
21 mg/kg at E570SB012) had an arsenic concentration that exceeded the Zone E maximum
22 background surface soil arsenic concentration of 68 mg/kg. Table 5-1 lists detected arsenic
23 concentrations in surface soils.

24 A UCL₉₅ estimation of 15.8 mg/kg was calculated for arsenic in surface soil. Appendix G
25 includes a copy of the UCL₉₅ calculation table.

26 The background concentrations of arsenic in soils at the CNC have been shown to be above
27 both the residential and industrial RBCs. Arsenic concentrations in Zone E grid samples
28 range from 0.95 to 68 mg/kg, with a mean concentration of 8 mg/kg.

1 For sites where background arsenic levels exceed RBCs, EPA Region IV typically considers
2 arsenic concentrations in surface soil of up to 20 mg/kg and 270 mg/kg as acceptable for
3 unrestricted and industrial land use, respectively (EPA, 2001). Based on these criteria and
4 the UCL₉₅ exposure concentration estimate of 15.8 mg/kg, arsenic would not be considered
5 a COC for either unrestricted land use or industrial land use.

6 Arsenic was not detected above screening criteria in the subsurface soil; therefore, it is not a
7 leachability concern at these sites. Additionally, arsenic was not detected in groundwater
8 above its MCL during four RFI sampling events. Based on these observations, arsenic is not
9 considered a COC for soil at this site.

10 **5.1.2 BEQs**

11 **Surface Soil**

12 Table 5-1 lists detected BEQ concentrations in surface soils from the RFI sampling. BEQ
13 concentrations in surface soil detected during the RFI exceeded the CNC BEQ sitewide
14 reference concentration of 1,304 µg/kg at two RFI locations: E570SB012 at 3,817 µg/kg and
15 at E578SB005 at 1,619 µg/kg.

16 Based on these exceedances of the sitewide reference concentration, BEQs are considered a
17 surface soil COC for the unrestricted and industrial land use scenarios. Because these
18 exceedances are currently beneath pavement, they do not present a current exposure
19 concern. However, in the future, should site conditions change, potential exposure to BEQs
20 in soil could be a concern.

21 **Subsurface Soil**

22 During the RFI, BEQs were detected in the subsurface soil above the CNC subsurface BEQ
23 BRC of 1,400 µg/kg at E570SB005, at a concentration of 1,625 µg/kg. Table 5-1 shows BEQ
24 concentrations in subsurface soil samples at the site.

25 The detected subsurface soil BEQs might be related to extensive soil disturbance and
26 historical construction operations at these sites, which are typical of historically active
27 industrial areas, and/or due to asphalt materials pushed down to the subsurface depths
28 during sampling. Railroad tracks historically traversed through the site as shown in Figure
29 C-1, derived from the Public Works Map of the Charleston Naval Base, dated December 15,
30 1939.

31 There is only one detection of BEQs above screening criteria in subsurface soil. In both
32 surface and subsurface soil samples, detected concentrations of the seven individual
33 carcinogenic polyaromatic hydrocarbons (cPAHs) that are included in the calculated BEQ

1 concentrations did not exceed their respective SSLs. Additionally, BEQ compounds were
2 not detected above laboratory detection limits in the wells adjacent to the soil sample
3 locations that showed the highest BEQ detections. This indicates that the BEQs in soils do
4 not pose a threat to groundwater via leaching. Based on these observations, BEQs are not
5 considered a subsurface soil COC at this site.

6 **5.1.3 Lead**

7 During the RFI, lead was detected in surface soil above the EPA Region target cleanup goal
8 for unrestricted land use of 400 mg/kg at only one of 27 sampling locations at E578SB001
9 with a concentration of 567 mg/kg. This location was resampled during March 2002 to
10 determine if a source material for lead exists. The surface soil sample from March 2002
11 sampling event showed a lead detection of 301 mg/kg.

12 The RFI eliminated lead from consideration as a surface soil COC based on a comparison of
13 the mean lead concentration at the site being less than the target cleanup goal of 400 mg/kg.
14 Additionally, this location is under pavement and is expected to continue to be under
15 pavement. Therefore, lead does not represent a direct exposure concern at the site.

16 Although there were no lead exceedances in subsurface soil samples during the RFI, the
17 March 2002 resampling at E578SB001 showed a lead detection of 406 mg/kg, above its SSL
18 of 400 mg/kg. However, the average subsurface lead concentration for the site (with the
19 higher detection from March 2002 at E578SB001 included in the calculation) is 23.18 mg/kg
20 as shown in Table 5-1, below the SSL for lead. This indicates that lead is not a leaching
21 concern at the site. Additionally, lead has not been identified as a groundwater COC,
22 indicating that lead concentrations in soil are not a groundwater contamination threat at the
23 site.

24 Based on these observations, lead is not considered a soil COC at this site.

25 **5.1.4 Soil VOC Screening using SSL at DAF=1**

26 Soil VOC detections were compared to SSLs with a DAF =1. Several VOCs were detected
27 above laboratory detection limits. These detections are shown in Table 5-1. In surface soils,
28 methylene chloride was the only VOC detected above its generic SSL (with a DAF=1)
29 during the RFI. Benzene, ethylbenzene, toluene and xylenes in the surface soil sample
30 E569SB005b collected during the April-March 2002 sampling event also exceeded their
31 respective generic SSLs with a DAF=1.

32 In subsurface soils, acetone, benzene, carbon tetrachloride, ethylbenzene, methylene
33 chloride, toluene, and xylenes (total) exceeded the SSL with a DAF=1.

1 **Acetone**

2 One detection of acetone in the subsurface soil sample from E569SB005 at 47 mg/kg
3 exceeded its SSL of 0.8 mg/kg. Acetone was not detected above laboratory detection limits
4 in the subsurface soil sample E569SB005b from this location during the April 2002
5 sampling. Table 5-1 lists acetone detections in soil samples from the site. Acetone has not
6 been detected above laboratory detection limits in groundwater at the site, indicating that it
7 is not migrating into groundwater. Based on these observations, acetone is not considered a
8 COC in soil at this site.

9 **Benzene**

10 Table 5-1 lists benzene detections in soil samples from the site. Detections of benzene in
11 samples from E569SB005 exceeded its generic SSL of 0.002 mg/kg. In the surface soil
12 sample from E569SB005, benzene was detected at 0.68 mg/kg during April 2002 sampling,
13 above its SSL. In the subsurface soil sample from the same location, benzene was detected
14 during the RFI at 10 mg/kg and during the April 2002 sampling at 0.428 mg/kg, above its
15 SSL. Four additional soil samples were collected around E569SB005 during March 2003, as
16 part of the IM at AOC 569, as explained in Section 3.0. Site-specific SSLs were calculated
17 for benzene and are included in Appendix H.

18 Benzene detections from the March 2003 sampling event were compared with site-specific
19 SSLs. None of the surface soil samples showed exceedances of the SSL for the paved
20 scenario. Benzene detections in one surface soil sample (from E569SB010 at 0.437 mg/kg)
21 and two subsurface soil samples (from E569SB008 at 1.95 mg/kg and E569SB010 at 0.805
22 mg/kg) exceed the site-specific SSL of 0.078 mg/kg for the unpaved scenario. The benzene
23 detection of 1.95 mg/kg in the subsurface soil sample (collected from the 3-5 ft depth
24 interval bls at E569SB008) also exceeds the site-specific SSL of 1.04 mg/kg for the paved
25 scenario. At two of the four delineation sample locations, benzene was not detected above
26 laboratory detection limits in surface soil, and none of the surface soil benzene detections
27 exceed the EPA Region III residential RBC of 12 mg/kg.

28 The site average for surface soil benzene concentrations was calculated to be 0.0442 mg/kg,
29 as shown in Table 5-1. This value is below the site-specific SSL for the unpaved scenario of
30 0.078 mg/kg, indicating that benzene concentrations in the surface soil do not pose a threat
31 to groundwater. The site average for subsurface soil benzene concentrations was calculated
32 to be 0.442 mg/kg, as shown in Table 5-1. This value is above the site-specific SSL for the
33 unpaved scenario of 0.078 mg/kg and below the site-specific SSL for the paved scenario of
34 1.04 mg/kg. The soils at this site are under pavement and are expected to remain under

1 pavement. Also, the proposed construction activities related to the realignment of Hobson
2 Avenue would not impact this area. There is no direct exposure concern or a leaching
3 concern from these soils under the paved scenario, as long as LUCs are maintained to
4 ensure that the soils are covered with pavement/buildings. LUCs are being implemented
5 on all of Zone E and would apply to this site also.

6 Benzene was not detected above laboratory detection limits in six groundwater sampling
7 events in wells E569GW001 and E569GW01D which were installed downgradient from
8 E569SB005, indicating that groundwater is not being impacted by the detected soil
9 concentrations of benzene at E569SB005.

10 Based on these observations, benzene is not considered a surface soil COC, but will be
11 retained as a subsurface soil COC, based on the average benzene concentration in
12 subsurface soil exceeding the site-specific SSL (unpaved scenario).

13 **Carbon Tetrachloride**

14 Detections of carbon tetrachloride exceeded its SSL of 0.003 mg/kg in the subsurface soil
15 samples from E569SB005 during the RFI at 3.80 mg/kg. Carbon tetrachloride was not
16 detected above laboratory detection limits in the subsurface soil sample E569SB005b from
17 this location, during the April 2002 sampling. Table 5-1 lists carbon tetrachloride detections
18 in soil samples from the site. Based on these observations, carbon tetrachloride is not
19 considered a COC in soils at this site.

20 **Ethylbenzene**

21 Detections of ethylbenzene in samples from E569SB005 exceeded its SSL of 0.7 mg/kg. In
22 the surface soil sample from E569SB005, ethylbenzene was detected at 1.53 mg/kg during
23 April 2002 sampling, above its SSL. In the subsurface soil sample from the same location,
24 ethylbenzene was detected at 170 mg/kg during the RFI and at 19.3 mg/kg during the
25 April 2002 sampling, above its SSL. Table 5-1 lists ethylbenzene detections in soil samples
26 from the site. Ethylbenzene has not been detected above laboratory detection limits in
27 groundwater at the site, indicating that it is not migrating into groundwater. However,
28 ethylbenzene will be retained as a surface and subsurface soil COC at the site, based on
29 exceedances of its SSL.

30 Four additional soil samples were collected around E569SB005 during March 2003 as part of
31 the IM at AOC 569, as explained in Section 3.0. Site-specific SSLs were calculated for
32 ethylbenzene and are included in Appendix H.

1 Ethylbenzene detections from the March 2003 sampling event were compared with site-
2 specific SSLs of 62 mg/kg for the unpaved scenario and 827 mg/kg for the paved scenario.
3 None of the surface or subsurface soil samples showed exceedances of the SSL for the
4 unpaved or paved scenarios. At two of the four delineation sample locations, ethylbenzene
5 was not detected above laboratory detection limits in the surface soils, and none of the
6 surface soil ethylbenzene detections exceed the EPA Region III residential RBC of 780
7 mg/kg. The soils are under pavement and are expected to remain under pavement. Also,
8 the proposed construction activities related to the realignment of Hobson Avenue would
9 not impact this area. There is no direct exposure concern from these soils as long as LUCs
10 are maintained to ensure that the soils are covered with pavement/buildings. LUCs are
11 being implemented on all of Zone E and would apply to this site also.

12 Ethylbenzene was not detected above laboratory detection limits in six groundwater
13 sampling events in wells E569GW001 and E569GW01D, which were installed downgradient
14 from E569SB005, indicating that groundwater is not being impacted by the detected soil
15 concentrations of benzene at E569SB005. Based on the above observations, ethylbenzene is
16 not considered a COC in surface or subsurface soil at this site.

17 **Toluene**

18 Detections of toluene exceeded its SSL of 0.6 mg/kg in two subsurface soil samples from
19 E569SB005: one during the RFI at 220 mg/kg and the other during the April 2002 sampling
20 at 3.17 mg/kg. Table 5-1 lists toluene detections in soil samples from the site.

21 Four additional soil samples were collected around E569SB005 during March 2003 as part of
22 the IM at AOC 569, as explained in Section 3.0. Site-specific SSLs were calculated for
23 toluene and are included in Appendix H.

24 Toluene detections from the March 2003 sampling event were compared with site-specific
25 SSLs of 45 mg/kg for the unpaved scenario and 602 mg/kg for the paved scenario. None of
26 the surface or subsurface soil samples showed exceedances of the SSL for the unpaved or
27 paved scenarios. At two of the four delineation sample locations, toluene was not detected
28 above laboratory detection limits in the surface soils, and none of the surface soil toluene
29 detections exceed the EPA Region III residential RBC of 1,600 mg/kg. The soils are under
30 pavement and are expected to remain under pavement. Also, the proposed construction
31 activities related to the realignment of Hobson Avenue would not impact this area. There is
32 no direct exposure concern from these soils as long as LUCs are maintained to ensure that
33 the soils are covered with pavement/buildings. LUCs are being implemented on all of Zone
34 E and would apply to this site also.

1 Toluene was not detected above laboratory detection limits in six groundwater sampling
2 events in wells E569GW001 and E569GW01D, which were installed downgradient from
3 E569SB005, indicating that groundwater is not being impacted by the detected soil
4 concentrations of benzene at E569SB005. Based on the above observations, toluene is not
5 considered a COC in surface or subsurface soil at this site.

6 **Total Xylenes**

7 Detections of total xylenes exceeded its SSL of 9.0 mg/kg in two subsurface soil samples
8 from E569SB005: one during the RFI at 800 mg/kg and the other during the April 2002
9 sampling at 44.2 mg/kg. Table 5-1 lists total xylenes detections in soil samples from the
10 site. Four additional soil samples were collected around E569SB005 during March 2003 as
11 part of the IM at AOC 569, as explained in Section 3.0. Site-specific SSLs were calculated for
12 total xylenes and are included in Appendix H.

13 Total xylenes detections from the March 2003 sampling event were compared with site-
14 specific SSLs of 882 mg/kg for the unpaved scenario and 11,801 mg/kg for the paved
15 scenario. None of the surface or subsurface soil samples showed exceedances of the SSL for
16 the unpaved or paved scenarios. At two of the four delineation sample locations, total
17 xylenes were not detected above laboratory detection limits in the surface soils, and none of
18 the surface soil xylene detections exceed the EPA Region III residential RBC of 1,600 mg/kg.
19 The soils are under pavement and are expected to remain under pavement. Also, the
20 proposed construction activities related to the realignment of Hobson Avenue would not
21 impact this area. There is no direct exposure concern from these soils as long as LUCs are
22 maintained to ensure that the soils are covered with pavement/buildings. LUCs are being
23 implemented on all of Zone E, and would apply to this site also.

24 Total xylenes were not detected above laboratory detection limits in six groundwater
25 sampling events in wells E569GW001 and E569GW01D, which were installed downgradient
26 from E569SB005, indicating that groundwater is not being impacted by the detected soil
27 concentrations of benzene at E569SB005. Based on the above observations, total xylenes are
28 not considered a COC in surface or subsurface soil at this site.

29 As shown in Table 5-1, except for the methylene chloride detections and the single PCE
30 detection during the RFI, all the VOCs exceeding their SSLs were detected at a single
31 location, E569SB005, which is associated with the former gas station at AOC 569. There
32 were no detections of benzene, carbon tetrachloride, ethylbenzene, toluene and total
33 xylenes in surface or subsurface soil samples from any of the other RFI locations at this site.
34 These observations indicate that the elevated detections of these chemicals at the soil boring

1 location E569SB005 are due to a localized presence of petroleum products in the soil and do
2 not represent a sitewide release.

3 **Methylene Chloride**

4 Methylene chloride was detected in 6 of 22 surface soil samples and 4 of 21 subsurface soil
5 samples. Detections of methylene chloride above the SSL (DAF = 1) screening criteria
6 ranged from 0.009 mg/kg to 0.017 mg /kg in surface soil and 0.007 mg /kg to 0.019 mg /kg
7 in subsurface soil.

8 A site-specific SSL was calculated for this site for the paved and unpaved scenarios. The
9 site-specific SSL for the paved scenario is 0.277 mg/kg and for the unpaved scenario is 0.023
10 mg/kg. All detections of methylene chloride in surface and subsurface soils are below the
11 more conservative SSL for the unpaved scenario, indicating that methylene chloride is not a
12 leaching concern at this site. Table H-1 in Appendix H shows the site-specific parameters
13 and resulting SSL values.

14 In groundwater, methylene chloride was detected during the third quarterly groundwater
15 monitoring event in shallow well E570GW003 at a concentration of 8 µg/L. However, it was
16 not detected in the two preceding and three subsequent sampling events. Methylene
17 chloride was not detected above laboratory detection limits in the other monitoring wells
18 associated with this site. This intermittent methylene chloride detection in groundwater
19 samples collected from monitoring wells associated with this site indicate that methylene
20 chloride in soil does not likely pose a threat to groundwater via leaching.

21 Based on these observations, methylene chloride is not considered to be a COC for surface
22 or subsurface soil at this site.

23 **Tetrachloroethene (PCE)**

24 PCE was detected in 1 of 21 surface soil samples and in none of the subsurface soil samples.
25 The detection of PCE at a concentration of 3 µg/kg does not exceed the SSL (with a DAF =
26 1) of 3 µg/kg in surface soil. The lack of detections in the subsurface soil interval also
27 indicates that the low-level surface soil detections of PCE are not a leaching concern. Based
28 on these observations, PCE is not considered to be a COC for soil at this site.

29 **5.2 Groundwater**

30 Several VOCs and metals were identified as COCs in the original RFI report. Generally, the
31 chlorinated solvents PCE and TCE appear to be present as contaminants in groundwater
32 and should be considered COCs.

1 Several metals, specifically aluminum, chromium, lead, and vanadium, were detected only
2 in well E570GW002 at elevated concentrations. Review of the sampling logs for these
3 samples indicates that turbidity in this well has been elevated during these sampling
4 events. Sampling logs for E570GW002 are contained in Appendix A. Turbidities recorded
5 for this well during the RFI sampling are as follows:

6	<u>Sampling Date</u>	<u>Turbidity Range (NTU)</u>	<u>Last Recorded Value (NTU)</u>
7	5/3/1996	68 to 95	78
8	7/23/1996	24 to 200	17
9	11/19/1996	272 to 742	574
10	2/3/1997	195 to 597	299

11 Based on these elevated turbidities, the metals exceedances of the RBCs or MCLs are likely
12 related to turbidity rather than the presence of a metals "plume" in groundwater. Each of
13 the previously identified groundwater COCs is discussed in the following sections.

14 **5.2.1 Aluminum**

15 The RFI report considered aluminum to be a COC in shallow groundwater at this site based
16 on the detections above the EPA Region III tap water RBC and the Zone E shallow
17 groundwater BRC. One of these detections, at a concentration of 67,500 µg/L at well
18 E570GW002, exceeded the maximum Zone E background aluminum concentration in
19 shallow groundwater of 16,100 µg/L. There is no primary MCL for aluminum. The
20 aluminum detections in well E570GW002 in the subsequent three groundwater sampling
21 events were slightly above or below the maximum Zone E background aluminum
22 concentration in shallow groundwater, as shown in Table 5-2. There is no indication of an
23 aluminum release at the site from site-related activities. As noted above, the turbidity in
24 this well was elevated during the sampling events and the reported elevated detections of
25 aluminum are likely related to the presence of turbidity in the samples. Based on the
26 information presented above, aluminum is not considered to be a groundwater COC for
27 this site.

28 **5.2.2 Arsenic**

29 The RFI report considered arsenic to be a COC at this site, based on its detection in a
30 shallow groundwater sample from well E570GW002 during the first sampling event, at a
31 concentration of 40.2 µg/L, which exceeded both the tap water RBC and shallow
32 groundwater BRC for arsenic. However, the detection did not exceed the South Carolina

1 arsenic MCL of 50.0 µg/L, as shown in Table 5-2. Arsenic detections during the subsequent
2 groundwater sampling events were also below this MCL. Based on these observations,
3 arsenic is not considered to be a shallow groundwater COC for this site.

4 **5.2.3 Beryllium**

5 The RFI report considered beryllium to be a COC at this site, based on its detection in two
6 shallow groundwater samples from E570GW001 and E570GW002 at concentrations of 0.59
7 µg/L and 0.710 µg/L, respectively, which exceeded both the tap water RBC and shallow
8 groundwater BRC for beryllium. However, these detections did not exceed the beryllium
9 MCL of 4.0 µg/L, as shown in Table 5-2. Beryllium detections during subsequent
10 groundwater sampling events in these wells were also below the MCL. Based on these
11 observations, beryllium is not considered to be a shallow groundwater COC for this site.

12 **5.2.4 Chromium**

13 The RFI report considered chromium to be a COC at this site, based on its detection in
14 shallow groundwater sample from well E570GW002 during the first sampling event at a
15 concentration of 137 µg/L, which exceeded both the tap water RBC and shallow
16 groundwater BRC for chromium. The detection also exceeded the chromium MCL of 100
17 µg/L, as shown in Table 5-2. However, chromium detections in samples from three
18 subsequent groundwater sampling events at this well were below the MCL. As noted
19 earlier, the turbidity in this well was elevated during the sampling events and the reported
20 elevated detections of chromium are likely related to the presence of turbidity in the
21 samples. Based on these observations, chromium is not considered to be a shallow
22 groundwater COC for this site.

23 **5.2.5 Lead**

24 The RFI report considered lead to be a COC at this site, based on its detection in one
25 shallow groundwater sample from well E570GW002 during the first sampling event at a
26 concentration of 77.5 µg/L, which exceeded both the Treatment Technique Action Level
27 (TTAL) of 15 µg/L and shallow groundwater BRC of 4.8 µg/L for lead. However, the lead
28 detections in well E570GW002 in three subsequent groundwater sampling events were
29 either below the TTAL of 15 µg/L or the maximum Zone E background lead concentration
30 in shallow groundwater of 47µg/L, as shown in Table 5-2. As noted earlier, the turbidity in
31 this well was elevated during the sampling events and the reported elevated detections of
32 lead are likely related to the presence of turbidity in the samples. Based on these
33 observations, lead is not a shallow groundwater COC for this site.

1 5.2.6 Thallium

2 The RFI report considered thallium to be a COC at this site, based on its detection in a deep
3 groundwater sample from well E569GW01D at a concentration of 5.5 µg/L, which exceeded
4 both the tap water RBC (0.26 µg/L) and MCL of 2 µg/L for thallium. A thallium detection
5 in sample from well E570GW02D during the third sampling event, at a concentration of 6.1
6 µg/L, also exceeded its MCL. However, these detections did not exceed the maximum Zone
7 E background thallium concentration in deep groundwater of 7 µg/L, and thallium
8 concentrations in these wells during other groundwater sampling events were below
9 laboratory detection limits, as shown in Table 5-2. As noted earlier, the turbidity in this well
10 was elevated during the sampling events and the reported elevated detections of thallium
11 are likely related to the presence of turbidity in the samples. Based on these observations,
12 thallium is not considered to be a groundwater COC for this site.

13 5.2.7 Vanadium

14 The RFI report considered vanadium to be a COC at this site, based on its detection in
15 shallow groundwater sample 570GW00201 at a concentration of 180 µg/L, which exceeded
16 both the tap water RBC and shallow groundwater BRC for vanadium. There is no primary
17 MCL for vanadium. The vanadium detections in well E570GW002 in the three subsequent
18 groundwater sampling events were similar to the maximum Zone E background vanadium
19 concentration in shallow groundwater, as shown in Table 5-2, indicating that vanadium
20 detections at the site likely represent background conditions.

21 It must be noted that the majority of the elevated inorganic detections in groundwater
22 during the RFI occurred in the sample from well E569GW002 during the first sampling
23 event. It is likely that these detections, including the elevated vanadium detection in this
24 sample, are a result of entrainment of soil particles in an unfiltered groundwater sample,
25 which could elevate detections of metals.

26 There is no indication from information regarding historical site operations that vanadium
27 was a material of concern at this site, and vanadium did not exceed screening criteria in
28 soils. Thus, it is unlikely that a vanadium release occurred at the site. As noted earlier, the
29 turbidity in this well was elevated during the sampling events and the reported elevated
30 detections of vanadium are likely related to the presence of turbidity in the samples. Based
31 on these observations, vanadium is not considered to be a groundwater COC for this site.

1 **5.2.8 Chloroform**

2 The RFI report considered chloroform to be a COC at this site, based on its detection in the
3 sample from E570GW003 at a concentration of 2 µg/L, which exceeded the tap water RBC
4 for chloroform. However, the detection did not exceed the chloroform MCL of 100 µg/L, as
5 shown in Table 5-2. Chloroform concentrations during the subsequent groundwater
6 sampling events were not detected above laboratory detection limits. For this reason
7 chloroform is not considered to be a shallow groundwater COC for this site.

8 **5.2.9 Tetrachloroethene (PCE)**

9 The RFI report considered PCE to be a COC at this site, based on its detection in a sample
10 from E569GW002 at a concentration of 9 µg/L, which exceeded the tap water RBC for PCE
11 of 1.1 µg/L and the MCL of 5 µg/L. PCE detections at two other site wells, E569GW001 and
12 E570GW001 during the subsequent RFI groundwater sampling events, also exceeded the
13 MCL, as shown in Figure 4-2 and Table 5-2. During the March-April 2002 sampling event,
14 PCE detections in samples from wells E569GW001 and E570GW001, exceeded its MCL of 5
15 µg/L at concentrations of 18.9 µg/L and 46.5 µg /L respectively. During this sampling
16 event, PCE detection in well E569GW002 where intermittent slight exceedances of the MCL
17 had been historically noticed, was estimated at 2.1 µg /L, below the MCL.

18 Groundwater samples from three new wells E569GW003, E569GW004 and E569GW005
19 installed and sampled during April-March 2002 showed PCE detections of 20.6 µg /L and
20 5.9 µg /L and 1.1 µg /L respectively. The historic pattern of PCE detections in site wells
21 indicates that there may be a low-level source of PCE at the site in the vicinity of wells
22 E570GW001, E569GW001, E569GW003 and E569GW004. Therefore, PCE is considered as a
23 shallow groundwater COC for this site.

24 **5.2.10 Trichloroethene (TCE)**

25 **TCE in shallow groundwater**

26 The RFI report considered TCE to be a COC at this site, based on its detection in the shallow
27 groundwater sample from E569GW002 at a concentration of 4 µg/L, which exceeded the tap
28 water RBC for TCE of 1.6 µg/L. However, the detection did not exceed the TCE MCL of 5
29 µg/L, as shown in Table 5-2. A TCE detection at this location at a concentration of 6 µg/L
30 during the third quarter RFI sampling event exceeded the MCL. However, detections from
31 previous and subsequent RFI groundwater sampling events, and the April-March 2002
32 sampling event at this well have been below the MCL. In addition, no other wells

1 associated with this site had detections of TCE exceeding the MCL. Based on these
2 observations, TCE is not considered a shallow groundwater COC for this site.

3 **TCE in Deep Groundwater**

4 The RFI report considered TCE to be a COC at this site, based on its detection in the deep
5 groundwater sample from well E569GW03D during the first sampling event at a
6 concentration of 11 µg/L, which exceeded the tap water RBC of 1.6 µg/L for TCE. The
7 detection also exceeded the MCL for TCE of 5 µg/L. TCE detections in this well from
8 subsequent RFI sampling events and the March-April 2002 sampling event also showed
9 slight exceedances of the MCL, with detections ranging from 7 µg/L to 17 µg/L, as shown
10 in Figure 4-3 and Table 5-2, indicating that there is likely a low-level source of TCE at this
11 location. Based on these observations, TCE is considered as a deep groundwater COC for
12 this site.

13 **5.2.11 1,2-Dichloroethene (Total)**

14 **1,2-Dichloroethene (Total) in Deep Groundwater**

15 The RFI report considered 1,2-Dichloroethene (Total) to be a COC at this site, based on its
16 detection in a deep groundwater sample from E569GW03D during the first sampling event
17 at a concentration of 6 µg/L, which exceeded the tap water RBC of 5.5 µg/L for 1,2-
18 Dichloroethene (Total). However, the detection did not exceed the more conservative MCL
19 for cis-1,2-Dichloroethene of 70 µg/L, as shown in Table 5-2. 1,2-Dichloroethene (Total)
20 concentrations during the subsequent groundwater sampling events were also below this
21 MCL. For this reason 1,2-Dichloroethene is not considered to be a deep groundwater COC
22 for this site.

23 **5.3 COC Summary**

24 In surface soils, BEQs are considered COCs for the unrestricted and industrial land use
25 scenarios based on elevated detections above the CNC sitewide reference concentration of
26 1,304 µg/kg at two surface soil sampling locations: E570SB012 at 3,817 µg/kg, and at
27 E578SB005 at 1,619 µg/kg. The locations of these elevated BEQ detections are covered with
28 pavement and are expected to continue to be paved. Also, the site is expected to continue to
29 be used for industrial purposes and will be partially covered by the pending road
30 construction. As per BCT agreements, all of Zone E will undergo LUCs.

31 Benzene has been identified as a subsurface soil COC.

- 1 In shallow groundwater, PCE has been identified as a COC at this site, based on low-level
- 2 MCL exceedances in wells E570GW001, E569GW001, E569GW003, and E569GW004. The
- 3 detections indicate the possible presence of a low-level PCE source in this area of the site.

- 4 In deep groundwater, TCE has been identified as a COC at this site based on low-level MCL
- 5 exceedances in deep well E570GW03D.

- 6 The soil and groundwater COCs identified above will be addressed as part of a focused
- 7 CMS. A CMS Work Plan is included in Section 8.0 of this report. No other COCs for any
- 8 media or land use scenario have been identified at this site.

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils
 RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential RBC (mg/kg)	SSL (mg/kg)	Zone E Background Range of Conc. (mg/kg)	
Acetone	Surface Soil					780	DAF = 1 0.8	NA	
	E569SB001	569SB00101	0.011	U	10/13/1995				
	E569SB002	569SB00201	0.012	U	10/13/1995				
	E569SB003	569SB00301	0.019	U	10/13/1995				
	E569SB004	569SB00401	0.018	U	10/13/1995				
	E569SB005	569SB00501	0.040	U	10/13/1995				
	E570SB003	570SB00301	0.015	J	11/14/1995				
	E570SB004	570SB00401	0.012	U	11/15/1995				
	E570SB005	570SB00501	0.030	J	01/16/1996				
	E570SB006	570SB00601	0.340	J	01/16/1996				
	E570SB007	570SB00701	0.086	J	01/16/1996				
	E570SB008	570SB00801	0.160	UJ	01/16/1996				
	E570SB009	570SB00901	0.057	J	01/16/1996				
	E570SB010	570SB01001	0.081	=	01/16/1996				
	E570SB011	570SB01101	0.011	U	11/20/1995				
	E570SB012	570SB01201	0.011	U	11/15/1995				
	E570SB013	570SB01301	0.012	U	11/06/1995				
	E570SB014	570SB01401	0.011	U	11/06/1995				
	E570SB015	570SB01501	0.011	U	11/14/1995				
	E578SB001	578SB00101	0.040	J	05/16/1996				
	E578SB004	578SB00401	0.011	UJ	05/16/1996				
	E578SB005	578SB00501	0.069	U	05/16/1996				
	E578SB006	578SB00601	0.120	UJ	05/16/1996				
		Subsurface Soil					780	0.8	NA
	E569SB001	569SB00102	0.018	U	10/13/1995				
	E569SB002	569SB00202	0.021	U	10/13/1995				
	E569SB003	569SB00302	0.035	U	10/13/1995				
E569SB005	569SB00502	47.0	=	10/13/1995					
E570SB002	570SB00202	0.250	U	11/06/1995					
E570SB003	570SB00302	0.012	U	11/14/1995					
E570SB004	570SB00402	0.012	U	11/15/1995					
E570SB005	570SB00502	0.022	J	01/16/1996					
E570SB006	570SB00602	0.019	J	01/16/1996					
E570SB008	570SB00802	0.017	=	01/16/1996					
E570SB009	570SB00902	0.100	J	01/16/1996					
E570SB011	570SB01102	0.012	U	11/20/1995					
E570SB012	570SB01202	0.011	U	11/15/1995					
E570SB013	570SB01302	0.011	U	11/06/1995					
E570SB014	570SB01402	0.016	U	11/06/1995					
E570SB015	570SB01502	0.015	J	11/14/1995					

TABLE 5-1
 Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils
 RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential RBC (mg/kg)	SSL (mg/kg)	Zone E Backgr ound Range of Conc. (mg/kg)
	E578SB004	578SB00402	0.95	J	05/16/1996			
	E578SB002	578SB00202	1.40	=	05/16/1996			
	E578SB003	578SB00302	0.94	J	05/16/1996			
	E578SB001	578SB00102	0.63	J	05/16/1996			
	E570SB015	570SB01502	0.76	J	11/14/1995			
	E570SB014	570SB01402	1.20	=	11/06/1995			
	E570SB013	570SB01302	0.77	J	11/06/1995			
	E570SB007	570SB00702	0.61	J	01/16/1996			
	E570SB012	570SB01202	5.90	=	11/15/1995			
	E570SB002	570SB00202	0.98	J	11/06/1995			
	E570SB011	570SB01102	6.70	=	11/20/1995			
	E570SB005	570SB00502	1.00	J	01/16/1996			
	E570SB004	570SB00402	2.80	=	11/15/1995			
	E570SB0A4	570SB0A402	0.41	U	09/12/1996			
	E570SB003	570SB00302	0.86	J	11/14/1995			
	E570SB008	570SB00802	6.70	=	01/16/1996			
	E569SB004	569SB00402	2.70	=	10/13/1995			
	E569SB005	569SB00502	1.00	J	10/13/1995			
	E569SB003	569SB00302	1.20	J	10/13/1995			
	E569SB002	569SB00202	0.72	J	10/13/1995			
	E569SB007	569SB00702b	2.70	=	09/14/1996			
	E569SB001	569SB00102	3.20	=	10/13/1995			
	E570SB010	570SB01002	0.83	J	01/16/1996			
	E570SB009	570SB00902	9.60	=	01/16/1996			
	E570SB006	570SB00602	3.50	=	01/16/1996			
BEQs^a	Surface Soil		(µg/kg)			88 (µg/kg)	NA	1,304 (µg/kg)
	E569SB001	569SB00101	790.7	=	10/13/1995			
	E569SB002	569SB00201	901.3	U	10/13/1995			
	E569SB003	569SB00301	855.1	U	10/13/1995			
	E569SB004	569SB00401	605.7	=	10/13/1995			
	E569SB005	569SB00501	1,205.7	=	10/13/1995			
	E569SB007	569SB00701b	236.6	=	09/14/1996			
	E570SB003	570SB00301	832.0	U	11/14/1995			
	E570SB004	570SB00401	901.3	U	11/15/1995			
	E570SB005	570SB00501	1,011.5	=	01/16/1996			
	E570SB006	570SB00601	580.2	=	01/16/1996			
	E570SB007	570SB00701	566.2	=	01/16/1996			
	E570SB008	570SB00801	832.0	U	01/16/1996			
	E570SB009	570SB00901	775.3	=	01/16/1996			
	E570SB010	570SB01001	781.6	=	01/16/1996			

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils
RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential RBC (mg/kg)	SSL (mg/kg)	Zone E Backgr ound Range of Conc. (mg/kg)
	E570SB011	570SB01101	866.6	U	11/20/1995			
	E570SB012	570SB01201	3,817.1	=	11/15/1995			
	E570SB014	570SB01401	849.3	=	11/06/1995			
	E570SB0A4	570SB0A401	818.5	=	09/12/1996			
	E578SB001	578SB00101	246.1	=	05/16/1996			
	E578SB002	578SB00201	287.2	=	05/16/1996			
	E578SB003	578SB00301	175.7	=	05/16/1996			
	E578SB004	578SB00401	379.7	=	05/16/1996			
	E578SB005	578SB00501	1,619.4	=	05/16/1996			
	E578SB006	578SB00601	809.5	=	05/16/1996			
	Subsurface Soil					88 (µg/kg)	NA	1,400 (µg/kg)
	E569SB001	569SB00102	878.2	U	10/13/1995			
	E569SB002	569SB00202	901.3	U	10/13/1995			
	E569SB003	569SB00302	901.3	U	10/13/1995			
	E569SB004	569SB00402	878.2	U	10/13/1995			
	E569SB005	569SB00502	4,506.5	U	10/13/1995			
	E569SB007	569SB00702b	4,506.5	U	09/14/1996			
	E570SB002	570SB00202	808.9	U	11/06/1995			
	E570SB003	570SB00302	924.4	U	11/14/1995			
	E570SB004	570SB00402	901.3	U	11/15/1995			
	E570SB005	570SB00502	1,624.5	=	01/16/1996			
	E570SB006	570SB00602	820.4	U	01/16/1996			
	E570SB007	570SB00702	808.9	U	01/16/1996			
	E570SB008	570SB00802	820.4	U	01/16/1996			
	E570SB009	570SB00902	502.2	=	01/16/1996			
	E570SB010	570SB01002	832.0	U	01/16/1996			
	E570SB011	570SB01102	901.3	U	11/20/1995			
	E570SB012	570SB01202	499.4	=	11/15/1995			
	E570SB014	570SB01402	832.0	U	11/06/1995			
	E570SB015	570SB01502	808.9	U	11/14/1995			
	E570SB0A4	570SB0A402	439.1	U	09/12/1996			
	E578SB001	578SB00102	391.1	=	05/16/1996			
	E578SB002	578SB00202	389.4	=	05/16/1996			
	E578SB003	578SB00302	404.4	U	05/16/1996			
	E578SB004	578SB00402	321.2	=	05/16/1996			
	E578SB005	578SB00502	322.9	=	05/16/1996			
	E578SB006	578SB00602	427.5	U	05/16/1996			

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils
RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential RBC (mg/kg)	SSL (mg/kg)	Zone E Backgr ound Range of Conc. (mg/kg)	
							Site-Specific SSL (unpaved) 0.078	Site-Specific SSL (paved) 1.04	
Benzene	Surface Soil					12		NA	
	E569SB001	569SB00101	0.006	U	10/13/1995				
	E569SB002	569SB00201	0.006	U	10/13/1995				
	E569SB003	569SB00301	0.006	U	10/13/1995				
	E569SB004	569SB00401	0.006	U	10/13/1995				
	E569SB005	569SB00501	0.002	J	10/13/1995				
	E570SB003	570SB00301	0.005	U	11/14/1995				
	E570SB004	570SB00401	0.006	U	11/15/1995				
	E570SB005	570SB00501	0.005	UJ	01/16/1996				
	E570SB006	570SB00601	0.006	UJ	01/16/1996				
	E570SB007	570SB00701	0.006	UJ	01/16/1996				
	E570SB008	570SB00801	0.005	UJ	01/16/1996				
	E570SB009	570SB00901	0.005	UJ	01/16/1996				
	E570SB010	570SB01001	0.005	U	01/16/1996				
	E570SB011	570SB01101	0.006	U	11/20/1995				
	E570SB012	570SB01201	0.005	U	11/15/1995				
	E570SB013	570SB01301	0.006	U	11/06/1995				
	E570SB014	570SB01401	0.006	U	11/06/1995				
	E570SB015	570SB01501	0.006	U	11/14/1995				
	E578SB001	578SB00101	0.005	U	05/16/1996				
	E578SB004	578SB00401	0.005	UJ	05/16/1996				
	E578SB005	578SB00501	0.006	U	05/16/1996				
	E578SB006	578SB00601	0.006	UJ	05/16/1996				
	E569SB005b	569SB00501b	0.68	=	04/25/2002				
	E569SB008	569SB00801	0.0056	U	03/04/2003				
	E569SB009	569SB00901	0.010	=	03/04/2003				
	E569SB010	569SB01001	0.437	J	03/04/2003				
	E569SB011	569SB01101	0.006	U	03/04/2003				
		AVERAGE *	0.0442						
	Subsurface Soil					12	Site-Specific SSL (unpaved) 0.078	Site-Specific SSL (paved) 1.04	NA
	E569SB001	569SB00102	0.006	U	10/13/1995				
	E569SB002	569SB00202	0.006	U	10/13/1995				
	E569SB003	569SB00302	0.006	U	10/13/1995				
	E569SB005	569SB00502	10.0	=	10/13/1995				

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils

RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential RBC (mg/kg)	SSL (mg/kg)	Zone E Backgr ound Range of Conc. (mg/kg)
Benzene						12	Site-Specific SSL (unpaved) 0.078	Site-Specific SSL (paved) 1.04
	E570SB003	570SB00302	0.006	U	11/14/1995			
	E570SB004	570SB00402	0.006	U	11/15/1995			
	E570SB005	570SB00502	0.006	UJ	01/16/1996			
	E570SB006	570SB00602	0.005	UJ	01/16/1996			
	E570SB008	570SB00802	0.005	UJ	01/16/1996			
	E570SB009	570SB00902	0.006	UJ	01/16/1996			
	E570SB011	570SB01102	0.006	U	11/20/1995			
	E570SB012	570SB01202	0.005	U	11/15/1995			
	E570SB013	570SB01302	0.005	U	11/06/1995			
	E570SB014	570SB01402	0.005	U	11/06/1995			
	E570SB015	570SB01502	0.005	U	11/14/1995			
	E578SB001	578SB00102	0.005	U	05/16/1996			
	E578SB002	578SB00202	0.005	U	05/16/1996			
	E578SB003	578SB00302	0.005	U	05/16/1996			
	E578SB004	578SB00402	0.005	U	05/16/1996			
	E578SB005	578SB00502	0.005	U	05/16/1996			
	E578SB006	578SB00602	0.006	U	05/16/1996			
	E569SB005b	569SB00502b	0.428	J	04/25/2002			
	E569SB008	569SB00802	0.006	U	03/04/2003			
	E569SB008	569SB00803	1.950	J	03/04/2003			
	E569SB009	569SB00902	0.001	J	03/04/2003			
	E569SB009	569SB00903	0.008	J	03/04/2003			
	E569SB010	569SB01002	0.001	J	03/04/2003			
	E569SB010	569SB01003	0.805	J	03/04/2003			
	E569SB011	569SB01102	0.006	U	03/04/2003			
	E569SB011	569SB01103	0.007	U	03/04/2003			
		AVERAGE*	0.4419					
Carbon Tetrachloride	Surface Soil					5	DAF = 1 0.003	NA
	E569SB001	569SB00101	0.006	U	10/13/1995			
	E569SB002	569SB00201	0.006	U	10/13/1995			
	E569SB003	569SB00301	0.006	U	10/13/1995			
	E569SB004	569SB00401	0.006	U	10/13/1995			
	E569SB005	569SB00501	0.005	U	10/13/1995			
	E570SB003	570SB00301	0.005	U	11/14/1995			
	E570SB004	570SB00401	0.006	U	11/15/1995			
	E570SB005	570SB00501	0.005	UJ	01/16/1996			

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils

RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential RBC (mg/kg)	SSL (mg/kg)	Zone E Background Range of Conc. (mg/kg)
	E570SB006	570SB00601	0.006	UJ	01/16/1996			
	E570SB007	570SB00701	0.006	UJ	01/16/1996			
	E570SB008	570SB00801	0.005	UJ	01/16/1996			
	E570SB009	570SB00901	0.005	UJ	01/16/1996			
	E570SB010	570SB01001	0.005	U	01/16/1996			
	E570SB011	570SB01101	0.006	U	11/20/1995			
	E570SB012	570SB01201	0.005	U	11/15/1995			
	E570SB013	570SB01301	0.006	U	11/06/1995			
	E570SB014	570SB01401	0.006	U	11/06/1995			
	E570SB015	570SB01501	0.006	U	11/14/1995			
	E578SB001	578SB00101	0.005	U	05/16/1996			
	E578SB004	578SB00401	0.005	UJ	05/16/1996			
	E578SB005	578SB00501	0.006	U	05/16/1996			
	E578SB006	578SB00601	0.006	UJ	05/16/1996			
	E569SB005b	569SB00501b	0.501	U	04/25/2002			
	Subsurface Soil					5	0.003	NA
	E569SB001	569SB00102	0.006	U	10/13/1995			
	E569SB002	569SB00202	0.006	U	10/13/1995			
	E569SB003	569SB00302	0.006	U	10/13/1995			
	E569SB005	569SB00502	3.80	=	10/13/1995			
	E570SB003	570SB00302	0.006	U	11/14/1995			
	E570SB004	570SB00402	0.006	U	11/15/1995			
	E570SB005	570SB00502	0.006	UJ	01/16/1996			
	E570SB006	570SB00602	0.005	UJ	01/16/1996			
	E570SB008	570SB00802	0.005	UJ	01/16/1996			
	E570SB009	570SB00902	0.006	UJ	01/16/1996			
	E570SB011	570SB01102	0.006	U	11/20/1995			
	E570SB012	570SB01202	0.005	U	11/15/1995			
	E570SB013	570SB01302	0.005	U	11/06/1995			
	E570SB014	570SB01402	0.005	U	11/06/1995			
	E570SB015	570SB01502	0.005	U	11/14/1995			
	E578SB001	578SB00102	0.005	U	05/16/1996			
	E578SB002	578SB00202	0.005	U	05/16/1996			
	E578SB003	578SB00302	0.005	U	05/16/1996			
	E578SB004	578SB00402	0.005	U	05/16/1996			
	E578SB005	578SB00502	0.005	U	05/16/1996			
	E578SB006	578SB00602	0.006	U	05/16/1996			
	E569SB005b	569SB00502b	0.971	U	04/25/2002			

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils
RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential RBC (mg/kg)	SSL (mg/kg)	SSL (mg/kg)	Zone E Background Range of Conc. (mg/kg)
						780	Site-Specific SSL (unpaved) 62	Site-Specific SSL (paved) 827	NA
Ethylbenzene	Surface Soil								
		E569SB001	569SB00101	0.006	U	10/13/1995			
		E569SB002	569SB00201	0.006	U	10/13/1995			
		E569SB003	569SB00301	0.006	UJ	10/13/1995			
		E569SB004	569SB00401	0.006	U	10/13/1995			
		E569SB005	569SB00501	0.003	J	10/13/1995			
		E570SB003	570SB00301	0.005	U	11/14/1995			
		E570SB004	570SB00401	0.006	U	11/15/1995			
		E570SB005	570SB00501	0.005	UJ	01/16/1996			
		E570SB006	570SB00601	0.006	UJ	01/16/1996			
		E570SB007	570SB00701	0.006	UJ	01/16/1996			
		E570SB008	570SB00801	0.005	UJ	01/16/1996			
		E570SB009	570SB00901	0.005	UJ	01/16/1996			
		E570SB010	570SB01001	0.005	U	01/16/1996			
		E570SB011	570SB01101	0.006	U	11/20/1995			
		E570SB012	570SB01201	0.005	U	11/15/1995			
		E570SB013	570SB01301	0.006	U	11/06/1995			
		E570SB014	570SB01401	0.006	U	11/06/1995			
		E570SB015	570SB01501	0.006	U	11/14/1995			
		E578SB001	578SB00101	0.005	U	05/16/1996			
		E578SB005	578SB00501	0.006	U	05/16/1996			
		E578SB006	578SB00601	0.006	UJ	05/16/1996			
		E569SB005b	569SB00501b	1.53	=	04/25/2002			
		E569SB008	569SB00801	0.006	U	03/04/2003			
		E569SB009	569SB00901	0.007	=	03/04/2003			
		E569SB010	569SB01001	9.330	=	03/04/2003			
		E569SB011	569SB01101	0.006	U	03/04/2003			
	Subsurface Soil					780	Site-Specific SSL (unpaved) 62	Site-Specific SSL (paved) 827	NA
		E569SB001	569SB00102	0.006	U	10/13/1995			
		E569SB002	569SB00202	0.006	U	10/13/1995			
		E569SB003	569SB00302	0.006	U	10/13/1995			
		E569SB005	569SB00502	170	=	10/13/1995			
		E570SB003	570SB00302	0.006	U	11/14/1995			

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils

RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential RBC (mg/kg)	SSL (mg/kg)	SSL (mg/kg)	Zone E Backgr ound Range of Conc. (mg/kg)
Ethylbenzene									
	E570SB004	570SB00402	0.006	U	11/15/1995		Site-Specific SSL (unpaved) 62	Site-Specific SSL (paved) 827	
	E570SB005	570SB00502	0.006	UJ	01/16/1996				
	E570SB006	570SB00602	0.005	UJ	01/16/1996				
	E570SB008	570SB00802	0.005	UJ	01/16/1996				
	E570SB009	570SB00902	0.006	UJ	01/16/1996				
	E570SB011	570SB01102	0.006	U	11/20/1995				
	E570SB012	570SB01202	0.001	J	11/15/1995				
	E570SB013	570SB01302	0.005	U	11/06/1995				
	E570SB014	570SB01402	0.005	U	11/06/1995				
	E570SB015	570SB01502	0.005	U	11/14/1995				
	E578SB001	578SB00102	0.005	U	05/16/1996				
	E578SB002	578SB00202	0.005	U	05/16/1996				
	E578SB003	578SB00302	0.005	U	05/16/1996				
	E578SB004	578SB00402	0.005	U	05/16/1996				
	E578SB005	578SB00502	0.005	U	05/16/1996				
	E578SB006	578SB00602	0.006	U	05/16/1996				
	E569SB005b	569SB00502b	19.3	=	04/25/2002				
	E569SB008	569SB00802	0.006	U	03/04/2003				
	E569SB008	569SB00803	51.900	=	03/04/2003				
	E569SB009	569SB00902	0.006	U	03/04/2003				
	E569SB009	569SB00903	0.004	J	03/04/2003				
	E569SB010	569SB01002	0.056	=	03/04/2003				
	E569SB010	569SB01003	55.000	=	03/04/2003				
	E569SB011	569SB01102	0.000	J	03/04/2003				
	E569SB011	569SB01103	0.007	U	03/04/2003				
Lead	Surface Soil					400	400		1 - 400
	E569SB001	569SB00101	108.00	J	10/13/1995				
	E569SB002	569SB00201	10.20	J	10/13/1995				
	E569SB003	569SB00301	18.80	J	10/13/1995				
	E569SB004	569SB00401	91.40	J	10/13/1995				
	E569SB005	569SB00501	3.60	J	10/13/1995				
	E569SB007	569SB00701b	78.50	=	09/14/1996				
	E570SB002	570SB00201	332.00	=	11/06/1995				
	E570SB003	570SB00301	39.60	=	11/14/1995				
	E570SB004	570SB00401	89.20	=	11/15/1995				
	E570SB005	570SB00501	138.00	J	01/16/1996				
	E570SB006	570SB00601	47.70	J	01/16/1996				

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils
RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential RBC (mg/kg)	SSL (mg/kg)	Zone E Background Range of Conc. (mg/kg)
	E570SB007	570SB00701	61.10	J	01/16/1996			
	E570SB008	570SB00801	29.90	J	01/16/1996			
	E570SB009	570SB00901	14.30	J	01/16/1996			
	E570SB010	570SB01001	24.10	J	01/16/1996			
	E570SB011	570SB01101	133.00	J	11/20/1995			
	E570SB012	570SB01201	193.00	=	11/15/1995			
	E570SB013	570SB01301	120.00	=	11/06/1995			
	E570SB014	570SB01401	100.00	=	11/06/1995			
	E570SB015	570SB01501	50.70	=	11/14/1995			
	E570SB0A4	570SB0A401	68.90	J	09/12/1996			
	E578SB001	578SB00101	567.00	=	05/16/1996			
	E578SB002	578SB00201	22.70	=	05/16/1996			
	E578SB003	578SB00301	20.30	=	05/16/1996			
	E578SB004	578SB00401	22.00	=	05/16/1996			
	E578SB005	578SB00501	187.00	=	05/16/1996			
	E578SB006	578SB00601	17.60	=	05/16/1996			
		Average Conc.	95.87					
Lead	Subsurface Soil					NA	400	1.8 - 322
	E569SB001	569SB00102	2.30	J	10/13/1995			
	E569SB002	569SB00202	3.90	J	10/13/1995			
	E569SB003	569SB00302	4.30	J	10/13/1995			
	E569SB004	569SB00402	2.00	J	10/13/1995			
	E569SB005	569SB00502	7.30	J	10/13/1995			
	E569SB007	569SB00702b	12.20	=	09/14/1996			
	E570SB002	570SB00202	4.90	=	11/06/1995			
	E570SB003	570SB00302	1.90	=	11/14/1995			
	E570SB004	570SB00402	63.30	=	11/15/1995			
	E570SB005	570SB00502	4.00	J	01/16/1996			
	E570SB006	570SB00602	10.50	J	01/16/1996			
	E570SB007	570SB00702	1.70	J	01/16/1996			
	E570SB008	570SB00802	2.80	J	01/16/1996			
	E570SB009	570SB00902	24.50	J	01/16/1996			
	E570SB010	570SB01002	1.60	J	01/16/1996			
	E570SB011	570SB01102	16.20	J	11/20/1995			
	E570SB012	570SB01202	13.60	=	11/15/1995			
	E570SB013	570SB01302	1.40	=	11/06/1995			
	E570SB014	570SB01402	3.20	=	11/06/1995			
	E570SB015	570SB01502	2.10	=	11/14/1995			
	E570SB0A4	570SB0A402	1.30	J	09/12/1996			

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils
 RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential RBC (mg/kg)	SSL (mg/kg)	Zone E Backgr ound Range of Conc. (mg/kg)	
Methylene Chloride			406.00	=	05/16/1996	85	Site-Specific SSL (unpaved) 0.023 Site-Specific SSL (paved) 0.277	NA	
		E578SB001	578SB00102	7.50	=				05/16/1996
		E578SB002	578SB00202	2.60	=				05/16/1996
		E578SB003	578SB00302	7.10	=				05/16/1996
		E578SB004	578SB00402	14.50	=				05/16/1996
		E578SB005	578SB00502	3.10	=				05/16/1996
		E578SB006	578SB00602						
			Average Conc.	23.18					
			Surface Soil						
		E569SB001	569SB00101	0.006	U				10/13/1995
	E569SB002	569SB00201	0.006	U	10/13/1995				
	E569SB003	569SB00301	0.006	U	10/13/1995				
	E569SB004	569SB00401	0.006	U	10/13/1995				
	E569SB005	569SB00501	0.005	U	10/13/1995				
	E570SB003	570SB00301	0.005	U	11/14/1995				
	E570SB004	570SB00401	0.006	U	11/15/1995				
	E570SB005	570SB00501	0.009	J	01/16/1996				
	E570SB006	570SB00601	0.017	J	01/16/1996				
	E570SB007	570SB00701	0.015	J	01/16/1996				
	E570SB008	570SB00801	0.012	J	01/16/1996				
	E570SB009	570SB00901	0.012	J	01/16/1996				
	E570SB010	570SB01001	0.014	J	01/16/1996				
	E570SB011	570SB01101	0.021	U	11/20/1995				
	E570SB012	570SB01201	0.005	U	11/15/1995				
	E570SB013	570SB01301	0.011	U	11/06/1995				
	E570SB014	570SB01401	0.011	U	11/06/1995				
	E570SB015	570SB01501	0.006	U	11/14/1995				
	E578SB001	578SB00101	0.011	U	05/16/1996				
	E578SB004	578SB00401	0.011	UJ	05/16/1996				
	E578SB005	578SB00501	0.012	U	05/16/1996				
	E578SB006	578SB00601	0.037	UJ	05/16/1996				
		Subsurface Soil							
	E569SB001	569SB00102	0.008	U	10/13/1995				
	E569SB002	569SB00202	0.006	U	10/13/1995				
	E569SB003	569SB00302	0.011	U	10/13/1995				
	E569SB005	569SB00502	4.100	U	10/13/1995				
	E570SB003	570SB00302	0.006	U	11/14/1995				
	E570SB004	570SB00402	0.006	U	11/15/1995				

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils
RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential		Zone E Background Range of Conc. (mg/kg)
						RBC (mg/kg)	SSL (mg/kg)	
						85	Site-Specific SSL (unpaved) 0.023	Site-Specific SSL (paved) 0.277
	E570SB005	570SB00502	0.011	J	01/16/1996			
	E570SB006	570SB00602	0.007	J	01/16/1996			
	E570SB008	570SB00802	0.011	J	01/16/1996			
	E570SB009	570SB00902	0.019	J	01/16/1996			
	E570SB011	570SB01102	0.021	U	11/20/1995			
	E570SB012	570SB01202	0.006	U	11/15/1995			
	E570SB013	570SB01302	0.005	U	11/06/1995			
	E570SB014	570SB01402	0.005	U	11/06/1995			
	E570SB015	570SB01502	0.005	U	11/14/1995			
	E578SB001	578SB00102	0.011	U	05/16/1996			
	E578SB002	578SB00202	0.011	U	05/16/1996			
	E578SB003	578SB00302	0.011	U	05/16/1996			
	E578SB004	578SB00402	0.010	U	05/16/1996			
	E578SB005	578SB00502	0.010	U	05/16/1996			
	E578SB006	578SB00602	0.011	U	05/16/1996			
PCE	Surface Soil					12	DAF = 1 0.003	NA
	E569SB001	569SB00101	0.006	U	10/13/1995			
	E569SB002	569SB00201	0.006	U	10/13/1995			
	E569SB003	569SB00301	0.006	UJ	10/13/1995			
	E569SB004	569SB00401	0.006	U	10/13/1995			
	E569SB005	569SB00501	0.005	U	10/13/1995			
	E570SB003	570SB00301	0.005	U	11/14/1995			
	E570SB004	570SB00401	0.006	U	11/15/1995			
	E570SB005	570SB00501	0.005	UJ	01/16/1996			
	E570SB006	570SB00601	0.006	UJ	01/16/1996			
	E570SB007	570SB00701	0.006	UJ	01/16/1996			
	E570SB008	570SB00801	0.005	UJ	01/16/1996			
	E570SB009	570SB00901	0.005	UJ	01/16/1996			
	E570SB010	570SB01001	0.005	U	01/16/1996			
	E570SB011	570SB01101	0.006	U	11/20/1995			
	E570SB012	570SB01201	0.005	U	11/15/1995			
	E570SB013	570SB01301	0.006	U	11/06/1995			
	E570SB014	570SB01401	0.006	U	11/06/1995			
	E570SB015	570SB01501	0.006	U	11/14/1995			
	E578SB001	578SB00101	0.005	U	05/16/1996			
	E578SB005	578SB00501	0.003	J	05/16/1996			
	E578SB006	578SB00601	0.006	UJ	05/16/1996			

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils
RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential RBC (mg/kg)	SSL (mg/kg)	Zone E Backgr ound Range of Conc. (mg/kg)	
PCE	Subsurface Soil					12	0.003	NA	
	E569SB001	569SB00102	0.006	U	10/13/1995				
	E569SB002	569SB00202	0.006	U	10/13/1995				
	E569SB003	569SB00302	0.006	U	10/13/1995				
	E569SB005	569SB00502	3.6	U	10/13/1995				
	E570SB003	570SB00302	0.006	U	11/14/1995				
	E570SB004	570SB00402	0.006	U	11/15/1995				
	E570SB005	570SB00502	0.006	UJ	01/16/1996				
	E570SB006	570SB00602	0.005	UJ	01/16/1996				
	E570SB008	570SB00802	0.005	UJ	01/16/1996				
	E570SB009	570SB00902	0.006	UJ	01/16/1996				
	E570SB011	570SB01102	0.006	U	11/20/1995				
	E570SB012	570SB01202	0.005	U	11/15/1995				
	E570SB013	570SB01302	0.005	U	11/06/1995				
	E570SB014	570SB01402	0.005	U	11/06/1995				
	E570SB015	570SB01502	0.005	U	11/14/1995				
	E578SB001	578SB00102	0.005	U	05/16/1996				
	E578SB002	578SB00202	0.005	U	05/16/1996				
	E578SB003	578SB00302	0.005	U	05/16/1996				
	E578SB004	578SB00402	0.005	U	05/16/1996				
E578SB005	578SB00502	0.005	U	05/16/1996					
E578SB006	578SB00602	0.006	U	05/16/1996					
Toluene	Surface Soil					1,600	Site-Specific SSL (unpaved) 45	Site-Specific SSL (paved) 602	NA
	E569SB001	569SB00101	0.006	U	10/13/1995				
	E569SB002	569SB00201	0.006	U	10/13/1995				
	E569SB003	569SB00301	0.006	UJ	10/13/1995				
	E569SB004	569SB00401	0.006	U	10/13/1995				
	E569SB005	569SB00501	0.005	U	10/13/1995				
	E570SB003	570SB00301	0.005	U	11/14/1995				
	E570SB004	570SB00401	0.006	U	11/15/1995				
	E570SB005	570SB00501	0.005	UJ	01/16/1996				
	E570SB006	570SB00601	0.007	J	01/16/1996				
	E570SB007	570SB00701	0.006	UJ	01/16/1996				
	E570SB008	570SB00801	0.005	UJ	01/16/1996				
	E570SB009	570SB00901	0.005	UJ	01/16/1996				
	E570SB010	570SB01001	0.005	U	01/16/1996				
	E570SB011	570SB01101	0.006	U	11/20/1995				

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils
RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential RBC (mg/kg)	SSL (mg/kg)	Zone E Backgr ound Range of Conc. (mg/kg)	
	E570SB012	570SB01201	0.005	U	11/15/1995				
	E570SB013	570SB01301	0.006	U	11/06/1995				
	E570SB014	570SB01401	0.006	U	11/06/1995				
	E570SB015	570SB01501	0.006	U	11/14/1995				
	E578SB001	578SB00101	0.005	U	05/16/1996				
	E578SB005	578SB00501	0.006	U	05/16/1996				
	E578SB006	578SB00601	0.006	UJ	05/16/1996				
	E569SB005b	569SB00501b	0.093	J	04/25/2002				
	E569SB008	569SB00801	0.006	U	03/04/2003				
	E569SB009	569SB00901	0.000	J	03/04/2003				
	E569SB010	569SB01001	0.069	J	03/04/2003				
	E569SB011	569SB01101	0.006	U	03/04/2003				
Subsurface Soil						NA	Site-Specific SSL (unpaved) 45	Site-Specific SSL (paved) 602	NA
	E569SB001	569SB00102	0.006	U	10/13/1995				
	E569SB002	569SB00202	0.006	U	10/13/1995				
	E569SB003	569SB00302	0.006	U	10/13/1995				
	E569SB005	569SB00502	220	=	10/13/1995				
	E570SB003	570SB00302	0.006	U	11/14/1995				
	E570SB004	570SB00402	0.006	U	11/15/1995				
	E570SB005	570SB00502	0.006	UJ	01/16/1996				
	E570SB006	570SB00602	0.005	UJ	01/16/1996				
	E570SB008	570SB00802	0.005	UJ	01/16/1996				
	E570SB009	570SB00902	0.006	UJ	01/16/1996				
	E570SB011	570SB01102	0.006	U	11/20/1995				
	E570SB012	570SB01202	0.001	J	11/15/1995				
	E570SB013	570SB01302	0.005	U	11/06/1995				
	E570SB014	570SB01402	0.005	U	11/06/1995				
	E570SB015	570SB01502	0.005	U	11/14/1995				
	E578SB001	578SB00102	0.005	U	05/16/1996				
	E578SB002	578SB00202	0.005	U	05/16/1996				
	E578SB003	578SB00302	0.005	U	05/16/1996				
	E578SB004	578SB00402	0.005	U	05/16/1996				
	E578SB005	578SB00502	0.005	U	05/16/1996				
	E578SB006	578SB00602	0.006	U	05/16/1996				
	E569SB005b	569SB00502b	3.17	=	04/25/2002				
	E569SB008	569SB00802	0.006	U	03/04/2003				

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils
RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential RBC (mg/kg)	SSL (mg/kg)	Zone E Background Range of Conc. (mg/kg)
	E569SB008	569SB00803	0.773	J	03/04/2003			
	E569SB009	569SB00902	0.006	U	03/04/2003			
	E569SB009	569SB00903	0.001	J	03/04/2003			
	E569SB010	569SB01002	0.006	U	03/04/2003			
	E569SB010	569SB01003	1.470	J	03/04/2003			
	E569SB011	569SB01102	0.006	U	03/04/2003			
	E569SB011	569SB01103	0.007	U	03/04/2003			
Xylenes (Total)	Surface Soil					16,000	Site-Specific SSL (unpaved) 882 Site-Specific SSL (paved) 11,801	NA
	E569SB001	569SB00101	0.006	U	10/13/1995			
	E569SB002	569SB00201	0.006	U	10/13/1995			
	E569SB003	569SB00301	0.006	UJ	10/13/1995			
	E569SB004	569SB00401	0.006	U	10/13/1995			
	E569SB005	569SB00501	0.005	U	10/13/1995			
	E570SB003	570SB00301	0.005	U	11/14/1995			
	E570SB004	570SB00401	0.006	U	11/15/1995			
	E570SB005	570SB00501	0.005	UJ	01/16/1996			
	E570SB006	570SB00601	0.006	UJ	01/16/1996			
	E570SB007	570SB00701	0.006	UJ	01/16/1996			
	E570SB008	570SB00801	0.005	UJ	01/16/1996			
	E570SB009	570SB00901	0.005	UJ	01/16/1996			
	E570SB010	570SB01001	0.005	U	01/16/1996			
	E570SB011	570SB01101	0.006	U	11/20/1995			
	E570SB012	570SB01201	0.005	U	11/15/1995			
	E570SB013	570SB01301	0.006	U	11/06/1995			
	E570SB014	570SB01401	0.006	U	11/06/1995			
	E570SB015	570SB01501	0.006	U	11/14/1995			
	E578SB001	578SB00101	0.005	U	05/16/1996			
	E578SB005	578SB00501	0.006	U	05/16/1996			
	E578SB006	578SB00601	0.006	UJ	05/16/1996			
	E569SB005b	569SB00501b	0.207	J	04/25/2002			
	E569SB008	569SB00801	0.006	U	03/04/2003			
	E569SB009	569SB00901	0.003	J	03/04/2003			
	E569SB010	569SB01003	151.000	=	03/04/2003			
	E569SB011	569SB01101	0.006	U	03/04/2003			

TABLE 5-1

Detected Concentrations of Arsenic, BEQs, Acetone, Benzene, Carbon Tetrachloride, Ethylbenzene, Lead, Methylene Chloride, PCE, Toluene, and Xylenes (Total) in Surface and Subsurface Soils
 RFI Report Addendum, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result (mg/kg)	Qualifier	Date Collected	Region III Residential	SSL (mg/kg)		Zone E Backgr ound Range of Conc. (mg/kg)
						RBC (mg/kg)	Site-Specific SSL (unpaved)	Site-Specific SSL (paved)	NA
Xylenes (Total)	Subsurface Soil					NA	882	11,801	NA
	E569SB001	569SB00102	0.006	U	10/13/1995				
	E569SB002	569SB00202	0.006	U	10/13/1995				
	E569SB003	569SB00302	0.006	U	10/13/1995				
	E569SB005	569SB00502	800	=	10/13/1995				
	E570SB003	570SB00302	0.006	U	11/14/1995				
	E570SB004	570SB00402	0.001	J	11/15/1995				
	E570SB005	570SB00502	0.006	UJ	01/16/1996				
	E570SB006	570SB00602	0.005	UJ	01/16/1996				
	E570SB008	570SB00802	0.005	UJ	01/16/1996				
	E570SB009	570SB00902	0.006	UJ	01/16/1996				
	E570SB011	570SB01102	0.006	U	11/20/1995				
	E570SB012	570SB01202	0.005	U	11/15/1995				
	E570SB013	570SB01302	0.005	U	11/06/1995				
	E570SB014	570SB01402	0.003	J	11/06/1995				
	E570SB015	570SB01502	0.005	U	11/14/1995				
	E578SB001	578SB00102	0.005	U	05/16/1996				
	E578SB002	578SB00202	0.005	U	05/16/1996				
	E578SB003	578SB00302	0.005	U	05/16/1996				
	E578SB004	578SB00402	0.005	U	05/16/1996				
	E578SB005	578SB00502	0.005	U	05/16/1996				
	E578SB006	578SB00602	0.006	U	05/16/1996				
	E569SB005b	569SB00502b	44.2	=	04/25/2002				
	E569SB008	569SB00802	0.006	U	03/04/2003				
	E569SB008	569SB00803	19.00	=	03/04/2003				
	E569SB009	569SB00902	0.006	U	03/04/2003				
	E569SB009	569SB00903	0.002	J	03/04/2003				
	E569SB010	569SB01001	1.980	=	03/04/2003				
	E569SB010	569SB01002	0.016	=	03/04/2003				
	E569SB011	569SB01102	0.006	U	03/04/2003				
	E569SB011	569SB01103	0.007	U	03/04/2003				

Averages were calculated using half the detection limit for detections below laboratory detection limits, and the full concentrations for those concentrations with an "=" or "J" qualifier.

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

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

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

U Indicates that the concentration was not detected.

TABLE 5-2

Aluminum, Arsenic, Beryllium, Chromium, Lead, Thallium, Vanadium, Chloroform, TCE, PCE, and 1,2-DCE (Total) in Groundwater
 RFI Report Addendum, AOCs 569, 570 and 578, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Aluminum		Arsenic		Beryllium		Chromium	
		Concentration (µg/L)	Qualifier						
	MCL	NA		50		4		100	
	EPA Region III Tap Water RBC (HI=0.1)	3,700		0.045		7.3		11	
	Zone E Shallow Background Range Concentration ^a	19 - 16,100		2.6 - 316		0.3 - 0.9		0.8 - 31	
	Zone E Deep Background Range Concentration ^a	19 - 461		3 - 132		0.2 - 1.3		0.8 - 27	
E569GW001	05/03/1996	1,360.0	=	5.00	UJ	1.00	U	5.00	U
E569GW001	07/25/1996	1,280.0	=	2.50	U	0.99	U	0.80	U
E569GW001	11/21/1996	1,510.0	J	2.50	UJ	0.95	J	0.80	U
E569GW001	02/05/1997	1,370.0	=	2.50	U	0.76	J	0.80	U
E569GW002	05/07/1996	36.3	U	5.00	UJ	1.00	U	1.00	U
E569GW002	07/25/1996	25.1	UJ	2.50	U	0.31	U	0.80	U
E569GW002	11/21/1996	60.3	J	2.50	UJ	0.30	U	0.80	U
E569GW002	02/06/1997	134.0	J	2.50	U	0.31	J	0.80	U
E570GW001	05/02/1996	833.0	J	2.50	U	0.71	J	0.80	U
E570GW001	07/23/1996	716.0	=	2.50	U	1.30	U	0.81	U
E570GW001	11/20/1996	742.0	J	2.50	UJ	0.79	J	0.89	J
E570GW001	01/31/1997	755.0	=	2.50	U	0.69	J	0.80	U
E570GW002	05/03/1996	67,500.0	=	40.20	=	2.00	U	137.00	=
E570GW002	07/23/1996	8490.0	=	8.50	U	1.00	U	15.50	=
E570GW002	11/19/1996	16,300.0	=	13.50	=	0.80	J	31.20	=

TABLE 5-2

Aluminum, Arsenic, Beryllium, Chromium, Lead, Thallium, Vanadium, Chloroform, TCE, PCE, and 1,2-DCE (Total) in Groundwater
RFI Report Addendum, AOCs 569, 570 and 578, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Aluminum		Arsenic		Beryllium		Chromium	
		Concentration (µg/L)	Qualifier						
	MCL	NA		50		4		100	
	EPA Region III Tap Water RBC (HI=0.1)	3,700		0.045		7.3		11	
	Zone E Shallow Background Range Concentration^a	19 – 16,100		2.6 - 316		0.3 – 0.9		0.8 - 31	
	Zone E Deep Background Range Concentration^a	19 - 461		3 - 132		0.2 – 1.3		0.8 - 27	
E570GW002	02/03/1997	11,200.0	=	8.90	J	0.67	J	21.40	=
E570GW003	05/06/1996	65.8	U	5.00	UJ	1.00	U	5.00	U
E570GW003	07/22/1996	191.0	=	2.50	U	0.45	U	0.80	U
E570GW003	11/20/1996	40.4	J	2.50	UJ	0.30	U	0.80	U
E570GW003	02/04/1997	74.8	J	2.50	U	0.31	J	0.80	U
E570GW004	11/01/1996	2,490.0	=	5.70	J	0.59	J	5.40	J
E570GW004	10/08/1997	165.0	=	2.10	U	0.20	U	1.00	U
E570GW004	03/06/1997	1,180.0	=	2.10	U	0.38	J	2.90	U
E570GW004	06/27/1997	482.0	=	2.10	U	0.27	UJ	1.00	U
E569GW01D	05/09/1996	23.9	J	5.30	J	0.30	U	2.20	U
E569GW01D	07/25/1996	18.0	UJ	3.20	U	0.35	U	0.80	U
E569GW01D	11/21/1996	18.0	UJ	4.40	J	0.30	U	0.80	U
E569GW01D	02/05/1997	18.0	U	2.70	J	0.32	J	0.80	U
E570GW02D	05/06/1996	30.0	U	5.00	UJ	1.00	U	5.00	U
E570GW02D	07/23/1996	18.0	U	3.20	U	0.76	U	0.80	U

TABLE 5-2

Aluminum, Arsenic, Beryllium, Chromium, Lead, Thallium, Vanadium, Chloroform, TCE, PCE, and 1,2-DCE (Total) in Groundwater
 RFI Report Addendum, AOCs 569, 570 and 578, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Aluminum		Arsenic		Beryllium		Chromium	
		Concentration (µg/L)	Qualifier						
	MCL	NA		50		4		100	
	EPA Region III Tap Water RBC (HI=0.1)	3,700		0.045		7.3		11	
	Zone E Shallow Background Range Concentration^a	19 – 16,100		2.6 - 316		0.3 – 0.9		0.8 - 31	
	Zone E Deep Background Range Concentration^a	19 - 461		3 - 132		0.2 – 1.3		0.8 - 27	
E570GW02D	11/19/1996	37.0	U	2.50	U	0.30	U	0.80	U
E570GW02D	01/31/1997	18.1	J	2.50	U	0.30	U	0.80	U
E570GW03D	05/10/1996	23.0	U	2.50	UJ	0.30	U	2.20	U
E570GW03D	07/22/1996	20.1	J	2.50	U	0.38	U	0.80	U
E570GW03D	11/19/1996	19.5	U	2.50	U	0.30	U	1.10	U
E570GW03D	02/04/1997	18.0	U	2.50	U	0.30	U	0.80	U

^a The Zone E Background Range of Concentrations were obtained from Appendix J of the *Project Team Notebook and Instructions - Charleston Naval Complex, Environmental Restoration Project, Revision 1A* (CH2M-Jones, December 2001).

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

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

HI Hazard index

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.

µg/L Micrograms per liter

NA Screening criteria not available for the referenced compound.

U Indicates analyte not detected above laboratory detection limit.

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

TABLE 5-2

Aluminum, Arsenic, Beryllium, Chromium, Lead, Thallium, Vanadium, Chloroform, TCE, PCE, and 1,2-DCE (Total) in Groundwater
 RFI Report Addendum, AOCs 569, 570 and 578, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Lead		Thallium		Vanadium	
		Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier
	MCL	15		2		NA	
	EPA Region III Tap Water RBC (HI=0.1)	15		0.26		26	
	Zone E Shallow Background Range Concentration^a	2 - 47		3 - 6		0.6 - 26	
	Zone E Deep Background Range Concentration^a	2 - 3		3 - 7		0.5 - 8	
E569GW001	05/03/1996	3.00	U	5.00	U	5.00	U
E569GW001	07/25/1996	1.70	U	3.70	U	0.50	UJ
E569GW001	11/21/1996	1.70	U	2.70	UJ	0.50	UJ
E569GW001	02/05/1997	1.70	U	2.70	UJ	0.50	U
E569GW002	05/07/1996	3.00	U	5.00	U	1.00	U
E569GW002	07/25/1996	1.70	U	2.70	U	0.50	UJ
E569GW002	11/21/1996	1.70	U	3.40	UJ	0.50	UJ
E569GW002	02/06/1997	1.70	U	2.70	UJ	0.91	J
E570GW001	05/02/1996	1.70	U	2.70	U	0.67	U
E570GW001	07/23/1996	1.70	U	2.70	U	0.50	U
E570GW001	11/20/1996	1.70	U	2.70	UJ	0.50	UJ
E570GW001	01/31/1997	1.70	U	4.70	U	0.58	J
E570GW002	05/03/1996	77.50	=	5.00	U	180.00	=
E570GW002	07/23/1996	14.50	=	2.70	U	26.70	=
E570GW002	11/19/1996	22.50	=	2.70	U	42.00	J

TABLE 5-2

Aluminum, Arsenic, Beryllium, Chromium, Lead, Thallium, Vanadium, Chloroform, TCE, PCE, and 1,2-DCE (Total) in Groundwater
RFI Report Addendum, AOCs 569, 570 and 578, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Lead		Thallium		Vanadium	
		Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier
	MCL	15		2		NA	
	EPA Region III Tap Water RBC (HI=0.1)	15		0.26		26	
	Zone E Shallow Background Range Concentration^a	2 - 47		3 - 6		0.6 - 26	
	Zone E Deep Background Range Concentration^a	2 - 3		3 - 7		0.5 - 8	
E570GW002	02/03/1997	17.90	=	5.90	U	31.30	J
E570GW003	05/06/1996	3.00	U	5.00	U	5.00	U
E570GW003	07/22/1996	1.70	U	2.70	U	1.50	U
E570GW003	11/20/1996	1.70	U	2.70	UJ	0.50	UJ
E570GW003	02/04/1997	1.70	U	2.70	UJ	0.50	U
E570GW004	11/01/1996	4.40	=	2.70	UJ	9.20	J
E570GW004	10/08/1997	0.90	U	5.00	U	1.10	U
E570GW004	03/06/1997	0.90	U	5.00	U	1.20	J
E570GW004	06/27/1997	0.90	U	5.00	U	2.20	J
E569GW01D	05/09/1996	2.30	J	5.50	J	3.40	U
E569GW01D	07/25/1996	1.70	U	2.70	U	0.83	UJ
E569GW01D	11/21/1996	1.70	U	2.70	UJ	0.50	UJ
E569GW01D	02/05/1997	1.70	U	2.70	UJ	0.50	U
E570GW02D	05/06/1996	3.00	U	5.00	U	5.00	U
E570GW02D	07/23/1996	1.70	U	2.70	U	0.50	U

TABLE 5-2

Aluminum, Arsenic, Beryllium, Chromium, Lead, Thallium, Vanadium, Chloroform, TCE, PCE, and 1,2-DCE (Total) in Groundwater
 RFI Report Addendum, AOCs 569, 570 and 578, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Lead		Thallium		Vanadium	
		Concentration ($\mu\text{g/L}$)	Qualifier	Concentration ($\mu\text{g/L}$)	Qualifier	Concentration ($\mu\text{g/L}$)	Qualifier
	MCL	15		2		NA	
	EPA Region III Tap Water RBC (HI=0.1)	15		0.26		26	
	Zone E Shallow Background Range Concentration^a	2 - 47		3 - 6		0.6 - 26	
	Zone E Deep Background Range Concentration^a	2 - 3		3 - 7		0.5 - 8	
E570GW02D	11/19/1996	1.70	U	6.10	J	0.54	U
E570GW02D	01/31/1997	1.70	U	5.30	U	0.50	U
E570GW03D	05/10/1996	1.70	U	2.70	UJ	3.40	U
E570GW03D	07/22/1996	1.70	U	2.70	U	0.50	U
E570GW03D	11/19/1996	1.70	U	2.70	U	0.50	U
E570GW03D	02/04/1997	1.70	U	2.70	UJ	0.50	U

^a The Zone E Mean Background Reference Concentrations and Range of Concentrations were obtained from Appendix J of the *Project Team Notebook and Instructions - Charleston Naval Complex, Environmental Restoration Project, Revision 1A* (CH2M-Jones, December 2001).

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

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

HI Hazard index

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.

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

NA Screening criteria not available for the referenced compound.

U Indicates analyte not detected above laboratory detection limit.

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

TABLE 5-2
 Aluminum, Arsenic, Beryllium, Chromium, Lead, Thallium, Vanadium, Chloroform, TCE, PCE, and 1,2-DCE (Total) in Groundwater
 RFI Report Addendum, AOCs 569, 570 and 578, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Chloroform		Trichloroethene (TCE)		Tetrachloroethene (PCE)		1,2-Dichloroethene (Total)	
		Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier
	MCL	100		5		5		70	
EPA Region III Tap Water RBC (HI=0.1)		0.15		1.6		1.1		5.5	
E569GW001	05/03/1996	5.00	U	5.00	U	1.00	J	5.00	U
E569GW001	07/25/1996	5.00	U	5.00	U	5.00	U	5.00	U
E569GW001	11/21/1996	5.00	U	1.00	J	10.00	=	5.00	U
E569GW001	02/05/1997	5.00	U	3.00	J	53.00	=	5.00	U
E569GW001	03/10/1998	5.00	SU	2.00	SJ	29.00	S=	5.00	SU
E569GW001	10/12/1998	5.00	SU	2.00	SJ	45.00	S=	-----	-----
E569GW001	04/17/2002	5.00	U	4.70	J	18.90	=	0.92	J
E569GW002	05/07/1996	5.00	U	4.00	J	9.00	=	2.00	J
E569GW002	07/25/1996	5.00	U	3.00	J	8.00	=	5.00	U
E569GW002	11/21/1996	5.00	U	6.00	=	13.00	=	2.00	J
E569GW002	02/06/1997	5.00	U	5.00	U	2.00	J	5.00	U
E569GW002	03/06/1998	5.00	SU	5.00	SU	4.00	SJ	5.00	SU
E569GW002	10/13/1998	5.00	SU	4.00	SJ	8.00	S=	-----	-----
E569GW002	04/16/2002	5.00	U	1.00	J	2.10	J	0.34	J
E569GW003	03/06/2002	5.00	U	2.40	J	20.60	=	0.90	J
E569GW004	03/06/2002	5.00	U	0.45	J	5.90	=	5.00	U
E569GW005	03/06/2002	5.00	U	5.00	U	1.10	J	5.00	U

TABLE 5-2
 Aluminum, Arsenic, Beryllium, Chromium, Lead, Thallium, Vanadium, Chloroform, TCE, PCE, and 1,2-DCE (Total) in Groundwater
 RFI Report Addendum, AOCs 569, 570 and 578, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Chloroform		Trichloroethene (TCE)		Tetrachloroethene (PCE)		1,2-Dichloroethene (Total)	
		Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier
	MCL	100		5		5		70	
EPA Region III Tap Water RBC (HI=0.1)		0.15		1.6		1.1		5.5	
E570GW001	05/02/1996	5.00	U	5.00	U	5.00	U	5.00	U
E570GW001	07/23/1996	5.00	U	5.00	U	5.00	U	5.00	U
E570GW001	11/20/1996	5.00	U	5.00	U	7.00	=	5.00	U
E570GW001	01/31/1997	5.00	U	5.00	U	16.00	=	5.00	U
E570GW001	03/10/1998	5.00	SU	1.00	SJ	58.00	S=	5.00	SU
E570GW001	10/13/1998	5.00	SU	5.00	SU	8.00	S=	-----	-----
E570GW001	04/17/2002	5.00	U	2.30	J	46.50	=	0.36	J
E570GW002	05/03/1996	5.00	U	5.00	U	5.00	U	5.00	U
E570GW002	07/23/1996	5.00	U	5.00	U	5.00	U	5.00	U
E570GW002	11/19/1996	5.00	U	5.00	U	5.00	U	5.00	U
E570GW002	02/03/1997	5.00	U	5.00	U	5.00	U	5.00	U
E570GW002	10/13/1998	5.00	SU	5.00	SU	5.00	SU	-----	-----
E570GW003	05/06/1996	2.00	J	5.00	U	5.00	U	5.00	U
E570GW003	07/22/1996	5.00	U	5.00	U	5.00	U	5.00	U
E570GW003	11/20/1996	5.00	U	5.00	U	5.00	U	5.00	U
E570GW003	02/04/1997	5.00	U	5.00	U	5.00	U	5.00	U
E570GW003	03/06/1998	5.00	SU	5.00	SU	5.00	SU	5.00	SU

TABLE 5-2
 Aluminum, Arsenic, Beryllium, Chromium, Lead, Thallium, Vanadium, Chloroform, TCE, PCE, and 1,2-DCE (Total) in Groundwater
RFI Report Addendum, AOCs 569, 570 and 578, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Chloroform		Trichloroethene (TCE)		Tetrachloroethene (PCE)		1,2-Dichloroethene (Total)	
		Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier
	MCL	100		5		5		70	
EPA Region III Tap Water RBC (HI=0.1)		0.15		1.6		1.1		5.5	
E570GW003	10/12/1998	5.00	SU	5.00	SU	5.00	SU	-----	-----
E570GW004	11/01/1996	5.00	U	5.00	U	5.00	U	5.00	U
E570GW004	03/06/1997	5.00	U	5.00	U	5.00	U	5.00	U
E570GW004	06/27/1997	5.00	U	5.00	U	5.00	U	5.00	U
E570GW004	10/08/1997	5.00	U	5.00	U	5.00	UJ	5.00	U
E570GW004	10/13/1998	5.00	SU	5.00	SU	5.00	SU	-----	-----
E569GW01D	05/09/1996	5.00	U	5.00	U	5.00	U	3.00	J
E569GW01D	07/25/1996	5.00	U	5.00	U	5.00	U	1.00	J
E569GW01D	11/21/1996	5.00	U	5.00	U	5.00	U	8.00	=
E569GW01D	02/05/1997	5.00	U	5.00	U	5.00	U	3.00	J
E569GW01D	03/10/1998	5.00	SU	5.00	SU	5.00	SU	6.00	S=
E569GW01D	10/12/1998	5.00	SU	5.00	SU	5.00	SU	-----	-----
E570GW02D	05/06/1996	5.00	U	5.00	U	5.00	U	5.00	U
E570GW02D	07/23/1996	2.00	J	5.00	U	5.00	U	5.00	U
E570GW02D	11/19/1996	5.00	U	5.00	U	5.00	U	5.00	U
E570GW02D	01/31/1997	5.00	U	5.00	U	5.00	U	5.00	U
E570GW02D	10/13/1998	5.00	SU	5.00	SU	5.00	SU	-----	-----

TABLE 5-2
 Aluminum, Arsenic, Beryllium, Chromium, Lead, Thallium, Vanadium, Chloroform, TCE, PCE, and 1,2-DCE (Total) in Groundwater
 RFI Report Addendum, AOCs 569, 570 and 578, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Chloroform		Trichloroethene (TCE)		Tetrachloroethene (PCE)		1,2-Dichloroethene (Total)	
		Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier	Concentration (µg/L)	Qualifier
	MCL	100		5		5		70	
	EPA Region III Tap Water RBC (HI=0.1)	0.15		1.6		1.1		5.5	
E570GW03D	05/10/1996	5.00	U	11.00	=	5.00	U	6.00	=
E570GW03D	07/22/1996	5.00	U	7.00	=	5.00	U	5.00	=
E570GW03D	11/19/1996	5.00	U	17.00	=	5.00	U	9.00	=
E570GW03D	02/04/1997	5.00	U	13.00	=	5.00	U	8.00	=
E570GW03D	03/06/1998	5.00	SU	10.00	S=	5.00	SU	5.00	SU
E570GW03D	10/12/1998	5.00	SU	10.00	S=	5.00	SU	-----	-----
E570GW03D	04/16/2002	5.00	U	8.00	=	5.00	U	6.30	=

^a The Zone E Mean Background Reference Concentrations and Range of Concentrations were obtained from Appendix J of the *Project Team Notebook and Instructions - Charleston Naval Complex, Environmental Restoration Project, Revision 1A* (CH2M-Jones, December 2001).

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

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

HI Hazard index

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.

µg/L micrograms per liter

NA Screening criteria not available for the referenced compound.

U Indicates analyte not detected above laboratory detection limit.

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

S Indicates that the data has not been validated and can only be used for screening.

----- Indicates that analyte was not sampled for at this location

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

3 **6.1 RFI Status**

4 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) addressed SWMUs/AOCs within Zone E of
5 the CNC, including AOCs 569, 570, and 578.

6 In accordance with the RFI completion process, if a determination of No Further
7 Investigation (NFI) is made upon completion of the RFI, then a site may proceed to either
8 no further action (NFA) status or to a CMS. The RFI for AOCs 569, 570, and 578 identified
9 COCs for surface soil and shallow and deep groundwater. Based on the discussion
10 presented in Section 5 of this report, the following are considered to be COCs at AOCs 569,
11 570, and 578: BEQs in surface soil; benzene in subsurface soil; PCE in shallow groundwater;
12 and TCE in deep groundwater.

13 The remaining subsections address the issues that the BCT agreed to evaluate prior to site
14 closeout.

15 **6.2 Presence of Inorganics in Groundwater**

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

21 There were no detections of thallium in shallow wells above the laboratory detection limits.
22 There were no detections of antimony or arsenic above the MCL in samples from the
23 shallow groundwater monitoring wells.

1 There were no detections of antimony in deep wells above the laboratory detection limits.
2 There were no detections of arsenic above the MCL in samples from the deep groundwater
3 monitoring wells. Intermittent detections of thallium in deep groundwater at the site above
4 the MCL do not point to a site-specific source, but can be attributed to natural occurrence.
5 These detections did not exceed the maximum background concentrations for thallium in
6 deep groundwater. Table 5-3 shows thallium concentrations from the RFI groundwater
7 sampling at AOCs 569, 570, and 578. Further evaluation of this issue is not warranted.

8 **6.3 Potential Linkage to SWMU 37, Investigated Sanitary** 9 **Sewers at the CNC**

10 Three DPT groundwater samples (LE037GP008, LE037GP009, LE037GP010) were collected
11 as part of the SWMU 37 (sanitary sewer) investigation outside of Building 30 near the
12 northwest corner of the building, where a sewer line connection from Building 30 connects
13 to the sanitary sewer main. No VOCs were detected in these samples. The metals results for
14 the Zone L DPT groundwater samples are considered invalid due to elevated turbidity.
15 Turbidity measurements for these three DPT samples were not collected during the Zone L
16 investigation.

17
18 Additionally, one surface soil sample (037SP001) was collected as part of the SWMU 37
19 investigation just north of Building 30. Three VOCs—acetone, toluene, and methyl ethyl
20 ketone—were detected at concentrations of 45, 47, and 8 $\mu\text{g}/\text{kg}$, respectively. Each of these
21 detections are below the COPC screening criteria (RBC and SSL) used to identify COPCs.
22 There are no data suggesting that there was an impact to the sanitary sewers from this site.
23 Therefore, further evaluation of this issue is not warranted.

24 **6.4 Potential Linkage to AOC 699, Investigated Storm Sewers at** 25 **the CNC**

26 No investigations of the storm sewers was conducted in the vicinity of this site. There are
27 no data suggesting that there was an impact to the storm sewers from this site. Therefore,
28 further evaluation of this issue is not warranted.

29 **6.5 Potential Linkage to AOC 504, Investigated Railroad Lines** 30 **at the CNC**

31 There were historical railroad lines at the site, but no AOC 699 investigations were
32 conducted at this site. Figure C-1 in Appendix C shows the presence of historical railroad

1 lines at the site from the Public Works Map of the CNC, dated December 15, 1939. Most of
2 these railroad line locations appear to have been paved over according to the Public Works
3 Maps from the mid 1950s and later, and currently remain paved over with concrete and
4 asphalt.

5 **6.6 Potential Migration Pathways to Surface Water Bodies at** 6 **the CNC**

7 The nearest surface water body to AOCs 569, 570, and 578 is the Cooper River, which lies
8 approximately 900 feet northeast of the site. The only potential migration pathway from the
9 site to surface water is via overland flow via stormwater runoff. The entire site is covered
10 with pavement, which eliminates contact of surface soil with stormwater. Similarly, runoff
11 directed to the storm sewer system, which discharges to the Cooper River, does not contact
12 the soil. Further evaluation of this issue is not warranted.

13 **6.7 Potential Contamination in Oil/Water Separators**

14 There are no OWSs associated with AOCs 569, 570, and 578. In addition, there is no
15 reference to an OWS at the site in the *Oil Water Separator Data* report, Department of the
16 Navy, September 2000. Therefore, further evaluation of this issue is not warranted.

17 **6.8 Land Use Control**

18 The CNC BCT has agreed that all of Zone E will have at least some LUCs and restrictions.
19 At a minimum, these LUCs are likely to include restrictions against unrestricted land use.
20 The LUC issue will be addressed in the CMS work plan and CMS report.

1 **7.0 Recommendations**

2 AOC 569 is a former gas station and oil storehouse previously housed in Building 1279 in
3 Zone E of the CNC. The gas station was constructed in 1944 and consisted of two pumps
4 and two 2,500-gallon USTs. In 1986, an additional 3,000-gallon UST was installed. During
5 1992, the site was demolished and the three USTs were removed by the Navy.

6 AOC 570 is a former coal storage area in Zone E of the CNC. The coal storage facility
7 extended from Building 30 to Sixth Avenue and from Carolina Avenue to Hobson Avenue
8 at the CNC. The coal storage area was operated from 1919 to 1941.

9 AOC 578 consists of a transportation shop and garage in Building 25 in Zone E of the CNC.
10 The structure was built in 1940 and was originally used as an automobile garage and more
11 recently as a transportation and appliance maintenance shop. Building 25 recently included
12 various facilities, such as an air-conditioning repair shop, a sheet metal shop, two electric
13 shops, a paint shop, a sign shop, a carpenter's shop, a paper shredding area, an electrical
14 maintenance shop, a tool room, and an emergency supply storage area. Currently Building
15 25 is used for equipment storage and as a transportation shop by the Environmental
16 Enterprises Group.

17 The *Zone E RFI Report, Revision 0* identified arsenic and BEQs as surface soil COCs for both
18 the unrestricted and industrial land use scenarios; aluminum, arsenic, beryllium,
19 chromium, lead, vanadium, chloroform, PCE, and TCE as shallow groundwater COCs; and
20 1,2-dichloroethene (total), TCE, and thallium as deep groundwater COCs for AOCs 569, 570
21 and 578. Accordingly, LUCs should be applied at this site in order to preclude use of the site
22 for residential purposes.

23 Based on an evaluation of the data and site conditions as discussed herein, this RFI Report
24 Addendum recommends that a focused CMS be undertaken to address BEQs in surface soil;
25 benzene in subsurface soil; PCE in shallow groundwater; and TCE in deep groundwater at
26 this site. No other COCs have been identified for any other media at this site. A work plan
27 for conducting a focused CMS is provided in Section 8.0 of this report.

1 **8.0 CMS Work Plan**

2 At AOCs 569, 570 and 578, BEQs were identified as surface soil COCs; benzene has been
3 identified as a subsurface soil COC; PCE and TCE were identified as COCs in shallow and
4 deep groundwater, respectively. Currently there is no unacceptable exposure or risk from
5 these COCs; however, it is feasible that in the future, should land use and/or site conditions
6 change, some exposure could occur. Therefore, a CMS should be conducted to evaluate
7 potential corrective measures and identify an appropriate remedy for the site.

8 This section presents a focused CMS work plan. Media cleanup standards are identified for
9 COCs and potential remedies that should be evaluated are also presented.

10 **8.1 Remedial Action Objectives**

11 Remedial action objectives (RAOs) are medium-specific goals that the remedial actions are
12 designed to accomplish in order to protect human health and the environment by
13 preventing or reducing exposures under current and future land use conditions. The RAOs
14 identified for soil and groundwater at AOCs 569, 570 and 578 are 1) to prevent ingestion
15 and direct/dermal contact with soil or groundwater having unacceptable carcinogenic or
16 non-carcinogenic risk, and 2) to restore the site soils and the aquifer to beneficial use.

17 **8.2 Remedial Goal Options and Media Cleanup Standards**

18 Throughout the process of remediating a hazardous waste site, a risk manager uses a
19 progression of increasingly acceptable site-specific media levels in considering remedial
20 alternatives. Under the RCRA program, remedial goal options (RGOs) and media cleanup
21 standards (MCSs) are developed at the end of the risk assessment in the RFI/Remedial
22 Investigation (RI) programs and before completion of the CMS.

23 RGOs can be based on a variety of criteria, such as specific incremental lifetime cancer risk
24 (ILCR) levels (e.g., 1E-04, 1E-05, or 1E-06), HI levels (e.g., 0.1, 1.0, 3.0), or site background
25 concentrations. For a particular RGO, specific MCSs can be determined as target
26 concentration values. Achieving these MCSs is accepted as demonstrating that RGOs and
27 RAOs have been achieved. Achieving these goals should promote the protection of human
28 health and the environment, while achieving compliance with applicable state and federal
29 standards.

1 The exposure media of concern for this site are surface soil contaminated with BEQs;
2 subsurface soil contaminated with benzene; shallow groundwater contaminated with PCE;
3 and deep groundwater contaminated with TCE. Because this site is located within a highly
4 developed area of the CNC and there are no surface water bodies in the immediate vicinity
5 of the site, ecological exposures were not considered applicable for evaluation.

6 Benzene detections in three subsurface soil samples (from E569SB005 at 0.428 mg/kg from
7 the April 2002 sampling; from E569SB008 at 1.95 mg/kg; and E569SB010 at 0.805 mg/kg)
8 exceed the site-specific SSL of 0.078 mg/kg for the unpaved scenario. The benzene
9 detection of 1.95 mg/kg in the subsurface soil sample (collected from the 3-5 ft depth
10 interval bls at E569SB008) also exceeds the site-specific SSL for the paved scenario of 1.04
11 mg/kg. BEQs were detected in two surface soil samples above the CNC BEQ sitewide
12 reference concentration of 1,304 µg/kg at two RFI locations: E570SB012 at 3,817 µg/kg and
13 at E578SB005 at 1,619 µg/kg. TCE and PCE were the only COCs identified for the
14 groundwater and were detected at concentrations ranging from 5 µg/L to 120 µg/L, and 7
15 µg/L to 17 µg/L, respectively.

16 The MCSs/RGOs for BEQs are the CNC sitewide reference concentration of 1,304 µg/kg,
17 which represents background BEQ conditions, the site-specific SSL (for the unpaved
18 scenario) for benzene of 0.078 mg/kg), and the MCLs for TCE (5 µg/L) and PCE (5 µg/L).

19 **8.3 Potential Remedies to Evaluate**

20 The presumptive remedies that will be evaluated as part of the CMS include:

21 Soil:

- 22 • Soil excavation and disposal
- 23 • LUCs

24 Groundwater:

- 25 • Natural attenuation with LUC
- 26 • In Situ treatment

27 **8.4 Focused CMS Approach**

28 The focused CMS will consist of the following tasks that will be performed in the order
29 presented below:

- 1 1. The corrective measure alternatives described above will be screened using several
- 2 criteria and decision factors.
- 3 2. A preferred corrective measure alternative will be selected.
- 4 3. The CMS and preferred corrective measure alternative will be documented in the CMS
- 5 report.

6 **8.5 Approach to Evaluating Corrective Measure Alternatives**

7 According to the RCRA permit issued by SCDHEC (SCDHEC, 1998), the alternatives will be
8 evaluated with the following five standards:

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

18 Each of the five standards is defined in more detail below:

- 19 1. **Protecting human health and the environment.** The alternatives will be evaluated on
- 20 the basis of their ability to protect human health and the environment. The ability of an
- 21 alternative to achieve this standard may or may not be independent of its ability to
- 22 achieve the other four standards. For example, an alternative may be protective of
- 23 human health, but may not be able to attain the MCSs if the MCSs are not directly tied
- 24 to protecting human health.
- 25 2. **Attaining media cleanup standards (RGOs).** The alternatives will be evaluated on the
- 26 basis of their ability to achieve the RGOs defined in this CMS Work Plan. Another
- 27 aspect of this standard is the timeframe to achieve the RGOs. Estimates of the timeframe
- 28 for the alternatives to achieve RGOs will be provided.

- 1 3. **Controlling the source of releases.** This standard deals with the control of releases of
2 contamination from the source (the area in which the contamination originated).
- 3 4. **Complying with applicable standards for management of wastes.** This standard deals
4 with the management of wastes derived from implementing the alternatives, for
5 example, treatment or disposal of excavated material. The soil removal alternative will
6 be designed to comply with all applicable standards for management of remediation
7 wastes. Consequently, this standard will not be explicitly included in the detailed
8 evaluation presented in the CMS but will be part of a work plan, specific to the removal
9 action should a removal action become the chosen alternative.
- 10 5. **Other factors.** Five other factors are to be considered if an alternative is found to meet
11 the four standards described above. These other factors are as follows:
- 12 a. Long-term reliability and effectiveness
13 The two alternatives will be evaluated on the basis of their reliability and the
14 potential impact should the chosen alternative fail. In other words, a qualitative
15 assessment will be made as to the chance of the alternative's failure and the
16 consequences of that failure.
- 17 b. Reduction in the toxicity, mobility, or volume of wastes
18 Alternatives with technologies that reduce the toxicity, mobility, or volume of the
19 contamination will be generally favored over those that do not. Consequently, a
20 qualitative assessment of this factor will be performed for each alternative.
- 21 c. Short-term effectiveness
22 Alternatives will be evaluated on the basis of the risk they create during the
23 implementation of the remedy. Factors that may be considered include fire,
24 explosion, and exposure of workers to hazardous substances.
- 25 d. Implementability
26 The alternatives will be evaluated for their implementability by considering any
27 difficulties associated with conducting the alternatives (such as the construction
28 disturbances they may create), operation of the alternatives, and the availability of
29 equipment and resources to implement the technologies comprising the alternatives.
- 30 e. Cost
31 A net present value of each alternative will be developed. These cost estimates will
32 be used for the relative evaluation of the alternatives, not to bid or budget the work.
33 The estimates will be based on information available at the time of the CMS and on a

1 conceptual design of the alternative. They will be “order-of-magnitude” estimates
2 with a generally expected accuracy of -50 percent to +50 percent for the scope of
3 action described for each alternative. The estimates will be categorized into capital
4 costs and operations and maintenance costs for each alternative.

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

7 **8.6 Focused CMS Report**

8 A focused CMS Report will be prepared to present the identification, development, and
9 evaluation of potential corrective measures for this site. A proposed outline of the report, as
10 shown in Table 8-1, provides an example of the report format and content.

TABLE 8-1
 Outline of Focused CMS Report for AOCs 569, 570 and 578
RFI Report Addendum, AOCs 569, 570 and 578, Zone E, Charleston Naval Complex

Section No.	Section Title
1.0	Introduction
1.1	Corrective Measures Study Purpose and Scope
1.2	Report Organization
1.3	Background Information
1.3.1	Facility Description
1.3.2	Site History and Background
1.3.2.1	Nature and Extent of Contamination
1.3.2.2	Summary of Risk Assessment
2.0	Remedial Goal Objectives
3.0	Detailed Analysis of Focused Alternatives
3.1	Approach
3.2	Evaluation Criteria
3.3	Description of Alternatives
3.3.1	Soil Alternative 1: Soil Excavation and Disposal
3.3.2	Soil Alternative 2: Land Use Controls
3.3.3	Groundwater Alternative 1: Long-term Monitoring with LUCs
3.3.4	Groundwater Alternative 2: In Situ Remediation
3.4	Detailed Analysis of Alternatives
3.4.1	Analysis of Soil Alternative 1
3.4.1	Analysis of Groundwater Alternative 1
3.4.2	Analysis of Groundwater Alternative 2
3.5	Comparative Analysis of Soil and Groundwater Alternatives
4.0	Recommended Remedial Alternatives
5.0	References
Appendix A	Corrective Measure Alternative Cost Estimates^b
	List of Tables
	List of Figures

^a Additional alternatives will be analyzed, as necessary.

^b Additional appendices will be added, if necessary.

1 9.0 References

- 2 CH2M-Jones. *Technical Information for Development of Background BEQ Values*. February 2001.
- 3 CH2M-Jones. *Project Team Notebook and Instructions - Charleston Naval Complex,*
4 *Environmental Restoration Project, Revision 1A*. December 2001.
- 5 CH2M-Jones. *Interim Measure Work Plan, Soil Delineation and Excavation at E569SB005, AOC*
6 *569, Zone E, Charleston Naval Complex*. February 2003.
- 7 South Carolina Department of Health and Environmental Control, *Final RCRA Part B*
8 *Permit No. SC0 170 022 560*.
- 9 EnSafe Inc. *Zone E RFI Report, Revision 0, NAVBASE Charleston*. November 1997.
- 10 EnSafe/Allen & Hoshall. *Final RCRA Facility Assessment, Naval Base Charleston*. June 1995.
- 11 LandRec, Inc. for Landmark Construction Company. *Investigation of Underground*
12 *Contamination, Charleston Naval Shipyard - Building 1279, North Charleston, South*
13 *Carolina*. August 1992.
- 14 U.S. Environmental Protection Agency (EPA). EPA Region 4 Memorandum from Dann
15 Spariosu to Mihir Mehta, Remedial Goals for Arsenic in Soil, March 30, 2001, with
16 attachment of memorandum from Ted Simon to Dann Spariosu, Remediation Goals for
17 Arsenic in Soil at DOD Facilities, dated March 29, 2001.

**Chemicals Detected in Zone E Groundwater Samples
AOC 569**

Name	Location	Round 1 Conc.	Round 2 Conc.	Round 3 Conc.	Round 4 Conc.	RBC (THQ=.1)	UTL	MCL
<i>Volatile Organic Compounds (ug/l)</i>								
1,2-Dichloroethene (total)	569GW002	2.00	ND	2.00	ND	5.50	NA	70.00
	569GW01D	3.00	1.50	8.00	4.50			
Tetrachloroethene	569GW001	1.00	ND	10.00	53.00	1.10	NA	5.00
	569GW002	9.00	9.00	13.00	2.00			
Trichloroethene	569GW001	ND	ND	1.00	3.00	1.60	NA	5.00
	569GW002	4.00	3.50	6.00	ND			
<i>Semi-volatile Compounds (ug/l)</i>								
Benzoic acid	569GW002	ND	1.00	ND	ND	NA	NA	NA
Phenol	569GW01D	ND	1.00	ND	ND	2200.00	NA	NA
<i>Other Compounds (mg/l)</i>								
Chloride	569GW001	ND	33.80	36.40	27.10	NA	NA	NA
	569GW002	ND	13.15	13.60	7.30			
	569GW01D	41.70	39.60	39.75	37.60			
Sulfate	569GW001	70.00	63.10	80.00	66.30	NA	NA	NA
	569GW002	ND	49.50	46.15	43.05			
	569GW01D	80.05	70.55	69.70	69.40			
Total Dissolved Solids (TDS)	569GW001	ND	194.00	136.00	132.00	NA	NA	NA
	569GW002	ND	150.00	108.00	90.00			
	569GW01D	368.50	382.00	326.00	314.00			
<i>Inorganic Compounds (ug/l)</i>								
Aluminum (Al)	569GW001	1360.00	1280.00	1510.00	1370.00	73.00	7.90	200.00
	569GW002	ND	37.90	56.10	126.00			
Arsenic (As)	569GW01D	5.30	3.00	3.50	2.70	0.05	18.70	50.00
Barium (Ba)	569GW001	ND	67.10	73.30	56.20	260.00	211.00	2000.00
	569GW002	ND	13.05	16.60	17.00			
	569GW01D	41.00	34.55	36.45	32.55			
Beryllium (Be)	569GW001	ND	ND	0.95	0.76	0.02	0.43	4.00
	569GW002	ND	ND	ND	0.31			
	569GW01D	ND	ND	ND	0.33			
Calcium (Ca)	569GW001	24000.00	23600.00	24600.00	21500.00	NA	NA	NA
	569GW002	20650.00	20050.00	19250.00	16400.00			
	569GW01D	58200.00	65900.00	69950.00	58750.00			
Chromium (Cr)	569HW01D	ND	ND	0.87	ND	3700.00	12.30	100.00
Cobalt (Co)	569GW001	7.20	ND	7.00	5.50	220.00	2.50	NA
	569GW002	ND	ND	1.20	ND			
Copper (Cu)	569GW001	ND	ND	7.70	4.60	150.00	2.70	1300.00
	569GW002	ND	ND	0.68	1.60			
	569GW01D	1.60	ND	1.70	ND			
Iron (Fe)	569GW001	769.00	780.00	600.00	830.00	1100.00	NA	NA
	569GW002	57.45	197.50	180.00	265.00			
	569GW01D	491.50	748.50	838.50	624.00			
Lead (Pb)	569GW01D	2.30	ND	ND	ND	15.00	4.80	15.00
Magnesium (Mg)	569GW001	3450.00	3950.00	3880.00	3530.00	NA	NA	NA
	569GW002	3020.00	2935.00	2675.00	2400.00			
	569GW01D	8145.00	8680.00	8560.00	7325.00			

**Chemicals Detected in Zone E Groundwater Samples
AOC 569**

Name	Location	Round 1 Conc.	Round 2 Conc.	Round 3 Conc.	Round 4 Conc.	RBC (THQ=.1)	UTL	M.
Manganese (Mn)	569GW001	275.00	315.00	341.00	330.00	84.00	2560.00	NA
	569GW002	74.65	74.00	76.70	69.10			
	569GW01D	84.00	105.00	123.50	112.00			
Nickel (Ni)	569GW001	ND	5.60	6.60	4.50	73.00	15.20	100.00
	569GW002	ND	1.00	1.46	ND			
	569GW01D	1.10	ND	1.40	ND			
Potassium (K)	569GW001	ND	4760.00	4530.00	3610.00	NA	NA	NA
	569GW002	ND	2830.00	3270.00	3445.00			
	569GW01D	3030.00	3290.00	3510.00	3200.00			
Selenium (Se)	569GW01D	ND	ND	ND	4.00	18.00	NA	50.00
Silver (Ag)	569GW01D	1.90	ND	ND	ND	18.00	NA	NA
Sodium (Na)	569GW001	ND	12700.00	15300.00	14500.00	NA	NA	NA
	569GW002	ND	12400.00	12750.00	9940.00			
	569GW01D	37550.00	37750.00	4240.00	37750.00			
Thallium (Tl)	569GW01D	4.25	ND	ND	ND	0.29	5.40	2.00
Tin (Sn)	569GW01D	ND	ND	ND	3.50	2200.00	NA	NA
	569GW002	ND	ND	ND	3.10			
Vanadium (V)	569GW002	ND	ND	0.57	0.79	26.00	11.40	NA
Zinc (Zn)	569GW001	ND	ND	ND	22.10	1100.00	27.30	NA
	569GW002	ND	ND	ND	6.15			
	569GW01D	29.90	ND	ND	6.00			
	569HW002	6.50	ND	ND	6.70			

Notes:

ND: Not Detected

NS: No Sample Taken/Sample Not Analyzed

NA: Not Applicable

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

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

Chemicals Detected in Zone E Groundwater Samples
AOC 570

Name	Location	Round 1 Conc.	Round 2 Conc.	Round 3 Conc.	Round 4 Conc.	RBC (THQ=.1)	UTL	MCL
<i>Volatile Organic Compounds (ug/l)</i>								
1,2-Dichloroethene (total)	570GW03D	6.00	5.00	9.00	8.00	5.5	NA	70
Carbon disulfide	570GW004	1.00	ND	ND	ND	100.00	NA	NA
	570GW03D	ND	ND	1.00	ND			
Chloroform	570GW003	2.00	ND	ND	ND	0.15	NA	80.00
Methylene chloride	570GW003	ND	ND	8.00	ND	4.10	NA	5.00
Tetrachloroethene	570GW001	ND	ND	7.00	16.00	1.10	NA	5.00
Trichloroethene	570GW03D	11.00	7.00	17.00	13.00	1.60	NA	5.00
<i>Semi-volatile Compounds (ug/l)</i>								
Diethylphthalate	570GW004	ND	ND	1.00	ND	11.00	NA	NA
<i>Other Compounds (mg/l)</i>								
Chloride	570GW001	ND	21.60	23.10	19.10	NA	NA	NA
	570GW002	ND	7.40	4.40	6.60			
	570GW003	ND	56.20	11.30	11.60			
	570GW004	6.50	8.00	ND	ND			
	570GW02D	ND	50.80	49.80	46.60			
	570GW03D	26.90	27.20	27.20	24.60			
Sulfate	570GW001	74.00	64.80	64.20	72.10	NA	NA	NA
	570GW002	ND	42.10	32.30	37.30			
	570GW003	64.00	53.00	61.60	54.70			
	570GW004	47.10	53.10	ND	ND			
	570GW02D	ND	45.60	47.10	44.00			
	570GW03D	48.80	41.70	44.70	41.50			
Total Dissolved Solids (TDS)	570GW001	ND	164.00	176.00	156.00	NA	NA	NA
	570GW002	3010.00	318.00	496.00	304.00			
	570GW003	ND	146.00	136.00	76.00			
	570GW004	172.00	124.00	ND	ND			
	570GW02D	ND	342.00	372.00	320.00			
	570GW03D	288.00	306.00	252.00	256.00			
<i>Inorganic Compounds (ug/l)</i>								
Aluminum (Al)	570GW001	833.00	716.00	742.00	755.00	73.00	7.90	200.00
	570GW002	67500.00	8490.00	16300.00	11200.00			
	570GW003	ND	191.00	40.40	74.80			
	570GW004	2490.00	1180.00	482.00	ND			
	570GW02D	ND	ND	ND	18.10		319.00	
	570GW03D	ND	20.10	ND				
Antimony (Sb)	570GW002	ND	ND	2.50	ND	3700.00	2810.00	NA
Arsenic (As)	570GW002	40.20	ND	13.50	8.90	0.05	18.70	50.00
	570GW004	5.70	ND	ND	ND			
Barium (Ba)	570GW001	ND	50.80	50.20	45.50	260.00	211.00	2000.00
	570GW002	ND	44.30	74.30	60.80			
	570GW003	ND	31.80	34.10	30.60			
	570GW004	76.40	95.90	44.80	ND			
	570GW02D	ND	38.80	35.90	30.20		218.00	
	570GW03D	23.20	20.30	20.50	18.30			
Beryllium (Be)	570GW001	0.71	ND	0.79	0.69	0.02	0.43	4.00
	570GW002	ND	ND	0.80	0.67			

**Chemicals Detected in Zone E Groundwater Samples
AOC 570**

Name	Location	Round 1 Conc.	Round 2 Conc.	Round 3 Conc.	Round 4 Conc.	RBC (THQ=.1)	UTL	M.
Cadmium (Cd)	570GW003	ND	ND	ND	0.31			
	570GW004	0.59	0.38	ND	ND			
	570GW002	ND	0.59	ND	ND	1.80	NA	5.00
	570GW001	118000.00	18700.00	20300.00	19500.00	NA	NA	NA
Calcium (Ca)	570GW002	ND	9260.00	11000.00	12300.00			
	570GW003	ND	19600.00	19100.00	18000.00			
	570GW004	18600.00	14700.00	14800.00	ND			
	570GW02D	48700.00	51700.00	51600.00	47300.00		NA	
Chromium (Cr)	570GW03D	50800.00	52700.00	54800.00	51500.00			
	570GW001	ND	ND	0.89	ND	3700.00	12.30	100.00
	570GW002	137.00	15.50	31.20	21.40			
	570GW004	5.40	ND	ND	ND			
Cobalt (Co)	570GW001	8.30	5.90	8.30	8.50	220.00	2.50	NA
	570GW002	10.50	2.20	ND	3.90			
	570GW003	ND	1.20	0.98	ND			
	570GW004	3.20	2.60	ND	ND			
Copper (Cu)	570GW001	ND	ND	2.80	ND	150.00	2.70	1300.00
	570GW002	23.30	ND	12.70	ND			
	570GW004	ND	ND	2.40	ND			
	570GW001	535.00	243.00	635.00	572.00	1100.00	NA	NA
Iron (Fe)	570GW002	46800.00	7130.00	14000.00	10000.00			
	570GW003	205.00	612.00	347.00	338.00			
	570GW004	6330.00	ND	721.00	1110.00			
	570GW02D	351.00	608.00	715.00	606.00		NA	
Lead (Pb)	570GW03D	229.00	317.00	330.00	251.00			
	570GW002	77.50	14.50	22.50	17.90	15.00	4.80	15.00
	570GW004	4.40	ND	ND	ND			
	570GW001	4570.00	3790.00	4510.00	ND	NA	NA	NA
Magnesium (Mg)	570GW002	8400.00	2400.00	2720.00	2930.00			
	570GW003	3000.00	3340.00	3410.00	3310.00			
	570GW004	2800.00	3350.00	2050.00	ND			
	570GW02D	8360.00	8370.00	8600.00	7780.00		NA	
Manganese (Mn)	570GW03D	5940.00	5750.00	5860.00	5480.00			
	570GW001	613.00	500.00	617.00	588.00	84.00	2560.00	NA
	570GW002	ND	229.00	169.00	216.00			
	570GW003	88.00	101.00	107.00	111.00			
Potassium (K)	570GW004	92.30	52.60	24.20	ND			
	570GW02D	116.00	122.00	138.00	125.00		869.00	
	570GW03D	41.60	41.30	39.30	41.60			
	570GW002	523.00	ND	ND	ND			
Mercury (Hg)	570GW002	0.26	ND	ND	ND	1.10	NA	2.00
Nickel (Ni)	570GW001	5.60	7.00	6.80	5.20	73.00	15.20	100.00
	570GW002	17.00	4.40	7.40	5.80			
	570GW004	4.10	ND	0.78	ND			
	570GW02D	ND	0.93	ND	ND		42.20	
Potassium (K)	570GW001	3770.00	ND	3950.00	3990.00	NA	NA	NA
	570GW002	ND	2220.00	2390.00	2680.00			
	570GW003	ND	3980.00	4560.00	4160.00			
	570GW004	4350.00	4400.00	3810.00	ND			

**Chemicals Detected in Zone E Groundwater Samples
AOC 570**

Name	Location	Round 1 Conc.	Round 2 Conc.	Round 3 Conc.	Round 4 Conc.	RBC (THQ=.1)	UTL	MCL
	570GW02D	ND	3550.00	3580.00	3300.00		NA	
	570GW03D	2360.00	2250.00	2380.00	2430.00			
Selenium (Se)	570GW003	ND	ND	3.50	ND	18.00	NA	50.00
	570GW03D	ND	ND	3.00	ND		NA	
	570GW03D	ND	ND	3.30	ND			
Sodium (Na)	570GW001	ND	14600.00	16300.00	20100.00	NA	NA	NA
	570GW002	ND	20200.00	15400.00	18300.00			
	570GW003	ND	11900.00	12100.00	11800.00			
	570GW004	9090.00	10100.00	6700.00	ND			
	570GW02D	ND	39200.00	49400.00	44900.00		NA	
	570GW03D	32100.00	34300.00	34300.00	33500.00			
Thallium (Tl)	570GW02D	ND	ND	6.10	ND	0.29	5.40	2.00
Tin (Sn)	570GW002	ND	4.20	ND	7.80	2200.00	NA	NA
	570GW004	ND	29.90	ND	ND			
Vanadium (V)	570GW001	ND	ND	ND	0.58	26.00	11.40	NA
	570GW002	180.00	26.70	42.00	31.30			
	570GW004	9.20	1.20	ND	ND			
	570GW004	ND	ND	2.20	ND			
Zinc (Zn)	570GW002	125.00	ND	42.70	47.60	1100.00	27.30	NA
	570GW004	48.20	ND	ND	ND			
	570GW03D	9.50	ND	ND	ND		11.80	

Notes:

ND: Not Detected

NS: No Sample Taken/Sample Not Analyzed

NA: Not Applicable

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

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

Chemicals Detected in Zone E Soil Samples
AOC 569

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
<i>Volatile Organic Compounds (ug/kg)</i>						
2-Butanone (MEK)	569SB003	ND	6.00	4700000.00	NA	NA
Acetone	569SB005	ND	47000.00	780000.00	NA	NA
Benzene	569SB005	2.00	10000.00	22000.00	NA	NA
Carbon tetrachloride	569SB005	ND	3800.00	4900.00	NA	NA
Ethylbenzene	569SB005	3.00	170000.00	780000.00	NA	NA
Toluene	569SB005	ND	220000.00	1600000.00	NA	NA
Xylene (Total)	569SB005	ND	800000.00	16000000.00	NA	NA
<i>Semi-volatile Compounds (ug/kg)</i>						
2-Methylnaphthalene	569SB003	1700.00	190.00	NA	NA	NA
	569SB005	160.00	43000.00			
	569SB007	ND	34000.00			
Anthracene	569SB001	160.00	ND	23000000.00	NA	NA
Benzo(a)anthracene	569SB001	340.00	ND	880.00	NA	NA
	569SB004	150.00	ND			
	569SB005	510.00	ND			
Benzo(a)pyrene	569SB007	39.00	ND			
	569SB001	320.00	ND	88.00	NA	NA
	569SB004	180.00	ND			
Benzo(b)fluoranthene	569SB005	780.00	ND			
	569SB007	48.00	ND			
	569SB001	380.00	ND	880.00	NA	NA
Benzo(g,h,i)perylene	569SB004	230.00	ND			
	569SB007	47.00	ND			
	569SB001	240.00	ND	310000.00	NA	NA
Benzo(k)fluoranthene	569SB004	160.00	ND			
	569SB005	580.00	ND			
	569SB007	48.00	ND			
Chrysene	569SB001	320.00	ND	8800.00	NA	NA
	569SB004	150.00	ND			
	569SB005	1200.00	ND			
Dibenz(a,h)anthracene	569SB007	54.00	ND			
	569SB001	490.00	ND	88000.00	NA	NA
	569SB004	210.00	ND			
Fluorene	569SB005	700.00	ND			
	569SB007	51.00	ND			
	569SB005	270.00	ND	88000.00	NA	NA
Indeno(1,2,3-cd)pyrene	569SB001	940.00	ND	3100000.00	NA	NA
	569SB004	260.00	ND			
	569SB005	680.00	ND			
Fluorene	569SB007	78.00	610.00			
	569SB005	ND	410.00	310000.00	NA	NA
	569SB001	200.00	ND	880.00	NA	NA
Indeno(1,2,3-cd)pyrene	569SB004	110.00	ND			
	569SB005	560.00	ND			
	569SB007	44.00	ND			

**Chemicals Detected in Zone E Soil Samples
AOC 569**

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Naphthalene	569SB003	670.00	110.00	310000.00	NA	NA
	569SB005	240.00	38000.00			
	569SB007	ND	36000.00			
Phenanthrene	569SB001	410.00	ND	310000.00	NA	NA
	569SB003	75.00	ND			
	569SB004	120.00	ND			
	569SB005	200.00	880.00			
	569SB007	ND	780.00			
Pyrene	569SB001	840.00	ND	230000.00	NA	NA
	569SB003	100.00	ND			
	569SB004	280.00	ND			
	569SB005	620.00	420.00			
	569SB007	65.00	450.00			
bis(2-Ethylhexyl)phthalate (BEHP)	569SB001	80.00	ND	4600.00	NA	NA
	569SB003	130.00	ND			
	569SB004	ND	90.00			

Inorganic Compounds (mg/kg)

Aluminum (Al)	569SB001	2850.00	4000.00	7800.00	26000	41100
	569SB002	3710.00	3970.00			
	569SB003	2850.00	4240.00			
	569SB004	2250.00	2550.00			
	569SB005	2710.00	3520.00			
	569SB007	3320.00	7100.00			
	Antimony (Sb)	569SB001	0.53	ND	3.10	1.77
569SB004		0.49	ND			
Arsenic (As)	569SB001	14.80	3.20	0.43	23.9	19.9
	569SB002	1.80	0.72			
	569SB003	1.70	1.20			
	569SB004	12.10	2.70			
	569SB005	0.87	1.00			
	569SB007	2.90	2.70			
	Barium (Ba)	569SB001	31.50	14.50	550.00	130
569SB002		14.00	15.40			
569SB003		16.10	12.30			
569SB004		18.80	33.10			
569SB005		19.30	9.00			
569SB007		17.90	28.70			
Beryllium (Be)		569SB001	0.16	ND	0.15	1.7
	569SB002	0.21	ND			
	569SB003	0.14	ND			
	569SB004	0.17	ND			
	569SB005	0.16	ND			
Cadmium (Cd)	569SB001	0.49	ND	3.90	1.5	0.96
	569SB002	0.15	ND			
	569SB003	0.20	ND			
	569SB004	0.34	ND			

Chemicals Detected in Zone E Soil Samples
AOC 569

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Calcium (Ca)	569SB007	0.31	ND			
	569SB001	28200.00	2340.00	NA	NA	NA
	569SB002	80100.00	1570.00			
	569SB003	9820.00	1740.00			
	569SB004	70600.00	1240.00			
	569SB005	6750.00	1260.00			
	569SB007	12200.00	1530.00			
Chromium (Cr)	569SB001	10.30	8.00	39.00	94.6	75.2
	569SB002	4.40	9.80			
	569SB003	6.20	7.60			
	569SB004	8.00	5.50			
	569SB005	3.80	10.80			
	569SB007	5.30	13.70			
	Cobalt (Co)	569SB001	1.10	0.56	470.00	19
569SB002		5.10	0.32			
569SB003		4.00	0.86			
569SB004		1.90	0.61			
569SB005		0.53	0.66			
569SB007		0.51	1.10			
Copper (Cu)		569SB001	20.20	3.30	310.00	66
	569SB002	2.70	0.69			
	569SB003	9.60	1.40			
	569SB004	20.30	3.40			
	569SB005	1.50	0.90			
	569SB007	5.30	0.50			
	Iron (Fe)	569SB001	13200.00	8710.00	2300.00	NA
569SB002		2560.00	3380.00			
569SB003		1720.00	4220.00			
569SB004		9060.00	9600.00			
569SB005		2550.00	5970.00			
569SB007		3490.00	8420.00			
Lead (Pb)		569SB001	108.00	2.30	400.00	265
	569SB002	10.20	3.90			
	569SB003	18.80	4.30			
	569SB004	91.40	2.00			
	569SB005	3.60	7.30			
	569SB007	78.50	12.20			
	Magnesium (Mg)	569SB001	620.00	226.00	NA	NA
569SB002		930.00	222.00			
569SB003		219.00	216.00			
569SB004		900.00	163.00			
569SB005		187.00	362.00			
569SB007		285.00	523.00			
Manganese (Mn)		569SB001	57.10	10.60	180.00	302
	569SB002	64.00	3.50			
	569SB003	17.70	8.00			
	569SB004	59.60	7.70			

Chemicals Detected in Zone E Soil Samples
AOC 569

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Mercury (Hg)	569SB005	17.20	7.90			
	569SB007	20.40	14.40			
	569SB001	0.07	ND	2.30	2.6	1.59
	569SB002	0.02	ND			
	569SB003	0.07	ND			
	569SB004	0.06	ND			
	569SB005	0.03	ND			
Nickel (Ni)	569SB001	3.50	1.40	160.00	77.1	57
	569SB002	2.80	ND			
	569SB003	3.60	1.50			
	569SB004	4.50	1.10			
	569SB005	1.20	1.10			
	569SB007	1.80	2.30			
	Potassium (K)	569SB001	591.00	436.00	NA	NA
569SB002		596.00	479.00			
569SB003		528.00	407.00			
569SB004		601.00	575.00			
569SB005		467.00	487.00			
569SB007		ND	342.00			
Selenium (Se)		569SB001	0.75	0.77	39.00	1.7
	569SB004	0.62	0.99			
	569SB007	ND	0.36			
Silver (Ag)	569SB003	1.10	ND	39.00	NA	NA
	569SB005	ND	0.24			
Sodium (Na)	569SB001	32.40	ND	NA	NA	NA
	569SB002	45.50	47.20			
	569SB003	38.10	18.40			
	569SB004	61.70	27.90			
	569SB005	14.00	27.70			
	569SB007	182.00	154.00			
	Thallium (Tl)	569SB001	1.20	ND	0.29	2.8
569SB004		0.73	0.93			
Tin (Sn)	569SB004	4.20	3.80	4700.00	59.4	9.23
	569SB005	3.50	3.80			
	569SB007	1.80	1.30			
Vanadium (V)	569SB002	ND	4.30			
	569SB001	8.50	8.20	55.00	94.3	155
	569SB002	4.10	11.10			
	569SB003	7.40	10.90			
	569SB004	8.40	5.10			
	569SB005	4.10	11.20			
	569SB007	6.30	16.10			
Zinc (Zn)	569SB001	96.10	5.10	2300.00	827	886
	569SB002	9.90	2.90			
	569SB003	39.80	5.90			
	569SB004	107.00	5.70			
	569SB005	5.00	4.60			

Chemicals Detected in Zone E Soil Samples
AOC 569

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	569SB007	35.90	8.60			

Notes:

ND: Not Detected

NS: No Sample Taken/Sample Not Analyzed

NA: Not applicable

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

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

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

Chemicals Detected in Zone E Soil Samples
AOC 570

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *	
<i>Volatile Organic Compounds (ug/kg)</i>							
1,1,1-Trichloroethane	570SB002	2.00	ND	270000.00	NA	NA	
	570SB012	ND	2.00				
2-Chloroethyl vinyl ether	570SB005	ND	11.00	200000.00	NA	NA	
	570SB002	ND	150.00	780000.00	NA	NA	
Acetone	570SB003	15.00	ND				
	570SB005	30.00	22.00				
	570SB006	340.00	19.00				
	570SB007	86.00	7.00				
	570SB008	ND	17.00				
	570SB009	73.00	100.00				
	570SB010	81.00	28.00				
	570SB015	ND	15.00				
	Methylene chloride	570SB005	9.00	11.00	85000.00	NA	NA
		570SB006	17.00	7.00			
570SB007		15.00	4.00				
570SB008		12.00	11.00				
570SB009		12.00	19.00				
570SB010		14.00	3.00				
Toluene	570SB006	7.00	ND	1600000.00	NA	NA	
	570SB012	ND	1.00				
Xylene (Total)	570SB004	ND	1.00	16000000.00	NA	NA	
	570SB014	ND	3.00				
<i>Semi-volatile Compounds (ug/kg)</i>							
2-Methylnaphthalene	570SB004	ND	120.00	NA	NA	NA	
	570SB005	180.00	ND				
	570SB006	120.00	ND				
	570SB007	390.00	ND				
	570SB010	75.00	ND				
	570SB012	200.00	ND				
	Acenaphthene	570SB002	310.00	ND	470000.00	NA	NA
570SB012		690.00	ND				
570SB0A4		47.00	ND				
Anthracene	570SB002	560.00	ND	23000000.00	NA	NA	
	570SB007	78.00	ND				
	570SB012	1000.00	ND				
	570SB0A4	190.00	ND				
Benzo(a)anthracene	570SB002	1300.00	ND	880.00	NA	NA	
	570SB005	560.00	640.00				
	570SB006	130.00	ND				
	570SB007	360.00	ND				
	570SB009	77.00	89.00				
	570SB012	2700.00	98.00				
	570SB014	380.00	ND				
	570SB015	150.00	ND				
	570SB0A4	735.00	ND				

Chemicals Detected in Zone E Soil Samples
AOC 570

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Benzo(a)pyrene	570SB002	1200.00	ND	88.00	NA	NA
	570SB005	650.00	1100.00			
	570SB006	140.00	ND			
	570SB007	330.00	ND			
	570SB009	78.00	77.00			
	570SB012	2500.00	88.00			
	570SB015	110.00	ND			
	570SB0A4	695.00	ND			
	Benzo(b)fluoranthene	570SB002	1500.00	ND	880.00	NA
570SB005		720.00	1200.00			
570SB006		130.00	ND			
570SB007		600.00	ND			
570SB009		76.00	110.00			
570SB010		80.00	ND			
570SB012		ND	99.00			
570SB014		420.00	ND			
570SB015		140.00	ND			
570SB0A4		1110.00	ND			
Benzo(g,h,i)perylene	570SB002	810.00	ND	310000.00	NA	NA
	570SB005	420.00	820.00			
	570SB006	94.00	ND			
	570SB007	320.00	ND			
	570SB009	58.00	ND			
	570SB012	1700.00	ND			
	570SB014	260.00	ND			
	570SB015	92.00	ND			
	570SB0A4	365.00	ND			
	Benzo(k)fluoranthene	570SB002	1200.00	ND	8800.00	NA
570SB005		580.00	970.00			
570SB006		150.00	ND			
570SB007		360.00	ND			
570CB009		67.00	ND			
570SB012		4900.00	110.00			
570SB014		480.00	ND			
570SB015		120.00	ND			
570SB0A4		485.00	ND			
Benzoic acid		570SB0A4	100.00	ND	31000000.00	NA
	570SB002	1400.00	ND	88000.00	NA	NA
Chrysene	570SB005	730.00	800.00			
	570SB006	220.00	ND			
	570SB007	630.00	ND			
	570SB009	88.00	110.00			
	570SB010	80.00	ND			
	570SB012	3100.00	130.00			
	570SB014	480.00	ND			
	570SB015	150.00	ND			
	570SB0A4	860.00	ND			

Chemicals Detected in Zone E Soil Samples
AOC 570

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Di-n-butylphthalate	570SB008	78.00	ND	7800000.00	NA	NA
	570SB0A4	38.00	ND			
Dibenz(a,h)anthracene	570SB002	320.00	ND	88000.00	NA	NA
	570SB005	170.00	230.00			
	570SB007	100.00	ND			
	570SB012	800.00	ND			
	570SB0A4	159.50	ND			
Dibenzofuran	570SB002	110.00	ND	31000.00	NA	NA
	570SB007	100.00	ND			
	570SB012	310.00	ND			
	570SB0A4	39.00	ND			
Ethylbenzene	570SB012	ND	1.00	780000.00	NA	NA
Fluoranthene	570SB002	3000.00	ND	3100000.00	NA	NA
	570SB005	870.00	710.00			
	570SB006	210.00	ND			
	570SB007	710.00	ND			
	570SB009	93.50	110.00			
	570SB012	5400.00	190.00			
	570SB013	500.00	ND			
	570SB014	730.00	ND			
	570SB015	230.00	ND			
	570SB0A4	1900.00	ND			
Fluorene	570SB002	170.00	ND	310000.00	NA	NA
	570SB012	460.00	ND			
	570SB0A4	74.00	ND			
Indeno(1,2,3-cd)pyrene	570SB002	780.00	ND	880.00	NA	NA
	570SB005	570.00	1000.00			
	570SB007	360.00	ND			
	570SB009	70.00	ND			
	570SB012	1600.00	ND			
	570SB014	240.00	ND			
	570SB015	96.00	ND			
	570SB0A4	485.00	ND			
	570SB002	120.00	ND	310000.00	NA	NA
Naphthalene	570SB004	ND	97.00			
	570SB005	190.00	ND			
	570SB006	120.00	ND			
	570SB007	380.00	ND			
	570SB012	420.00	78.00			
	570SB0A4	43.00	ND			
	570SB002	2300.00	ND	310000.00	NA	NA
Phenanthrene	570SB004	ND	150.00			
	570SB005	470.00	79.00			
	570SB006	280.00	ND			
	570SB007	590.00	ND			
	570SB009	51.00	76.00			
	570SB010	72.00	ND			

Chemicals Detected in Zone E Soil Samples
AOC 570

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Pyrene	570SB012	4800.00	150.00			
	570SB013	270.00	ND			
	570SB014	280.00	ND			
	570SB015	150.00	ND			
	570SB0A4	1050.00	ND			
	570SB002	2700.00	ND	230000.00	NA	NA
	570SB005	900.00	1200.00			
	570SB006	280.00	ND			
	570SB007	750.00	ND			
	570SB009	125.00	120.00			
	570SB010	81.00	ND			
	570SB012	5600.00	160.00			
	570SB013	620.00	ND			
	570SB014	790.00	ND			
	570SB015	310.00	ND			
bis(2-Ethylhexyl)phthalate (BEHP)	570SB0A4	1300.00	ND			
	570SB005	79.00	81.00	4600.00	NA	NA
	570SB007	130.00	1200.00			
	570SB008	2100.00	100.00			
	570SB009	245.00	110.00			
	570SB010	130.00	89.00			

Dioxin/Dibenzofuran (ng/kg)

1234678-HpCDD	570SB009	3.28	ND	NA	NA	NA
1234678-HpCDF	570SB009	3.65	ND	NA	NA	NA
	570SB015	ND	0.75			
123678-HxCDF	570SB009	4.10	ND	NA	NA	NA
OCDD	570SB009	32.40	ND	NA	NA	NA
	570SB015	ND	6.19			
OCDF	570SB009	5.05	ND	NA	NA	NA
	570SB015	ND	1.14			
Total Hepta-Dioxins	570SB009	6.17	ND	NA	NA	NA
Total Hepta-Furans	570SB009	2.67	ND	NA	NA	NA
Total Hexa-Furans	570SB009	2.93	ND	NA	NA	NA
Total Penta-Furans	570SB009	2.02	ND	NA	NA	NA

Hexachrome (mg/kg)

Chromium (Hexavalent)	570CB009	0.10	ND	39.00	94.6	75.2
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Inorganic Compounds (mg/kg)

Aluminum (Al)	570SB002	2630.00	2710.00	7800.00	26000	41100
	570SB003	3840.00	3580.00			
	570SB004	3750.00	4440.00			
	570SB005	2350.00	1820.00			
	570SB006	2170.00	2220.00			
	570SB007	1280.00	1170.00			
	570SB008	1610.00	1240.00			

Chemicals Detected in Zone E Soil Samples
AOC 570

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	570SB009	2070.00	1860.00			
	570SB010	2210.00	3730.00			
	570SB011	8640.00	11600.00			
	570SB012	1930.00	1090.00			
	570SB013	4920.00	2390.00			
	570SB014	5350.00	3810.00			
	570SB015	5620.00	1850.00			
	570SB0A4	4180.00	2620.00			
Antimony (Sb)	570SB002	1.80	ND	3.10	1.77	1.6
	570SB004	0.62	0.68			
	570SB005	0.54	ND			
	570SB006	1.10	ND			
	570SB008	0.59	ND			
	570SB009	ND	0.44			
	570SB011	0.59	ND			
	570SB012	2.00	0.56			
	570SB013	1.60	ND			
	570SB014	0.83	ND			
	570SB015	0.50	ND			
Arsenic (As)	570SB002	4.00	0.98	0.43	23.9	19.9
	570SB003	9.30	0.86			
	570SB004	2.90	2.80			
	570SB005	19.80	1.00			
	570SB006	13.40	3.50			
	570SB007	13.90	0.61			
	570SB008	21.70	6.70			
	570SB009	4.50	9.60			
	570SB010	4.80	0.83			
	570SB011	8.50	6.70			
	570SB012	70.90	5.90			
	570SB013	6.10	0.77			
	570SB014	8.00	1.20			
	570SB015	4.90	0.78			
	570SB0A4	3.90	ND			
Barium (Ba)	570SB002	43.80	18.00	550.00	130	94.1
	570SB003	21.10	10.60			
	570SB004	28.00	29.40			
	570SB005	30.50	11.60			
	570SB006	20.40	15.60			
	570SB007	25.30	9.70			
	570SB008	52.50	15.10			
	570SB009	15.15	21.10			
	570SB010	40.00	15.90			
	570SB011	62.50	34.70			
	570SB012	41.00	28.30			
	570SB013	38.10	17.10			
	570SB014	43.90	18.20			

Chemicals Detected in Zone E Soil Samples
AOC 570

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Beryllium (Be)	570SB015	54.90	15.55			
	570SB002	0.27	0.12	0.15	1.7	2.71
	570SB003	0.15	ND			
	570SB004	0.20	0.22			
	570SB005	0.23	ND			
	570SB006	0.33	0.12			
	570SB007	0.25	ND			
	570SB009	0.15	0.13			
	570SB010	0.18	0.20			
	570SB011	0.45	0.30			
	570SB012	0.31	ND			
	570SB013	0.43	0.15			
	570SB014	0.47	0.20			
	570SB015	0.74	0.11			
	Cadmium (Cd)	570SB002	0.76	ND	3.90	1.5
570SB003		0.15	ND			
570SB004		0.55	0.23			
570SB005		0.35	ND			
570SB006		0.37	0.12			
570SB007		0.46	ND			
570SB008		0.24	ND			
570SB009		0.19	0.19			
570SB010		0.15	ND			
570SB011		0.17	ND			
570SB012		0.79	ND			
570SB013		0.61	ND			
570SB014		0.41	ND			
570SB015		0.26	ND			
570SB0A4		0.23	ND			
Calcium (Ca)	570SB002	3000.00	246.00	NA	NA	NA
	570SB003	6780.00	556.00			
	570SB004	2880.00	1490.00			
	570SB005	12600.00	672.00			
	570SB006	35800.00	2210.00			
	570SB007	120000.00	115.00			
	570SB008	14700.00	1060.00			
	570SB009	18600.00	3310.00			
	570SB010	33000.00	1540.00			
	570SB011	11800.00	1030.00			
	570SB012	29800.00	2400.00			
	570SB013	2250.00	257.00			
	570SB014	1940.00	132.00			
	570SB015	2300.00	258.00			
	Chromium (Cr)	570SB002	32.50	2.40	39.00	94.6
570SB003		4.50	4.40			
570SB004		7.40	7.90			
570SB005		6.10	3.30			

Chemicals Detected in Zone E Soil Samples
AOC 570

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	570SB006	5.30	4.00			
	570SB007	7.70	2.10			
	570SB008	6.50	2.50			
	570SB009	2.90	3.20			
	570SB010	3.20	3.20			
	570SB011	10.20	22.00			
	570SB012	10.30	2.80			
	570SB013	16.90	1.80			
	570SB014	18.50	2.60			
	570SB015	6.70	1.95			
	570SB0A4	5.95	1.50			
Cobalt (Co)	570SB002	3.00	ND	470.00	19	14.9
	570SB003	0.67	0.47			
	570SB004	5.70	0.66			
	570SB005	1.20	ND			
	570SB006	18.00	0.71			
	570SB007	3.40	ND			
	570SB008	0.78	ND			
	570SB009	0.55	0.48			
	570SB010	0.84	0.46			
	570SB011	4.20	0.81			
	570SB012	1.60	0.44			
	570SB013	1.90	0.96			
	570SB014	2.00	0.36			
	570SB015	2.30	0.49			
Copper (Cu)	570SB002	192.00	6.50	310.00	66	152
	570SB003	10.60	0.99			
	570SB004	56.70	41.50			
	570SB005	13.50	1.00			
	570SB006	13.40	5.50			
	570SB007	10.00	0.96			
	570SB008	9.70	2.40			
	570SB009	4.75	7.50			
	570SB010	5.90	6.70			
	570SB011	54.70	2.50			
	570SB012	65.10	5.20			
	570SB013	58.80	1.20			
	570SB014	38.60	6.90			
	570SB015	26.60	1.00			
	570SB0A4	19.85	ND			
Iron (Fe)	570SB002	4510.00	1560.00	2300.00	NA	NA
	570SB003	2660.00	1580.00			
	570SB004	3500.00	2570.00			
	570SB005	8720.00	1380.00			
	570SB006	6800.00	5300.00			
	570SB007	7220.00	2520.00			
	570SB008	9370.00	6370.00			

Chemicals Detected in Zone E Soil Samples
AOC 570

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Lead (Pb)	570SB009	3665.00	5510.00			
	570SB010	3870.00	2710.00			
	570SB011	6600.00	17400.00			
	570SB012	5360.00	6890.00			
	570SB013	5700.00	1740.00			
	570SB014	6980.00	2590.00			
	570SB015	3700.00	2000.00			
	570SB002	332.00	4.90	400.00	265	173
	570SB003	39.60	1.90			
	570SB004	89.20	63.30			
	570SB005	138.00	4.00			
	570SB006	47.70	10.50			
	570SB007	61.10	1.70			
	570SB008	29.90	2.80			
	570SB009	14.30	24.50			
Magnesium (Mg)	570SB010	24.10	1.60			
	570SB011	133.00	16.20			
	570SB012	193.00	13.60			
	570SB013	120.00	1.40			
	570SB014	100.00	3.20			
	570SB015	50.70	2.30			
	570SB0A4	90.45	1.30			
	570SB002	513.00	93.40	NA	NA	NA
	570SB003	247.00	195.00			
	570SB004	170.00	169.00			
	570SB005	295.00	81.00			
	570SB006	518.00	128.00			
	570SB007	1210.00	70.40			
	570SB008	268.00	118.00			
	570SB009	271.00	152.00			
570SB010	428.00	169.00				
Manganese (Mn)	570SB011	610.00	450.00			
	570SB012	475.00	136.00			
	570SB013	346.00	87.90			
	570SB014	380.00	115.00			
	570SB015	275.00	115.00			
	570SB002	66.60	7.00	180.00	302	881
	570SB003	37.60	8.40			
	570SB004	31.90	9.90			
	570SB005	33.80	5.70			
	570SB006	37.10	18.30			
	570SB007	85.60	4.90			
	570SB008	20.40	16.00			
570SB009	24.60	15.30				
570SB010	38.90	24.80				
570SB011	110.00	17.30				
570SB012	71.80	16.20				

Chemicals Detected in Zone E Soil Samples
AOC 570

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *	
Mercury (Hg)	570SB013	128.00	39.60				
	570SB014	141.00	9.60				
	570SB015	408.00	35.55				
	570SB002	0.23	ND	2.30	2.6	1.59	
	570SB003	0.05	ND				
	570SB004	0.16	0.09				
	570SB005	0.13	ND				
	570SB006	0.06	ND				
	570SB007	0.11	ND				
	570SB008	0.07	ND				
	570SB009	0.06	0.05				
	570SB010	0.07	0.04				
	570SB011	0.06	0.03				
	570SB012	0.23	0.05				
	570SB013	0.34	ND				
Nickel (Ni)	570SB014	1.40	0.06				
	570SB015	0.12	ND				
	570SB002	7.50	1.60	160.00	77.1	57	
	570SB003	2.50	1.20				
	570SB004	5.80	2.50				
	570SB005	3.30	0.78				
	570SB006	7.30	1.20				
	570SB007	4.30	0.70				
	570SB008	1.90	0.78				
	570SB009	1.65	1.50				
	570SB010	2.00	2.00				
	570SB011	9.50	3.20				
	570SB012	6.40	1.10				
	570SB013	8.50	2.30				
	570SB014	4.90	1.60				
570SB015	5.10	0.99					
Potassium (K)	570SB0A4	2.80	ND				
	570SB002	482.00	ND	NA	NA	NA	
	570SB003	549.00	ND				
	570SB005	590.00	314.00				
	570SB006	502.00	480.00				
	570SB007	661.00	ND				
	570SB008	422.00	406.00				
	570SB009	429.00	393.00				
	570SB010	491.00	454.00				
	570SB011	930.00	737.00				
	570SB013	594.00	ND				
	570SB014	566.00	ND				
	570SB015	628.00	ND				
	Selenium (Se)	570SB005	1.10	ND	39.00	1.7	2.4
		570SB006	1.30	0.65			
570SB007		0.70	ND				

Chemicals Detected in Zone E Soil Samples
AOC 570

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	570SB008	0.97	0.58			
	570SB011	ND	0.64			
	570SB012	0.77	ND			
	570SB014	0.59	ND			
	570SB015	0.68	ND			
Silver (Ag)	570SB002	0.43	ND	39.00	NA	NA
	570SB004	14.30	ND			
Sodium (Na)	570SB007	109.00	ND	NA	NA	NA
	570SB011	76.80	ND			
Thallium (Tl)	570CB009	0.53	ND	0.29	2.8	NA
Tin (Sn)	570CB0A4	30.90	ND	4700.00	59.4	9.23
	570SB002	20.80	ND			
Vanadium (V)	570SB002	13.00	1.50	55.00	94.3	155
	570SB003	4.40	2.50			
	570SB004	8.30	8.10			
	570SB005	6.50	4.30			
	570SB006	11.80	5.30			
	570SB007	4.60	1.70			
	570SB008	3.70	2.70			
	570SB009	2.20	3.30			
	570SB010	2.50	3.10			
	570SB011	10.60	31.40			
	570SB012	7.70	2.00			
	570SB013	12.80	1.60			
	570SB014	14.40	2.50			
	570SB015	7.20	2.30			
	570SB0A4	6.05	1.30			
Zinc (Zn)	570SB002	168.00	30.10	2300.00	827	886
	570SB003	76.30	3.60			
	570SB004	90.90	66.20			
	570SB005	74.10	5.40			
	570SB006	36.20	9.60			
	570SB007	45.60	1.50			
	570SB008	28.80	3.70			
	570SB009	112.75	26.20			
	570SB010	16.20	4.00			
	570SB011	67.30	10.50			
	570SB012	187.00	12.30			
	570SB013	118.00	5.10			
	570SB014	102.00	4.30			
	570SB015	61.40	3.70			
	570SB0A4	76.40	2.50			

Notes:

ND: Not Detected

NS: No Sample Taken/Sample Not Analyzed

NA: Not applicable

Chemicals Detected in Zone E Soil Samples
AOC 570

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
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For compounds detected in both the primary and duplicate sample, the concentration for both detections are averaged and listed as one detection.

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

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

Chemicals Detected in Zone E Soil Samples
AOC 578

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
<i>Volatile Organic Compounds (ug/kg)</i>						
Acetone	578SB001	40.00	ND	780000	NA	NA
	578SB003	300.00	ND			
Methylene chloride	578SB004	8.00	ND	85000	NA	NA
	578SB003	57.00	ND			
Tetrachloroethene	578SB005	3.00	ND	12000	NA	NA
Toluene	578SB002	4.00	ND	1600000	NA	NA
<i>Semi-volatile Compounds (ug/kg)</i>						
Acenaphthene	578SB006	45.00	ND	470000	NA	NA
Acenaphthylene	578SB005	140.00	ND	310000	NA	NA
Anthracene	578SB004	37.00	83.00	23000000	NA	NA
	578SB005	180.00	ND			
	578SB006	150.00	ND			
	578SB004	121.00	240.00			
Benzo(a)anthracene	578SB001	57.00	ND	880	NA	NA
	578SB002	71.00	ND			
	578SB003	96.00	ND			
	578SB004	121.00	240.00			
	578SB005	910.00	96.00			
	578SB006	540.00	ND			
Benzo(a)pyrene	578SB001	37.00	ND	88	NA	NA
	578SB002	86.00	ND			
	578SB003	100.00	ND			
	578SB004	135.00	210.00			
	578SB005	1100.00	120.00			
	578SB006	560.00	ND			
Benzo(b)fluoranthene	578SB001	48.00	42.00	880	NA	NA
	578SB002	89.00	40.00			
	578SB003	160.00	ND			
	578SB004	143.50	230.00			
	578SB005	1200.00	120.00			
	578SB006	460.00	ND			
Benzo(g,h,i)perylene	578SB002	54.00	ND	310000	NA	NA
	578SB003	68.00	ND			
	578SB004	93.50	110.00			
	578SB005	520.00	54.00			
	578SB006	230.00	ND			
	578SB002	54.00	ND	310000	NA	NA
Benzo(k)fluoranthene	578SB001	51.00	ND	8800	NA	NA
	578SB002	74.00	38.00			
	578SB003	130.00	ND			
	578SB004	150.00	200.00			
	578SB005	940.00	98.00			
	578SB006	590.00	ND			
Benzoic acid	578SB006	ND	42.00	31000000	NA	NA
bis(2-Ethylhexyl)phthalate (BEHP)	578SB001	190.00	110.00	4600	NA	NA
	578SB002	38.00	ND			
	578SB003	130.00	42.00			
	578SB004	175.00	ND			
	578SB005	100.00	ND			
	578SB006	85.00	ND			

Chemicals Detected in Zone E Soil Samples
AOC 578

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Chrysene	578SB001	66.00	ND	88000	NA	NA
	578SB002	84.00	44.00			
	578SB003	250.00	ND			
	578SB004	145.00	270.00			
	578SB005	1000.00	100.00			
	578SB006	580.00	ND			
Di-n-butylphthalate	578SB001	78.00	64.00	7800000	NA	NA
	578SB004	37.00	ND			
Dibenz(a,h)anthracene	578SB003	42.00	ND	88000	NA	NA
	578SB004	36.00	52.00			
	578SB005	250.00	ND			
	578SB006	120.00	ND			
Fluoranthene	578SB001	150.00	70.00	3100000	NA	NA
	578SB002	110.00	53.00			
	578SB003	180.00	ND			
	578SB004	260.00	620.00			
	578SB005	1500.00	130.00			
	578SB006	1200.00	ND			
Indeno(1,2,3-cd)pyrene	578SB002	44.00	ND	880	NA	NA
	578SB003	65.00	ND			
	578SB004	78.50	99.00			
	578SB005	480.00	52.00			
	578SB006	230.00	ND			
	578SB001	62.00	ND	310000	NA	NA
Phenanthrene	578SB002	72.00	ND			
	578SB003	170.00	ND			
	578SB004	140.50	440.00			
	578SB005	640.00	48.00			
	578SB006	660.00	ND			
	578SB001	130.00	ND	230000	NA	NA
Pyrene	578SB001	140.00	62.00			
	578SB002	98.00	52.00			
	578SB003	160.00	ND			
	578SB004	290.00	490.00			
	578SB005	1300.00	130.00			
	578SB006	1100.00	ND			

Dioxin/Dibenzofuran (ng/kg)

1234789-HpCDF	578CB004	11.80	ND	NA	NA	NA
Total Hepta-Furans	578CB004	11.80	ND	NA	NA	NA

Inorganic Compounds (mg/kg)

Aluminum (Al)	578SB001	593.00	872.00	7800	26000	41100
	578SB002	4600.00	2800.00			
	578SB003	1210.00	2400.00			
	578SB004	3895.00	4470.00			
	578SB005	6180.00	2550.00			
	578SB006	5280.00	5570.00			
Antimony (Sb)	578SB001	8.50	3.10	3.1	1.77	1.6
	578SB003	0.64	ND			

Chemicals Detected in Zone E Soil Samples
AOC 578

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Arsenic (As)	578SB001	1.10	0.83	0.43	23.9	19.9
	578SB002	1.70	1.40			
	578SB003	18.00	0.94			
	578SB004	1.60	0.95			
	578SB005	3.80	1.40			
	578SB006	2.00	1.50			
Barium (Ba)	578SB001	13.90	14.90	550	130	94.1
	578SB002	24.90	13.20			
	578SB003	31.30	16.60			
	578SB004	19.90	19.50			
	578SB005	29.80	13.60			
	578SB006	24.00	26.70			
Beryllium (Be)	578SB001	ND	0.13	0.15	1.7	2.71
	578SB002	0.22	0.12			
	578SB003	0.23	ND			
	578SB004	0.17	0.15			
	578SB005	0.38	0.13			
	578SB006	0.21	0.22			
Cadmium (Cd)	578SB001	2.20	0.95	3.9	1.5	0.96
	578SB005	0.25	ND			
Calcium (Ca)	578SB001	5150.00	947.00	NA	NA	NA
	578SB002	1450.00	196.00			
	578SB003	1010.00	93.60			
	578SB004	4890.00	480.00			
	578SB005	5130.00	603.00			
	578SB006	1450.00	304.00			
Chromium (Cr)	578SB001	101.00	32.30	39	94.6	75.2
	578SB002	4.70	4.10			
	578SB003	2.50	3.70			
	578SB004	4.05	4.40			
	578SB005	4.90	3.40			
	578SB006	6.00	4.70			
Cobalt (Co)	578SB001	9.70	2.60	470	19	14.9
	578SB002	6.50	ND			
	578SB003	26.70	0.73			
	578SB004	34.55	1.30			
	578SB005	61.00	1.00			
	578SB006	11.20	0.58			
Copper (Cu)	578SB001	119.00	87.70	310	66	152
	578SB002	5.90	4.00			
	578SB003	8.70	2.60			
	578SB004	4.90	3.90			
	578SB005	53.10	3.10			
	578SB006	9.90	1.50			
Iron (Fe)	578SB001	8240.00	4590.00	2300	NA	NA
	578SB002	4500.00	3290.00			
	578SB003	14300.00	3700.00			
	578SB004	4210.00	3010.00			
	578SB005	8040.00	2470.00			
	578SB006	3440.00	2970.00			

**Chemicals Detected in Zone E Soil Samples
AOC 578**

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Lead (Pb)	578SB001	567.00	355.00	400	265	173
	578SB002	22.70	7.50			
	578SB003	20.30	2.60			
	578SB004	18.25	7.10			
	578SB005	187.00	14.50			
	578SB006	17.60	3.10			
Magnesium (Mg)	578SB001	116.00	94.30	NA	NA	NA
	578SB002	236.00	135.00			
	578SB003	136.00	173.00			
	578SB004	427.50	207.00			
	578SB005	298.00	149.00			
	578SB006	295.00	238.00			
Manganese (Mn)	578SB001	45.70	36.50	180	302	881
	578SB002	43.70	74.30			
	578SB003	12.80	20.50			
	578SB004	40.85	25.80			
	578SB005	73.70	21.30			
	578SB006	23.80	31.10			
Mercury (Hg)	578SB001	0.09	ND	2.3	2.6	1.59
	578SB003	0.10	ND			
	578SB004	0.11	0.17			
	578SB005	0.34	ND			
	578SB006	0.34	ND			
Nickel (Ni)	578SB001	10.00	7.00	160	77.1	57
	578SB002	3.10	1.60			
	578SB003	6.90	1.60			
	578SB004	4.80	2.00			
	578SB005	18.00	1.70			
	578SB006	2.80	1.90			
Potassium (K)	578SB001	184.00	177.00	NA	NA	NA
	578SB002	273.00	ND			
	578SB003	243.00	ND			
	578SB004	255.00	ND			
	578SB005	251.00	ND			
	578SB006	419.00	ND			
Selenium (Se)	578SB003	1.00	ND	39	1.7	2.4
	578SB005	0.66	ND			
Sodium (Na)	578SB001	181.00	183.00	NA	NA	NA
	578SB002	147.00	120.00			
	578SB003	665.00	246.00			
	578SB004	240.00	113.00			
	578SB005	146.00	179.00			
	578SB006	267.00	145.00			
Thallium (Tl)	578SB003	0.82	ND	0.29	2.8	2
Tin (Sn)	578SB001	2.50	ND	4700	59.4	9.23
Vanadium (V)	578SB001	3.00	3.40	55	94.3	155
	578SB002	3.70	2.70			
	578SB003	3.00	2.90			
	578SB004	4.45	3.90			
	578SB005	4.30	2.60			
	578SB006	5.40	4.50			

**Chemicals Detected in Zone E Soil Samples
AOC 578**

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Zinc (Zn)	578SB001	578.00	485.00	2300	827	886
	578SB002	22.30	5.20			
	578SB003	6.50	4.40			
	578SB004	29.30	31.00			
	578SB005	145.00	13.00			
	578SB006	45.80	9.00			

Notes:

ND: Not Detected

NS: No Sample Taken/Sample Not Analyzed

NA: Not applicable

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

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

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

FIGURE 6-1

Groundwater Sampling Form

Groundwater Sampling		Sample ID: NBCE\ 5706W00202	
PROJECT NAME: <u>NAVAL BASE CHARLESTON (clean)</u>		JOB NO: _____	DATE: <u>7/23/96</u>
WELL NO: <u>NBCE\ 570002</u>		LOCATION: <u>ZONE E</u>	
WEATHER CONDITIONS: <u>SUNNY, CLEAR</u>		AMBIENT TEMP: <u>89°F</u>	
REVIEWED BY: <u>[Signature]</u>		PERSONNEL: <u>P. Shaw, J. Harrow</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>NBCE\ 57002D</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>NBCE\ 57002D</u>	
INITIAL WELL VOLUME Well diameter (in.) <u>2</u> Stickup (ft.) <u>3'</u> Depth to bottom of well from TOC (ft.) <u>16.38</u> Depth to water surface from TOC (ft.) <u>10.32</u> Length of water (ft.) <u>6.06</u> Volume of water (ft.) _____ (gal.) <u>1.03</u> Amount of sediment at bottom of well (ft.) <u>0</u> 3 volumes of water (gal.) <u>3.09</u>		PURGING Time started <u>1012</u> Finished <u>1044</u> Volume purged <u>6.25</u> Comments on Well Recovery <u>Good</u> Depth to water (ft.) <u>13.27</u> Completion _____ Additional Comments _____ Sample Collected: Start <u>1050</u> Finish <u>1102</u>	
IN-SITU TESTING		Time: <u>1041</u> <u>1044</u> <u>1014</u> <u>1017</u> <u>1019</u> <u>1022</u> <u>1026</u> <u>1032</u> <u>1036</u> <u>1038</u>	
		<u>9</u> <u>10</u> <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> <u>6</u> <u>7</u> <u>8</u>	
Well Volume Purged (gal.)		<u>5.625</u> <u>6.25</u> <u>6.25</u> <u>1.25</u> <u>1.875</u> <u>2.5</u> <u>3.125</u> <u>3.75</u> <u>4.375</u> <u>5</u>	
Turbidity		<u>50</u> <u>61</u> <u>86</u> <u>100</u> <u>58</u> <u>40</u> <u>38</u> <u>200</u> <u>24</u> <u>17</u>	
Oder		<u>NO</u>	
pH (units)		<u>5.52</u> <u>5.44</u> <u>5.84</u> <u>5.68</u> <u>5.70</u> <u>5.61</u> <u>5.53</u> <u>5.67</u> <u>5.49</u> <u>5.97</u>	
Conductivity (µmho)		<u>.162</u> <u>.178</u> <u>.208</u> <u>.191</u> <u>.155</u> <u>.154</u> <u>.161</u> <u>.170</u> <u>.168</u> <u>.161</u>	
Water Temperature (deg. C)		<u>26.1</u> <u>25.9</u> <u>27.6</u> <u>27</u> <u>26.6</u> <u>26.3</u> <u>26.3</u> <u>26.9</u> <u>26.1</u> <u>26.3</u>	
Depth to water (ft.)		<u>12.56</u> <u>13.27</u> <u>10.92</u> <u>11.42</u> <u>11.77</u> <u>12.13</u> <u>12.41</u> <u>11.57</u> <u>11.94</u> <u>12</u>	
NOTES: 1 FT. LENGTH OF 4" Turbidity choices:		equals 0.087 ft or 0.65 gal. clear, turbid, opaque	
		1 ft. length 2" equals 0.022ft or 0.16 gal. Revision Date: 8/5/92	

FIGURE 6-1

Groundwater Sampling Form

Groundwater Sampling		Sample ID: NBCEI 5706W00204
PROJECT NAME: NAVAL BASE CHARLESTON (clean)	JOB NO: _____	DATE: 2/3/97
WELL NO: NBCEI 570002	LOCATION: ZONE E	
WEATHER CONDITIONS: Sunny	AMBIENT TEMP: 67°F	
REVIEWED BY: <i>A. Shaw</i>	PERSONNEL: P. Shaw J. H. Hagan	

PURGING DEVICE	SAMPLING DEVICE
Type device? Peristaltic Pump	Type device? Peristaltic Pump
How was the device decontaminated? Per CSAP	How was the device decontaminated? Per CSAP
How was the line decontaminated? Per CSAP	How was the line decontaminated? Per CSAP
Which well was previously purged? NBCEI 570020	Which well was previously sampled? NBCEI 570020

INITIAL WELL VOLUME	PURGING
Well diameter (in.) 2	Time started 1116 Finished 1200
Stickup (ft.) 3'	Volume purged 5 gal
Depth to bottom of well from TOC (ft.) 16.38	Comments on Well Recovery Good
Depth to water surface from TOC (ft.) 10.64	Depth to water (ft.) 12.36
Length of water (ft.) 5.74	Completion —
Volume of water (ft.) —	Additional Comments —
(gal.) .97	Sample Collected: Start 1207
Amount of sediment at bottom of well (ft.) -0-	Finish 1220
3 volumes of water (gal.) 2.91	

IN-SITU TESTING	Time:	1156	1200	1123	1127	1130	1135	1140	1144	1148	1152
		9	10	1	2	3	4	5	6	7	8
Well Volume Purged (gal.)		4.5	5	.5	1	1.5	2	2.5	3	3.5	4
Turbidity		274	236	195	390	388	597	444	343	284	299
Odor		NO									
pH (units)		5.71	5.65	5.23	5.92	5.90	5.87	5.82	5.79	5.86	5.78
Conductivity (µmho)		.149	.160	.131	.117	.116	.116	.126	.130	.135	.150
Water Temperature (deg. C)		21.8	21.8	21.4	21.4	21.7	21.5	21.5	21.6	21.5	21.6
Depth to water (ft.)		12.28	12.36	11.15	11.50	11.71	11.51	11.99	12.05	12.27	12.20

NOTES: 1 FT. LENGTH OF 4" equals 0.087 ft or 0.65 gal. 1 ft. length 2" equals 0.022ft or 0.16 gal.
 Turbidity choices: clear, turbid, opaque
 Revision Date: 8/5/92

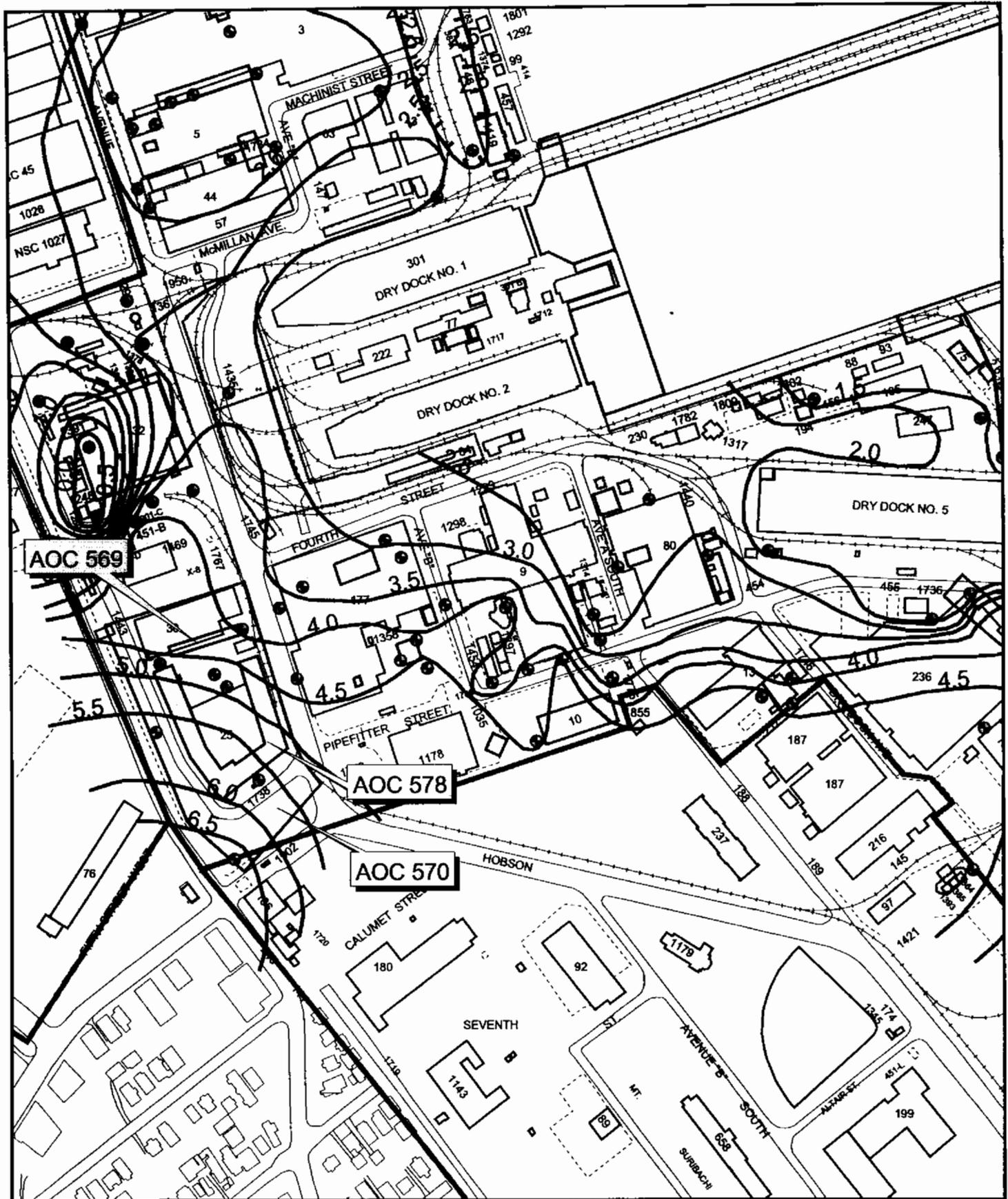


Figure A-1
 Shallow Groundwater Contour Map, May 2002
 AOCs 569, 570, and 578, Zone E
 Charleston Naval Complex

Comment Prepared by Charles B. Watson

AOC 569, 570, and 578

SCDHEC Comment 21:

The site map shows a former building 1199 in the center of AOC 570 but the report did not mention its former existence or usage.

Navy/EnSafe Response:

Information regarding Building 1199 will be researched and included in the Final Zone E RFI Report.

CH2M-Jones Response 21:

Building 1199 was used as an auto maintenance facility and was demolished in the early 1990's.

Comment Prepared by Eric F. Cathcart

AOC 569, 570, and 578

SCDHEC Comment 57:

The data presented in this section should be presented in an isoconcentration map form whenever possible. At this time, the Department is unable to determine if the extent of contamination has been fully characterized.

Navy/EnSafe Response:

Isoconcentration maps will be provided in the Final Zone E RFI Report.

CH2M-Jones Response:

Isoconcentration maps for groundwater contaminants will be provided in the CMS Report for this site. Isoconcentration maps for soil contaminants do not accurately represent the extent of soil contamination since soil contaminants do not form a plume.

SCDHEC Comment 58:

The Department recommends the installation of additional groundwater points from areas around the existing well network in an effort to determine the vertical and horizontal extent.

Navy/EnSafe Response:

Grid-based well pair NBCEGDE030/30D are located to the west of the site and indicated no significant VOC or metals contamination. Additional monitoring wells will be placed to the northwest, south, and southwest of the site to help determine the extent of contaminants.

CH2M-Jones Response:

Additional shallow and deep groundwater monitoring wells were installed and sampled by the Navy during April 2002 to further delineate COPCs at the site.

SCDHEC Comment 59:

On page 10.34-24, the report indicates that "the elevated aluminum concentration in the sample from well NBCE570002 indicates that suspended clay particles affected the analytical results". The Navy may opt to collect future samples as filtered versus non-filtered in an attempt to validate this statement.

Navy/EnSafe Response:

As part of the ongoing evaluation of inorganics in groundwater, the Navy will continue to collect samples using the "low flow" method, which appears to have eliminated the need for filtered samples. Samples are also being analyzed for TSS. If turbidity appears to persist, samples will be filtered.

CH2M-Jones Response 59:

No additional response.

Comment Prepared by Dynamac/Gannett Fleming

AOC 569, 570, and 578

SCDHEC Comment:

Section 10.34.4, Page 10.34-22, Line 8: The text states that only one metal (thallium) in deep groundwater exceeded its tap-water RBC. This statement is incorrect. Arsenic and manganese also exceeded their respective tap-water RBCs, according to Table 10.34.4.4 (page 10.34-18). The text should be corrected.

Navy/EnSafe Response:

The text will be revised to reflect this correction.

CH2M-Jones Response:

Manganese detection exceeded the tapwater RBC in deep groundwater at the site, but were all below the maximum background manganese concentration in deep groundwater of 1,660 µg/L. Manganese detections at the site represent naturally occurring conditions and do not warrant further investigation.

Analytical Data Summary

12/24/2002 1:25 PM

	StationID	E569SB005b		E569SB005b	
	SampleID	569SB00501b (0-1ft)		569SB00502b (3-5ft)	
	DateCollected	4/25/2002		4/25/2002	
	DateExtracted	5/1/2002		5/1/2002	
	DateAnalyzed	5/1/2002		5/1/2002	
	SDGNumber	59501		59501	
Parameter	Units				
Chloromethane	ug/kg	1000	U	1940	U
Vinyl chloride	ug/kg	1000	U	1940	U
Bromomethane	ug/kg	1000	U	1940	U
Chloroethane	ug/kg	1000	U	1940	U
1,1-Dichloroethene	ug/kg	501	U	971	U
Acetone	ug/kg	1000	U	1940	U
Carbon Disulfide	ug/kg	501	U	971	U
Methylene Chloride	ug/kg	501	U	971	U
trans-1,2-Dichloroethene	ug/kg	501	U	971	U
1,1-Dichloroethane	ug/kg	501	U	971	U
Vinyl acetate	ug/kg	1000	U	1940	U
Methyl ethyl ketone (2-Butanone)	ug/kg	1000	U	1940	U
cis-1,2-Dichloroethylene	ug/kg	501	U	971	U
1,2-Dichloroethene (total)	ug/kg	501	U	971	U
Chloroform	ug/kg	501	U	971	U
1,1,1-Trichloroethane	ug/kg	501	U	971	U
Carbon Tetrachloride	ug/kg	501	U	971	U
1,2-Dichloroethane	ug/kg	501	U	971	U
Benzene	ug/kg				
Trichloroethylene (TCE)	ug/kg	501	U	971	U
1,2-Dichloropropane	ug/kg	501	U	971	U
Bromodichloromethane	ug/kg	501	U	971	U
2-Chloroethyl vinyl ether	ug/kg	1000	U	1940	U
cis-1,3-Dichloropropene	ug/kg	501	U	971	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/kg	501	U	971	U
Benzene	ug/kg				
trans-1,3-Dichloropropene	ug/kg	501	U	971	U
1,1,2-Trichloroethane	ug/kg	501	U	971	U
2-Hexanone	ug/kg	1000	U	1940	U
Tetrachloroethylene (PCE)	ug/kg	501	U	971	U

Analytical Data Summary

12/24/2002 1:25 PM

	StationID	E569SB005b		E569SB005b	
	SampleID	569SB00501b (0-1ft)		569SB00502b (3-5ft)	
	DateCollected	4/25/2002		4/25/2002	
	DateExtracted	5/1/2002		5/1/2002	
	DateAnalyzed	5/1/2002		5/1/2002	
	SDGNumber	59501		59501	
Parameter	Units				
Dibromochloromethane	ug/kg	501	U	971	U
Chlorobenzene	ug/kg	501	U	971	U
[REDACTED SECTION]					
Styrene	ug/kg	501	U	971	U
Bromoform	ug/kg	501	U	971	U
1,1,2,2-Tetrachloroethane	ug/kg	501	U	971	U
1,3-Dichlorobenzene	ug/kg	501	U	971	U
1,4-Dichlorobenzene	ug/kg	501	U	971	U
1,2-Dichlorobenzene	ug/kg	501	U	971	U
1,2,4-Trichlorobenzene	ug/kg	501	U	971	U
1,2,3-Trichlorobenzene	ug/kg	501	U	971	U

Analytical Data Summary

12/24/2002 1:37 PM

StationID	E569SB004b	E569SB004b	E578SB001b	E578SB001b	E578SB001b
SampleID	569SB00401b (0-1ft)	569SB00402b (3-5ft)	578CB00102b (3-5ft)	578SB00101b (0-1ft)	578SB00102b (3-5ft)
DateCollected	4/25/2002	4/25/2002	4/25/2002	4/25/2002	4/25/2002
DateExtracted	5/3/2002	5/3/2002	5/3/2002	5/3/2002	5/3/2002
DateAnalyzed	5/5/2002	5/5/2002	5/5/2002	5/5/2002	5/5/2002
SDGNumber	59501	59501	59501	59501	59501

Parameter	Units								
Antimony	mg/kg			1.1	J	1.07	J	1.24	J
Chromium, Total	mg/kg			34.2	=	31.8	=	26.6	=
Lead	mg/kg			308	J	301	J	406	J
Thallium	mg/kg	0.547	U	0.565	U				

Analytical Data Summary

12/24/2002 1:25 PM

	StationID	E569GW001		E569GW001		E569GW002	
	SampleID	569GW001M2		569HW001M2		569GW002M2	
	DateCollected	4/17/2002		4/17/2002		4/16/2002	
	DateExtracted	4/18/2002		4/18/2002		4/18/2002	
	DateAnalyzed	4/18/2002		4/18/2002		4/18/2002	
	SDGNumber	59058		59058		59058	
Parameter	Units						
Chloromethane	ug/L	10	U	10	U	10	U
Vinyl chloride	ug/L	10	U	10	U	10	U
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	35.2	U	10	U	10	U
Carbon Disulfide	ug/L	5	U	5	U	5	U
Methylene Chloride	ug/L	5.1	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	U	10	U	10	U
Methyl ethyl ketone (2-Butanone)	ug/L	10	U	10	U	10	U
cis-1,2-Dichloroethylene	ug/L	0.92	J	1.3	J	0.34	J
1,2-Dichloroethene (total)	ug/L	0.92	J	1.3	J	0.34	J
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
Dichloroethane (total)	ug/L	4.7	U	4.7	U	4.7	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	5	R	5	U	5	U
cis-1,3-Dichloropropene	ug/L	5	U	5	U	5	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	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

Analytical Data Summary

12/24/2002 1:25 PM

	StationID	E570GW001	E570GW03D		
	SampleID	570GW001M2	570GW03DM2		
	DateCollected	4/17/2002	4/16/2002		
	DateExtracted	4/18/2002	4/18/2002		
	DateAnalyzed	4/18/2002	4/18/2002		
	SDGNumber	59058	59058		
Parameter	Units				
Chloromethane	ug/L	10	U	10	U
Vinyl chloride	ug/L	10	U	10	U
Bromomethane	ug/L	10	U	10	U
Chloroethane	ug/L	10	U	10	U
1,1-Dichloroethene	ug/L	5	U	5	U
Acetone	ug/L	10	U	5.5	U
Carbon Disulfide	ug/L	5	U	5	U
Methylene Chloride	ug/L	5	U	5	U
trans-1,2-Dichloroethene	ug/L	5	U	0.51	J
1,1-Dichloroethane	ug/L	5	U	5	U
Vinyl acetate	ug/L	10	U	10	U
Methyl ethyl ketone (2-Butanone)	ug/L	10	U	10	U
cis-1,2-Dichloroethylene	ug/L	0.36	J	5.8	=
1,2-Dichloroethene (total)	ug/L	0.36	J	6.3	=
Chloroform	ug/L	5	U	5	U
1,1,1-Trichloroethane	ug/L	5	U	5	U
Carbon Tetrachloride	ug/L	5	U	5	U
1,2-Dichloroethane	ug/L	5	U	5	U
Benzene	ug/L	5	U	5	U
2					
1,2-Dichloropropane	ug/L	5	U	5	U
Bromodichloromethane	ug/L	5	U	5	U
2-Chloroethyl vinyl ether	ug/L	5	U	5	U
cis-1,3-Dichloropropene	ug/L	5	U	5	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/L	10	U	10	U
Toluene	ug/L	5	U	5	U
trans-1,3-Dichloropropene	ug/L	5	U	5	U
1,1,2-Trichloroethane	ug/L	5	U	5	U
2-Hexanone	ug/L	10	U	10	U

Analytical Data Summary

12/24/2002 1:25 PM

StationID	E569GW001	E569GW001	E569GW002
SampleID	569GW001M2	569HW001M2	569GW002M2
DateCollected	4/17/2002	4/17/2002	4/16/2002
DateExtracted	4/18/2002	4/18/2002	4/18/2002
DateAnalyzed	4/18/2002	4/18/2002	4/18/2002
SDGNumber	59058	59058	59058

Parameter	Units	E569GW001		E569GW001		E569GW002	
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
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

12/24/2002 1:25 PM

		E570GW001		E570GW03D	
		570GW001M2		570GW03DM2	
		4/17/2002		4/16/2002	
		4/18/2002		4/18/2002	
		4/18/2002		4/18/2002	
		59058		59058	
Parameter	Units				
Dibromochloromethane	ug/L	5	U	5	U
Chlorobenzene	ug/L	5	U	5	U
Ethylbenzene	ug/L	5	U	5	U
m+p Xylene	ug/L	5	U	5	U
o-Xylene	ug/L	5	U	5	U
Xylenes, Total	ug/L	5	U	5	U
Styrene	ug/L	5	U	5	U
Bromoform	ug/L	5	U	5	U
1,1,2,2-Tetrachloroethane	ug/L	5	U	5	U
1,3-Dichlorobenzene	ug/L	5	U	5	U
1,4-Dichlorobenzene	ug/L	5	U	5	U
1,2-Dichlorobenzene	ug/L	5	U	5	U
1,2,4-Trichlorobenzene	ug/L	5	U	5	U
1,2,3-Trichlorobenzene	ug/L	5	U	5	U

Analytical Data Summary

12/24/2002 1:47 PM

	StationID	E569GW003		E569GW003		E569GW004	
	SampleID	569GW003M1		569HW003M1		569GW004M1	
	DateCollected	3/6/2002		3/6/2002		3/6/2002	
	DateExtracted	3/8/2002		3/8/2002		3/8/2002	
	DateAnalyzed	3/8/2002		3/8/2002		3/8/2002	
	SDGNumber	57091		57091		57091	
Parameter	Units						
Chloromethane	ug/L	10	UJ	10	UJ	10	UJ
Vinyl chloride	ug/L	10	U	10	U	10	U
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	UJ	5	UJ	5	UJ
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	U	10	U	10	U
Methyl ethyl ketone (2-Butanone)	ug/L	10	U	10	U	10	U
cis-1,2-Dichloroethylene	ug/L	0.9	J	0.39	J	5	U
1,2-Dichloroethene (total)	ug/L	0.9	J	0.39	J	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	5	U	5	U	5	U
cis-1,3-Dichloropropene	ug/L	5	U	5	U	5	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	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

Analytical Data Summary

12/24/2002 1:47 PM

	StationID	E569GW005		E569GW05D	
	SampleID	569GW005M1		569GW05DM1	
	DateCollected	3/6/2002		3/6/2002	
	DateExtracted	3/8/2002		3/8/2002	
	DateAnalyzed	3/8/2002		3/8/2002	
	SDGNumber	57091		57091	
Parameter	Units				
Chloromethane	ug/L	10	UJ	10	UJ
Vinyl chloride	ug/L	10	U	10	U
Bromomethane	ug/L	10	U	10	U
Chloroethane	ug/L	10	U	10	U
1,1-Dichloroethene	ug/L	5	U	5	U
Acetone	ug/L	10	U	10	U
Carbon Disulfide	ug/L	5	UJ	5	UJ
Methylene Chloride	ug/L	5	U	5	U
trans-1,2-Dichloroethene	ug/L	5	U	5	U
1,1-Dichloroethane	ug/L	5	U	5	U
Vinyl acetate	ug/L	10	U	10	U
Methyl ethyl ketone (2-Butanone)	ug/L	10	U	10	U
cis-1,2-Dichloroethylene	ug/L	5	U	5	U
1,2-Dichloroethene (total)	ug/L	5	U	5	U
Chloroform	ug/L	5	U	5	U
1,1,1-Trichloroethane	ug/L	5	U	5	U
Carbon Tetrachloride	ug/L	5	U	5	U
1,2-Dichloroethane	ug/L	5	U	5	U
Benzene	ug/L	5	U	5	U
Trichloroethylene (TCE)	ug/L	5	U	5	U
1,2-Dichloropropane	ug/L	5	U	5	U
Bromodichloromethane	ug/L	5	U	5	U
2-Chloroethyl vinyl ether	ug/L	5	U	5	U
cis-1,3-Dichloropropene	ug/L	5	U	5	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/L	10	U	10	U
Toluene	ug/L	5	U	5	U
trans-1,3-Dichloropropene	ug/L	5	U	5	U
1,1,2-Trichloroethane	ug/L	5	U	5	U
2-Hexanone	ug/L	10	U	10	U

Analytical Data Summary

12/24/2002 1:47 PM

StationID	E569GW003	E569GW003	E569GW004
SampleID	569GW003M1	569HW003M1	569GW004M1
DateCollected	3/6/2002	3/6/2002	3/6/2002
DateExtracted	3/8/2002	3/8/2002	3/8/2002
DateAnalyzed	3/8/2002	3/8/2002	3/8/2002
SDGNumber	57091	57091	57091

Parameter	Units	E569GW003		E569GW003		E569GW004	
Dibromochloromethane	ug/L	5	U	5	U	5	U
Chlorobenzene	ug/L	5	U	0.24	J	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
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	0.17	J	5	U
1,2-Dichlorobenzene	ug/L	0.44	J	1	J	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

12/24/2002 1:47 PM

	StationID	E569GW005		E569GW05D	
	SampleID	569GW005M1		569GW05DM1	
	DateCollected	3/6/2002		3/6/2002	
	DateExtracted	3/8/2002		3/8/2002	
	DateAnalyzed	3/8/2002		3/8/2002	
	SDGNumber	57091		57091	
Parameter	Units				
Dibromochloromethane	ug/L	5	U	5	U
Chlorobenzene	ug/L	5	U	5	U
Ethylbenzene	ug/L	5	U	5	U
m+p Xylene	ug/L	5	U	5	U
o-Xylene	ug/L	5	U	5	U
Xylenes, Total	ug/L	5	U	5	U
Styrene	ug/L	5	U	5	U
Bromoform	ug/L	5	U	5	U
1,1,2,2-Tetrachloroethane	ug/L	5	U	5	U
1,3-Dichlorobenzene	ug/L	5	U	5	U
1,4-Dichlorobenzene	ug/L	5	U	5	U
1,2-Dichlorobenzene	ug/L	5	U	5	U
1,2,4--Trichlorobenzene	ug/L	5	U	5	U
1,2,3-Trichlorobenzene	ug/L	5	U	5	U

Analytical Data Summary

10/02/2003 11:56 PM

StationID		E569SB008		E569SB008		E569SB008		E569SB008	
SampleID		569CB00802 (3-5ft)		569SB00801 (0-1ft)		569SB00802 (3-5ft)		569SB00803 (-ft)	
DateCollected		03/04/2003		03/04/2003		03/04/2003		03/04/2003	
DateExtracted		03/05/2003		03/05/2003		03/05/2003		03/05/2003	
DateAnalyzed		03/07/2003		03/06/2003		03/06/2003		03/07/2003	
SDGNumber		75886		75886		75886		75886	
Parameter	Units								
Benzene	ug/kg	1.3	J	5.6	U	5.7	U	1950	J
Toluene	ug/kg	0.76	J	5.6	U	5.7	U	773	J
Ethylbenzene	ug/kg	1.7	J	5.6	U	5.7	U	51900	=
Xylenes, Total	ug/kg	2.5	J	5.6	U	5.7	U	19000	=

Analytical Data Summary

10/02/2003 1:56 PM

StationID		E569SB009		E569SB009		E569SB009		E569SB010	
SampleID		569SB00901 (0-1ft)		569SB00902 (3-5ft)		569SB00903 (-ft)		569SB01001 (0-1ft)	
DateCollected		03/04/2003		03/04/2003		03/04/2003		03/04/2003	
DateExtracted		03/05/2003		03/05/2003		03/05/2003		03/05/2003	
DateAnalyzed		03/06/2003		03/06/2003		03/07/2003		03/06/2003	
SDGNumber		75886		75886		75886		75886	
Parameter	Units								
Benzene	ug/kg	9.6	=	1.1	J	8.1	J	437	J
Toluene	ug/kg	0.48	J	5.8	U	1.2	J	68.9	J
Ethylbenzene	ug/kg	6.6	=	5.8	U	3.6	J	9330	=
Xylenes, Total	ug/kg	2.5	J	5.8	U	2.4	J	1980	=

Analytical Data Summary

10/02/2003 1:56 PM

	StationID	E569SB010		E569SB010		E569SB011		E569SB011	
	SampleID	569SB01002 (3-5ft)		569SB01003 (-ft)		569SB01101 (0-1ft)		569SB01102 (3-5ft)	
	DateCollected	03/04/2003		03/04/2003		03/04/2003		03/04/2003	
	DateExtracted	03/05/2003		03/05/2003		03/06/2003		03/06/2003	
	DateAnalyzed	03/07/2003		03/06/2003		03/06/2003		03/06/2003	
	SDGNumber	75886		75886		75886		75886	
Parameter	Units								
Benzene	ug/kg	1.4	J	805	J	5.9	U	5.8	U
Toluene	ug/kg	5.5	U	1470	J	5.9	U	5.8	U
Ethylbenzene	ug/kg	55.7	=	55000	=	5.9	U	0.47	J
Xylenes, Total	ug/kg	16.1	=	151000	=	5.9	U	5.8	U

Analytical Data Summary

10/02/2003 1:56 PM

StationID	E569SB011
SampleID	569SB01103 (-ft)
DateCollected	03/04/2003
DateExtracted	03/05/2003
DateAnalyzed	03/06/2003
SDGNumber	75886

Parameter	Units		
Benzene	ug/kg	6.5	U
Toluene	ug/kg	6.5	U
Ethylbenzene	ug/kg	6.5	U
Xylenes, Total	ug/kg	6.5	U

Data Validation Summary - Charleston Naval Complex - Zone E, AOC 569/570/578

TO: Sam Naik/CH2M HILL/ATL

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

DATE: June 4, 2002

The purpose of this memorandum is to present the results of the data validation process for the samples collected AOC 569/570/578 in Zone E. The samples were collected between the dates of April 16 to April 25, 2002.

The specific samples and analytical fractions reviewed are summarized below in Table 1.

The Quality Control areas that were review 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 1994)* and *National Functional Guidelines for Organic Data Review (EPA 1999)*. Quality assurance/quality control (QA/QC) summary forms and data reports were reviewed.

Samples were submitted to General Engineering Laboratories, Inc., in Charleston, South Carolina, for the following analyses: SW-846 8260 Volatile Organic Compounds (VOC), and Metals following SW-846 6010 Series methodology.

Sample results that were not within the acceptance limits were appended with a qualifying flag, which consisted of a single- or double-letter code that indicated a possible problem with the data. The qualifying flags originated during the data review and validation processes. These also include the secondary, or the two-digit "sub-qualifier" flags. The secondary qualifiers provide the reasoning behind the assignment of a qualifier flag to the data. The secondary qualifiers are presented and defined below.

Attachment 1 lists the changes in data qualifiers, due to the validation process.

The following primary flags were used to qualify the data:

- [=] Detected. The analyte was analyzed for and detected at the concentration shown.
- [J] Estimated. The analyte was present but the reported value may not be accurate or precise.
- [U] Undetected. The analyte was analyzed for but not detected above the method detection limit.
- [UJ] Detection limit estimated. The analyte was analyzed for but qualified as not detected; the result is estimated.
- [R] Rejected. The data is not useable.

Secondary Data Validation Qualifiers

<u>Code</u>	<u>Definition</u>
2S	Second Source
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
TN	Tune

59501	LABQC	1200207089	1200207089		SQ	LB				X
59501	LABQC	1200207093	1200207093		SQ	BS				X
59501	LABQC	1200208048	1200208048		SQ	LB			X	
59501	LABQC	1200208051	1200208051		SQ	BS			X	
59501	LABQC	1200208679	1200208679		SQ	LB			X	
59501	LABQC	1200208687	1200208687		SQ	LB			X	
59501	LABQC	1200208688	1200208688		SQ	BS			X	
59501W	FIELDQC	569TW001M2	59503001	04/17/02 00:nn	WQ	TB			X	
59501W	FIELDQC	5698EB004M2	59503002	04/25/02 00:nn	WQ	EB				X
59501W	LABQC	1200208057	1200208057		WQ	LB			X	
59501W	LABQC	1200208060	1200208060		WQ	BS			X	
59501W	LABQC	1200209024	1200209024		WQ	LB				X
59501W	LABQC	1200209028	1200209028		WQ	BS				X

MATRIX CODE

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

SAMPLE TYPE CODE

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

ANALYSIS CODE

VOC - Volatile Organic Compounds

Organic Parameters

Quality Control Review

The following list represents the QA/QC measures that were reviewed during the data quality evaluation procedure for organic data.

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Method blanks, trip blanks and equipment blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Surrogate Recoveries** – Surrogate Compounds are added to each sample and the recoveries are used to monitor lab performance and possible matrix interference.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", either laboratory reagent water or Ottawa sand, in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **GC/MS Tuning** – The mass spectrum of the tuning compound is evaluated for method compliance. The criteria are established to verify the proper mass assignment and mass resolution.
- **Initial Calibration** – The initial calibration ensures that the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest.
- **Continuing Calibration** – The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds.
- **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:

Blanks

The VOC target parameters detected in blank samples are listed in Table 2.

TABLE 2
Blank Contamination: VOCs
Charleston Naval Complex, Zone E, AOC 569/570/578, Charleston, SC

59058	Method BLK	VBLK01	MB	Methylene Chloride	4.1	µg/L	<41.0 µg/L
				Toluene	0.2	µg/L	<1.0 µg/L
59058	59058006	569EW001M2	EB	Acetone	3.9	µg/L	<39.0 µg/L
				Methylene Chloride	4.1	µg/L	<41.0 µg/L
				Toluene	0.2	µg/L	<1.0 µg/L
				2-Hexanone	0.82	µg/L	<8.2 µg/L
				1,4-Dichlorobenzene	0.22	µg/L	<1.1 µg/L
59058	59058007	569TW001M2	TB	Acetone	4.2	µg/L	<42.0 µg/L
				Methylene Chloride	2.8	µg/L	<28.0 µg/L
				Toluene	0.19	µg/L	<1.0 µg/L
				1,4-Dichlorobenzene	0.15	µg/L	<0.8 µg/L
59058	59058008	569EW002M2	EB	Acetone	3.2	µg/L	<32.0 µg/L
				Methylene Chloride	2.0	µg/L	<20.0 µg/L
				Toluene	0.23	µg/L	<1.2 µg/L
				1,4-Dichlorobenzene	0.2	µg/L	<1.0 µg/L
59501	Method BLK	VBLK01MED	MB	Methylene Chloride	272.0	µg/Kg	<2720.0 µg/Kg
				2-Butanone	487.0	µg/Kg	<4870.0 µg/Kg
				1,4-Dichlorobenzene	52.7	µg/Kg	<263.5 µg/Kg
59501	Method BLK	VBLK01	MB	Methylene Chloride	1.8	µg/Kg	<18.0 µg/Kg
				1,4-Dichlorobenzene	0.25	µg/Kg	<1.3 µg/Kg
59501	59503001	569TW001M2	TB	Acetone	4.6	µg/L	<46.0 µg/Kg
				Methylene Chloride	2.6	µg/L	<26.0 µg/Kg
				1,4-Dichlorobenzene	0.47	µg/L	<2.4 µg/Kg

TABLE 2

Blank Contamination: VOCs

Charleston Naval Complex, Zone E, AOC 569/570/578, Charleston, SC

59501	Method BLK	VBLK02	MB	1,4-Dichlorobenzene	0.40	µg/Kg	<2.0 µg/Kg
59503	59503001	569TW001M2	TB	Acetone	4.6	µg/L	<46.0 µg/Kg
				Methylene Chloride	2.6	µg/L	<26.0 µg/Kg
				1,4-Dichlorobenzene	0.47	µg/L	<2.4 µg/Kg
59501	Method BLK	VBLK01	MB	1,4-Dichlorobenzene	0.25	µg/Kg	<1.3 µg/Kg

If a target parameter determined to be a common contaminant was reported in a field sample, and the concentration was below the level determined to be due to blank contamination, the following actions were taken:

- If the concentration was above the reporting limit, the numeric result was unchanged, but it was flagged "U", as undetected.
- If the concentration was below the reporting limit, the numeric result was changed to the value of the reporting limit, and it was flagged "U", as undetected.

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

Recoveries - Surrogate, MS/MSD and LCS

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

- In SDG 59058, the MS/MSD recoveries for 2-Chloroethylvinylether were both 0%. The data for this compound in the associated sample, 59058001, was qualified 'R', rejected.

Field Duplicate Samples

All Field Duplicate Samples were within acceptable quality control limits, except as noted below.

- The percent Difference for Tetrachloroethylene in the Native/Field Duplicate sample 569GW001M2/569HW001M2 was 49.1 percent. No flags were applied due to Field Duplicate precision.

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 569/570/578, Charleston, SC

VOA8-CCAL-04/18/02, 08:29	Vinyl Acetate	20.9% high	59058 – All samples
VOA8-CCAL-05/01/02, 08:31	1,1,1-Trichloroethane	22.3% high	59501006, 59501007
	Carbon Tetrachloride	22.6% high	
	Dibromochloromethane	21.0% high	

Flags were applied to the compounds in the associated samples in the following manner:

- When the percent difference (%D) was high in the continuing calibration standards, detected compounds were flagged "J", as estimated. Non-detected compounds were not flagged.

Inorganic Parameters

Quality Control Review

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

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Sample preparation, initial calibration blanks/continuing calibration blanks, and equipment blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", in which target parameters have been added prior to digestion/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **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 569/570/578, Charleston, SC

59501	CCB		CCB	Lead	1.78	ug/L	0.445 mg/Kg
59501	1200207089	1200207089	MB	Chromium	0.077	ug/L	0.01925 mg/Kg
59501	59503002	5698EB004M2	EB	Lead	1.35	ug/L	0.3375 mg/Kg
59503	CCB		CCB	Lead	1.78	ug/L	0.445 mg/Kg
59503	1200209024	1200209024	MB	Lead	1.99	ug/L	0.4975 mg/Kg
59503	59503002	5698EB004M2	EB	Lead	1.35	ug/L	0.3375 mg/Kg

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

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

Recoveries – Matrix Spike/Matrix Spike Duplicate (MS/MSD) and Laboratory Control Sample (LCS)

All Matrix Spike (MS), Matrix Spike Duplicate (MSD) and Laboratory Control Sample (LCS) recoveries were within acceptable quality control limits, except as noted in Table 5 below.

TABLE 5
MS/MSD Recoveries Out of QC Limits: Metals
Charleston Naval Complex, Zone E, AOC 569/570/578, Charleston, SC

59501	569SB00401MS/MSD	Antimony	43.7* / 44.8*	80-120	59501 - All	Detects-J, non-detects-UJ
		Lead	77.3* / 91.7			
* - out of control limits						

Rejected Data

The rejected data are summarized in Table 6 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 6
Data Qualification Summary: Rejected Data
Charleston Naval Complex, Zone E, AOC 569/570/578, Charleston, SC

59058	59058001	569GW001M2	VOA	2-Chloroethyl vinyl ether	5	U	R	ug/L	MS
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Conclusion

A review of the analytical data submitted regarding the investigation of Zone E, AOC 569/570/578, at the Charleston Naval Complex, Charleston, South Carolina by CH2M HILL has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed, and that the analytical results should be considered usable as qualified.

The analytical data had minor QC concerns as indicated above. However, with the exception of the single result for 2-chloroethyl vinyl ether that was rejected, it did not affect data usability for the analytical results.

The validation review demonstrated that the analytical systems were generally in control and the data results can be used in the decision making process.

Attachment 1 - Changed Qualifiers and Results
 Zone E, AOC 569 / 570 / 578 - Data Validation

59058	569GW001M2	59058001	WG	VOA	SW8260B	2-Chloroethyl vinyl ether	5	U	5	R	ug/L	MS
59058	569GW001M2	59058001	WG	VOA	SW8260B	ACETONE	35.2	=	35.2	U	ug/L	BL
59058	569GW001M2	59058001	WG	VOA	SW8260B	METHYLENE CHLORIDE	5.1	B	5.1	U	ug/L	BL
59058	569GW001M2	59058001	WG	VOA	SW8260B	TOLUENE	0.22	JB	5	U	ug/L	BL
59058	569HW001M2	59058002	WG	VOA	SW8260B	ACETONE	5.2	J	10	U	ug/L	BL
59058	569HW001M2	59058002	WG	VOA	SW8260B	METHYLENE CHLORIDE	1.6	JB	5	U	ug/L	BL
59058	569GW002M2	59058003	WG	VOA	SW8260B	ACETONE	3.2	J	10	U	ug/L	BL
59058	569GW002M2	59058003	WG	VOA	SW8260B	METHYLENE CHLORIDE	2.7	JB	5	U	ug/L	BL
59058	570GW001M2	59058004	WG	VOA	SW8260B	ACETONE	3	J	10	U	ug/L	BL
59058	570GW001M2	59058004	WG	VOA	SW8260B	METHYLENE CHLORIDE	2.3	JB	5	U	ug/L	BL
59058	570GW001M2	59058004	WG	VOA	SW8260B	TOLUENE	0.24	JB	5	U	ug/L	BL
59058	570GW03DM2	59058005	WG	VOA	SW8260B	ACETONE	5.5	J	5.5	U	ug/L	BL
59058	570GW03DM2	59058005	WG	VOA	SW8260B	METHYLENE CHLORIDE	2.2	JB	5	U	ug/L	BL
59058	570GW03DM2	59058005	WG	VOA	SW8260B	TOLUENE	0.22	JB	5	U	ug/L	BL
59501	578SB00101	59501003	SO	METAL	SW6010B	ANTIMONY	1.07	BN	1.07	J	mg/kg	MS
59501	578SB00101	59501003	SO	METAL	SW6010B	LEAD	301	=	301	J	mg/kg	MS
59501	578SB00102	59501004	SO	METAL	SW6010B	ANTIMONY	1.24	BN	1.24	J	mg/kg	MS
59501	578SB00102	59501004	SO	METAL	SW6010B	LEAD	406	=	406	J	mg/kg	MS
59501	578CB00102	59501005	SO	METAL	SW6010B	ANTIMONY	1.1	BN	1.1	J	mg/kg	MS
59501	578CB00102	59501005	SO	METAL	SW6010B	LEAD	308	=	308	J	mg/kg	MS
59501	569SB00501	59501006	SO	VOA	SW8260B	1,4-DICHLOROBENZENE	50.7	JB	501	U	ug/kg	BL
59501	569SB00501	59501006	SO	VOA	SW8260B	2-BUTANONE (MEK)	640	J	1000	U	ug/kg	BL
59501	569SB00501	59501006	SO	VOA	SW8260B	METHYLENE CHLORIDE	140	J	501	U	ug/kg	BL
59501	569SB00502	59501007	SO	VOA	SW8260B	METHYLENE CHLORIDE	412	J	971	U	ug/kg	BL

MEMORANDUM

CH2MHILL

Data Validation Summary - Charleston Naval Complex - Zone E, AOC 569

TO: Tom Wiley/CH2M HILL/ATL

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

DATE: April 15, 2002

The purpose of this memorandum is to present the results of the data validation process for the samples collected in Zone E, AOC 569. The samples were collected on March 6, 2002.

The specific samples and analytical fractions reviewed are summarized below in Table 1.

The Quality Control areas that were review 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 1994)* 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 SW-846 8260 Volatile Organic Compounds (VOC).

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
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
TN	Tune

Table 1 - Chemical Analytical Methods – Field and Quality Control Samples

57091	WG	E569GW003	569GW003M1	03/06/02	57091001	N	X
57091	WG	E569GW003	569HW003M1	03/06/02	57091002	FD	X
57091	WG	E569GW004	569GW004M1	03/06/02	57091003	N	X
57091	WG	E569GW005	569GW005M1	03/06/02	57091004	N	X
57091	WG	E569GW05D	569GW05DM1	03/06/02	57091005	N	X
57091	WQ	FIELDQC	569EW003M1	03/06/02	57091006	EB	X
57091	WQ	FIELDQC	569TW003M1	03/06/02	57091007	TB	X
<p>MATRIX CODE WG - Groundwater WQ - Water QC Samples</p> <p>SAMPLE TYPE CODE EB - Equipment Blank FD - Field Duplicate N - Native Sample TB - Trip Blank</p> <p>ANALYSIS CODE VOC - Volatile Organic Compounds</p>							

Organic Parameters

Quality Control Review

The following list represents the QA/QC measures that were reviewed during the data quality evaluation procedure for organic data.

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Method blanks, equipment blanks, and trip blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Surrogate Recoveries** – Surrogate Compounds are added to each sample and the recoveries are used to monitor lab performance and possible matrix interference.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", either laboratory reagent water or Ottawa sand, in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **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.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **GC/MS Tuning** – The mass spectrum of the tuning compound is evaluated for method compliance. The criteria are established to verify the proper mass assignment and mass resolution.
- **Initial Calibration** – The initial calibration ensures that the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest.
- **Continuing Calibration** – The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds.
- **Internal Standards** – The internal standards (retention time and response) are evaluated for method compliance. The internal standards are used in quantitation of the target parameters and monitor the instrument sensitivity and response for stability during each analysis.

Volatile Organic Compounds (VOC) Analyses

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

Blanks

The VOC target parameters detected in blank samples are listed in Table 2.

TABLE 2
Equipment Blank Contamination: VOCs
Charleston Naval Complex, Zone E, AOC 569, Charleston, SC

57091	VBLK01	1200177988	MB	Acetone	3.5	µg/L	<35.0 µg/L
				Toluene	0.22	µg/L	<1.1 µg/L
57091	57091006	569EW003M1	EB	Acetone	7.8	µg/L	<78.0 µg/L
				Toluene	0.23	µg/L	<1.2 µg/L
				1,4-Dichlorobenzene	0.27	µg/L	<1.4 µg/L
57091	57091007	569TW003M1	TB	Acetone	4.3	µg/L	<43.0 µg/L
				Toluene	0.27	µg/L	<1.4 µg/L
				1,4-Dichlorobenzene	0.24	µg/L	<1.2 µg/L

If a target parameter determined to be a common contaminant was reported in a field sample, and the concentration was below the level determined to be due to blank contamination, the following actions were taken:

- If the concentration was above the reporting limit, the numeric result was unchanged, but it was flagged "U", as undetected.
- If the concentration was below the reporting limit, the numeric result was changed to the value of the reporting limit, and it was flagged "U", as undetected.

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

Recoveries - LCS

All Laboratory Control Sample (LCS) recoveries were within acceptable quality control limits, except as noted in Table 3 below.

TABLE 3
LCS Recoveries Out of QC Limits: VOCs
Charleston Naval Complex, Zone E, AOC 569, Charleston, SC

57091	VBLK01LCS	Chloromethane	140.2*	70-130	57091 – All	Detects only- J
		Carbon Disulfide	175.2*	70-130		
* - out of control limits						

Field Duplicate Samples

All Field Duplicate Samples were within acceptable quality control limits, except as noted in Table 4 below. No flags are applied due to Field Duplicate precision.

TABLE 4
Field Duplicate RPDs Out of QC Limits: VOCs
Charleston Naval Complex, Zone E, AOC 572, Charleston, SC

57091	569GW003M1 / 569HW003M1	Tetrachloroethylene	5.9 µg/L	10.7 µg/L	57.8*	20
* - out of control limits						

Initial and Continuing Calibration Criteria

All initial calibration criteria and continuing calibration criteria were met, except as listed in Table 5.

TABLE 5
 Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: VOC
 Charleston Naval Complex, Zone E, AOC 569, Charleston, SC

VOA1 – ICAL – 02/28/02, 23:10	Carbon Disulfide	R ² =0.984	57091 – All
VOA1 – CCAL – 03/08/02, 08:23	Chloromethane	40.3% low	57091 - All
	Carbon Disulfide	75.4% low	
	4-Methyl-2-Pentanone	23.0% high	

Flags were applied to the compounds in the associated samples in the following manner:

- When the percent Relative Standard Deviation (%RSD) or correlation coefficient (R²) was out in the initial calibration, all associated samples were qualified. Detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.
- When the percent difference (%D) was low in the continuing calibration standards, detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.
- When the percent difference (%D) was high in the continuing calibration standards, detected compounds were flagged "J", as estimated. Non-detected compounds were not flagged.

Rejected Data

No data was rejected for this sampling event.

Conclusion

A review of the analytical data submitted regarding the investigation of selected sites in Zone E, AOC 569 at the Charleston Naval Complex, Charleston, South Carolina by CH2M HILL has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed, and that the analytical results should be considered usable as qualified.

The analytical data had minor QC concerns as indicated above, however, it did not affect data usability for those specific results. The validation review demonstrated that the analytical systems were generally in control and the data results can be used in the decision making process.

Attachment 1 - Changed Qualifiers and Results
 Zone E, AOC 569 - Data Validation

DG	Lab Sample ID	Sample ID	Matrix	Parameter Class	Sample Type	Analytical Method	Parameter	Lab Result	Lab Qual	Final Result	Final Qual	Units	Validation Notes
091	57091001	569GW003M1	WG	VOA	N	SW8260B	ACETONE	4.1	J	10	U	ug/L	BL
091	57091001	569GW003M1	WG	VOA	N	SW8260B	CARBON DISULFIDE	5	U	5	UJ	ug/L	IC,CC
091	57091001	569GW003M1	WG	VOA	N	SW8260B	CHLOROMETHANE	10	U	10	UJ	ug/L	CC
091	57091001	569GW003M1	WG	VOA	N	SW8260B	TOLUENE	0.25	J	5	U	ug/L	BL
091	57091002	569HW003M1	WG	VOA	FD	SW8260B	ACETONE	4.3	J	10	U	ug/L	BL
091	57091002	569HW003M1	WG	VOA	FD	SW8260B	CARBON DISULFIDE	5	U	5	UJ	ug/L	IC,CC
091	57091002	569HW003M1	WG	VOA	FD	SW8260B	CHLOROMETHANE	10	U	10	UJ	ug/L	CC
091	57091003	569GW004M1	WG	VOA	N	SW8260B	ACETONE	4.1	J	10	U	ug/L	BL
091	57091003	569GW004M1	WG	VOA	N	SW8260B	CARBON DISULFIDE	5	U	5	UJ	ug/L	IC,CC
091	57091003	569GW004M1	WG	VOA	N	SW8260B	CHLOROMETHANE	10	U	10	UJ	ug/L	CC
091	57091003	569GW004M1	WG	VOA	N	SW8260B	TOLUENE	0.18	J	5	U	ug/L	BL
091	57091004	569GW005M1	WG	VOA	N	SW8260B	ACETONE	4.5	J	10	U	ug/L	BL
091	57091004	569GW005M1	WG	VOA	N	SW8260B	CARBON DISULFIDE	5	U	5	UJ	ug/L	IC,CC
091	57091004	569GW005M1	WG	VOA	N	SW8260B	CHLOROMETHANE	10	U	10	UJ	ug/L	CC
091	57091004	569GW005M1	WG	VOA	N	SW8260B	TOLUENE	0.2	J	5	U	ug/L	BL
091	57091005	569GW05DM1	WG	VOA	N	SW8260B	ACETONE	4.4	J	10	U	ug/L	BL
091	57091005	569GW05DM1	WG	VOA	N	SW8260B	CARBON DISULFIDE	5	U	5	UJ	ug/L	IC,CC
091	57091005	569GW05DM1	WG	VOA	N	SW8260B	CHLOROMETHANE	10	U	10	UJ	ug/L	CC
091	57091005	569GW05DM1	WG	VOA	N	SW8260B	TOLUENE	0.34	J	5	U	ug/L	BL

Data Validation Summary - Charleston Naval Complex - Zone E, AOC 569

TO: Sam Naik/CH2M HILL/ATL

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

DATE: May 2, 2003

The purpose of this memorandum is to present the results of the data validation process for the samples collected AOC 569 in Zone E. The samples were collected on March 4, 2003.

The specific samples and analytical fractions reviewed are summarized below in **Table 1**.

The Quality Control areas that were reviewed and the resulting findings are documented within each subsection that follows. This data was validated for compliance with the analytical method requirements. This process also included a review of the data to assess the accuracy, precision, and completeness based upon procedures described in the guidance documents such as the Environmental Protection Agency (EPA) *National Functional Guidelines for Inorganic Data Review (EPA 2002)* and *National Functional Guidelines for Organic Data Review (EPA 1999)*. Quality assurance/quality control (QA/QC) summary forms and data reports were reviewed.

Samples were submitted to General Engineering Laboratories, Inc., in Charleston, South Carolina, for the following analyses: SW-846 8260 Volatile Organic Compounds (VOC).

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

75886	E569SB011	569SB01103	75886001	SO	N			03/04/03	X
75886	E569SB008	569SB00801	75886002	SO	N	0	1	03/04/03	X
75886	E569SB008	569SB00803	75886003	SO	N			03/04/03	X
75886	E569SB008	569SB00802	75886004	SO	N	3	5	03/04/03	X
75886	E569SB008	569CB00802	75886005	SO	FD			03/04/03	X
75886	E569SB009	569SB00901	75886006	SO	N	0	1	03/04/03	X
75886	E569SB009	569SB00903	75886007	SO	N			03/04/03	X
75886	E569SB009	569SB00902	75886008	SO	N	3	5	03/04/03	X
75886	E569SB010	569SB01001	75886009	SO	N	0	1	03/04/03	X
75886	E569SB010	569SB01003	75886010	SO	N			03/04/03	X
75886	E569SB010	569SB01002	75886011	SO	N	3	5	03/04/03	X
75886	E569SB011	569SB01101	75886012	SO	N	0	1	03/04/03	X
75886	E569SB011	569SB01102	75886013	SO	N	3	5	03/04/03	X
75886	LABQC	1200390740	1200390740	SQ	LB				X
75886	E569SB011	569SB01103MS	1200390741	SO	MS			03/04/03	X
75886	E569SB011	569SB01103SD	1200390742	SO	SD			03/04/03	X
75886	LABQC	1200390743	1200390743	SQ	BS				X
75886	LABQC	1200391817	1200391817	SQ	LB				X
75886	LABQC	1200391818	1200391818	SQ	BS				X
75886	LABQC	1200391819	1200391819	SQ	LB				X
75887	FIELDQC	569EB008N1	75887001	WQ	EB			03/04/03	X
75887	FIELDQC	569TB008N1	75887002	WQ	TB			02/20/03	X
75887	LABQC	1200390156	1200390156	WQ	LB				X
75887	LABQC	1200390159	1200390159	WQ	BS				X

MATRIX CODE

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

SAMPLE TYPE CODE

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

ANALYSIS CODE

VOC - Volatile Organic Compounds

Organic Parameters

Quality Control Review

The following list represents the QA/QC measures that were reviewed during the data quality evaluation procedure for organic data.

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Method blanks, trip blanks and equipment blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Surrogate Recoveries** – Surrogate Compounds are added to each sample and the recoveries are used to monitor lab performance and possible matrix interference.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", either laboratory reagent water or Ottawa sand, in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **GC/MS Tuning** – The mass spectrum of the tuning compound is evaluated for method compliance. The criteria are established to verify the proper mass assignment and mass resolution.
- **Initial Calibration** – The initial calibration ensures that the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest.
- **Continuing Calibration** – The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds.
- **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 569, Charleston, SC

75886	569SB00801	Bromofluorobenzene (surrogate)	125*	59-113	569SB00801	Detects only - J
75886	569SB00903	Bromofluorobenzene (surrogate)	160*	59-113	569SB00903	Detects only - J
75887	569EB008N1	Toluene-d8 (surrogate)	87*	88-110	569EB008N1	No flags applied (EB)
* - out of control limits						

Rejected Data

No data were rejected based upon the validation process for this sampling event.

Conclusion

A review of the analytical data submitted regarding the investigation of Zone E, AOC 569, at the Charleston Naval Complex, Charleston, South Carolina by CH2M HILL has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed, and that the analytical results should be considered usable as qualified.

The analytical data had minor QC concerns as indicated above, however, it did not affect data usability for those specific results. The validation review demonstrated that the analytical systems were generally in control and the data results can be used in the decision making process.

Attachment 1 - Change Qualifiers and Results
 Zone E, AOC 569 - Data Validation

Sample ID	Location	Compound	Batch	Sample ID	Sample ID	Method	Result	Qualifier	Limit	Qualifier	Unit	SS
VOA	SW8260B	BENZENE	75886	569SB00903	75886007	SO	8.1	=	8.1	J	ug/kg	SS
VOA	SW8260B	ETHYLBENZENE	75886	569SB00903	75886007	SO	3.6	J	3.6	J	ug/kg	SS
VOA	SW8260B	TOLUENE	75886	569SB00903	75886007	SO	1.2	J	1.2	J	ug/kg	SS
VOA	SW8260B	XYLENES, TOTAL	75886	569SB00903	75886007	SO	2.4	J	2.4	J	ug/kg	SS

Investigation of Underground Contamination

Charleston Naval Shipyard -- Building 1279

North Charleston, South Carolina

For

Landmark Construction Company

August 1992

LandRec, Inc.

Post Office Box 50528 - Columbia, S.C. 29250-0528

Office (803) 254-1545 Fax 779-8538

LandRec, Inc.

Real Estate Reclamation

P.O. Box 50528
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August 26, 1992

Mr. Rick Mixson
Landmark Construction
3275 Associate Drive
North Charleston, SC 29418

Subject: Tank Removal
Charleston Naval Shipyard
Building 1279

Dear Mr. Mixson:

On August 18 and 19 LandRec was on site at the Naval Shipyard to identify and stockpile soils contaminated by leaking underground storage tanks. The concrete and crushed rock overburden was removed from the tank area and disposed of at an approved landfill. When the tanks were removed, it was discovered that the size of the tanks varied from what had been anticipated. Instead of two 2,500 gallon and one 3,000 gallon steel tanks, we found one 2,500 gallon, one 3,000 gallon and one 3,500 gallon tanks. All three tanks had contained gasoline. All soils over the tank area were screened with a Foxboro 128 hydrogen flame OVA and found to be extremely contaminated. See Attachment A for the OVA logs. The soils were stockpiled between buildings 1199 and 1279 on a 6 mil waterproof membrane. Soils between the tanks were also highly contaminated and were stockpiled. All three tanks were excavated on Tuesday. Two hundred fifty (250) gallons of gasoline contaminated water were pumped from the tank system and disposed of by AAA Petroleum Tank Service of Mt. Pleasant. This company also disposed of the three steel tanks. A copy of the disposal manifest for the tank contents is enclosed as Attachment B and the tank disposal certificate is included as Attachment C. Under each tank was a 12" concrete ballast which was removed and disposed of at the landfill.

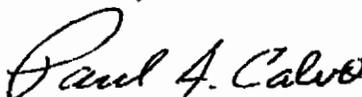
The excavation was divided into quadrants as shown on the site layout plan in Attachment D. Soils were screened with the OVA in quadrant 1 until the meter reading dropped to an insignificant level at 10.5 feet. A clearance sample was taken by General Engineering Company and the quadrant was backfilled with clean material to prevent groundwater infiltration. Screening, excavation, stockpiling, sampling and backfilling then proceeded to quadrants 2, 3 and 4 in sequence. The excavation measured approximately 43' x 43' x 10.5'.

When the excavation was finished, composite samples were taken from the stockpile and sent to a laboratory for analysis (SCDHEC Lab ID # 40111). The stockpile was covered with a 6 mil waterproof membrane and bermed with sand as shown in the diagram in Attachment E. The stockpile measures approximately 45' x 45' x 9' and contains approximately 675 cubic yards of soil.

When the results of the laboratory analysis were received, all samples tested very hot. Eight of the ten samples had TPH values ranging from 329 to 6,750 ppm. The two samples whose TPH values were below detectable levels had extremely high BTEX components (39.02 and 70.66 ppm). All sample results indicate the need for soil treatment. The laboratory analysis sheets are enclosed as Attachment F.

LandRec appreciates the opportunity of working with you on this project and looks forward to doing so again.

Sincerely,



Paul A. Calvo
President

Attachments

file: report\blg1279.cha

BORING LOG

JOB:	Charleston Shipyard
LOCATION:	Bldg. 1279
DATE:	8/18/92
BY:	Paul Calvo

Location	Time	Depth Ft	OVA (ppm)	Soil Color/Type	Remark
XG	9:35	1	1000+	fine grain dark brown sand	petro smell
XE	9:38	1	1000+	"	"
XD	9:40	1	1000+	"	"
VG	9:42	1	465	"	"
VE	9:43	1	440	"	"
VD	9:45	1	950	"	"
TG	9:50	1	1000+	"	"
TE	9:55	1	1000+	"	"
TD	10:00	1	1000+	"	"
RG	10:05	1	1000+	fine grain black sand	"
RE	10:10	1	1000+	"	"
RD	10:12	1	1000+	"	"
XF	11:30	2.5	1000+	fine grain gray sand	"
XG	11:40	5	1000+	"	"
XF	11:50	6	1000+	"	"
RG	1:40	4	1000+	fine grain black sand	"
RF	1:55	6	950+	fine grain brown sand	"

BORING LOG

JOB:	Charleston Shipyard
LOCATION:	Bldg. 1279
DATE:	8/19/92
BY:	Paul Calvo

Location	Time	Depth Ft.	QVA (ppm)	Soil Color/Type	Remarks
TI	7:00	2	1000+	fine grain brown sand	petro smell
TI	7:10	3	1000+	"	"
TI	7:15	5	1000+	fine grain black sand	"
SH	7:40	6	1000+	fine grain green sand	"
RH	7:45	6	720	fine grain grey sand	"
GS	8:03	7	1000+	fine grain gray sand	"
HS	8:20	6	1000+	fine grain gray sand	petro smell
SI	10:15	6	600	fine grain gray sand	petro smell
RI	10:22	8	820	"	"
RI				directed contractor to clean to tan sand thru backfill	
RI	10:28	9	14	fine grain orange tan sand	no odor
SH	10:30			Gen Engr Labs collected clearance sample. Contractor backfilling RTGI.	
DR	10:45	5	1000+	fine grain gray sand	petro smell
DR	10:55	6	1000+	fine grain black sand	"
DR	11:05	7	1000+	fine grain tan/gray sand	"

BORING LOG

JOB:	Charleston Shipyard
LOCATION:	Bldg. 1279
DATE:	8/16/92
BY:	Paul Calvo

Location	Time	Depth Ft	OVA (ppm)	Soil Color/Type	Remark
SE	11:15	6	1000+	fine grain gray sand	petro smell
RO	11:17	2	1000+	fine grain gray/tan sand	"
SE				Gen Engr Labs takes clearance sample. Contractor backfills RTCG.	
SE	11:20	7	550	fine grain gray sand	petro smell
SE	11:25	8	350	"	"
SE	11:30	8.5	120	fine grain gray/tan sand	"
SE	11:35	10.5	7	fine grain tan sand	no odor
GV	1:25	7	1000+	fine grain black sand	"
GV	1:45	9	24	fine grain gray sand	no odor
GV	1:48	10	8	Gen Engr Labs took clearance sample. Contractor backfilling TZCG. (tan sand)	
stockpile					Sample
A	2:30	3-5	1000+	fine grain black sand	1
B	2:42	3-5	1000+	"	2
C	2:58	3-5	1000+	"	3
D	3:10	3-5	1000+	"	4
E	3:22	3-5	1000+	fine grain gray/black sand	5
F	3:33	3-5	1000+	"	6
G	3:42	3-5	1000+	"	7
H	3:50	3-5	1000+	"	8
I	3:58	3-5	1000+	fine grain gray sand	9
J	4:06	3-5	1000+	fine grain black sand	10

BORING LOG

JOB:	Charleston Shipyard
LOCATION:	Bldg. 1279
DATE:	8/19/92
BY:	Paul Calvo

Location	Time	Depth Ft	OVA (ppm)	Soil Color/Type	Remark
GW	4:15	5	1000+	fine grain black sand	petro smell
HX	4:18	4	1000+	"	"
HU	4:20	3	1000+	fine grain green/gray sand	"
HU	4:25	5	1000+	"	"
HU	4:30	7	1000+	fine grain gray/black sand	"
HU	4:33	9	875	fine grain green/tan sand	"
HU	4:40	10	60	fine grain tan sand	no odor
	5:00			Contractor completes backfill operation in grid TZGI.	
	5:30			Covers stockpiled soils with waterproof membrane.	

Foxboro Model 128 Detector
Hydrogen Flame Organic Vapor Meter (OVA)

WASTE OIL MANIFEST
 OR
 AUTOMOTIVE BATTERY MANIFEST

MANIFEST DOCUMENT NUMBER
 23536

Name	I.D. Code	Address	Phone Number Area Code and Number	Date Shipped or Accepted
(1) Transporter No. 1 AAA PTS, Inc	SCD 9991279449	PO Box 97 Mt Pleasant, SC	803-884-7742	92 09 12 year month day
(2) Transporter No. 2		29465		year / month / day
(3) TSDP				year / month / day

(1) Containers		(2) DOT Proper Shipping Name/ Hazard Class/DOT I.D. Number	(3) Total Quantity	(4) Waste Collected from Name and Address	(5) Signature of person from whom waste is collected or their authorized Agent.
No.	Type				
2	55'S	NOS		NSC Bldg 1279	Paul A. Calvo Paul A. Calvo Signature Print Name
3	UST	gas/water	250	Charleston Navy Base, SC	Signature Print Name
					Signature Print Name
					Signature Print Name
					Signature Print Name
					Signature Print Name

C. Emergency Response Information: In the event of an emergency, phone the Transporter at: 803 884-7742 In event of a spill in South Carolina, call the Department at (803) 758-5651.	D. Special Handling Instructions: (None)	E. Comments: Bldg 1279 UST 90's
--	---	------------------------------------

F. I hereby certify that I am a Permitted Hazardous Waste Transporter in the State, that the above information is correct to the best of my knowledge and belief and is being transported in accordance with all applicable regulations of the U.S. DOT, U.S. EPA, the S.C. PSC and the S.C. DHEC.
 Signature: [Signature] Print Name and Title: IC GUR CARDO, PRES Date: 8/21/92

G. I hereby certify that I am an authorized representative of the permitted transporter and that the waste and quantity described in this Manifest have been accepted by us for ultimate delivery to the TSDP identified above.
 Transporter #1: _____ Signature: _____ Print Name and Title: _____ Date: _____

H. I hereby certify that I am an authorized representative of the TSDP identified above and that the waste and quantity described in this Manifest have been accepted by me for treatment, storage, and/or disposal.
 Signature: _____ Print Name and Title: _____ Date: _____

UST

8/21/92

Tank Owner: NSC Bldg 1279 Charleston, SC

Tank Location: same

Tank Size: 2-2570
1-3500 Gallons

Tank Contents: Gas Fuel Oil Other

Current Status: Removed From Site In Place Abandonment

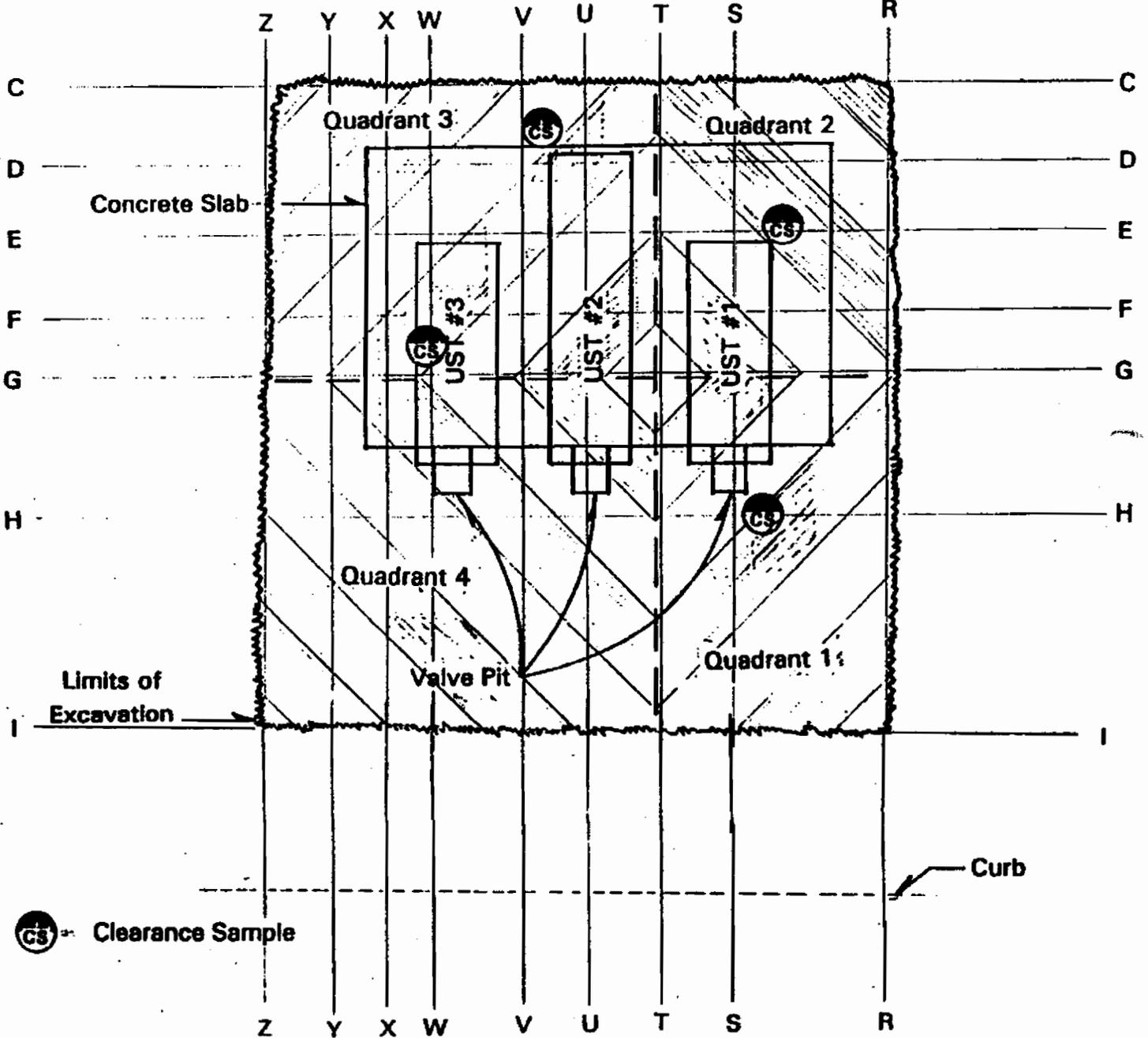
Tanks removed by Landover/Carroll Const., delivered to AAA PTS, Inc. Tanks were pumped & scraped out of AAA PTS, Inc., delivered to Charleston Steel & Metal for recycling of steel

UST Contractor: AAA Petroleum Tank Service, Inc.
P.O. Box 92
Mt. Pleasant, SC 29465
(803) 881-1380 Office
(803) 881-0525 Mobile

THIS IS TO CERTIFY THAT THE ABOVE CITED WORK HAS BEEN COMPLETED

[Signature]
E. J. GIRLARDO

BUILDING 1199



Job Title

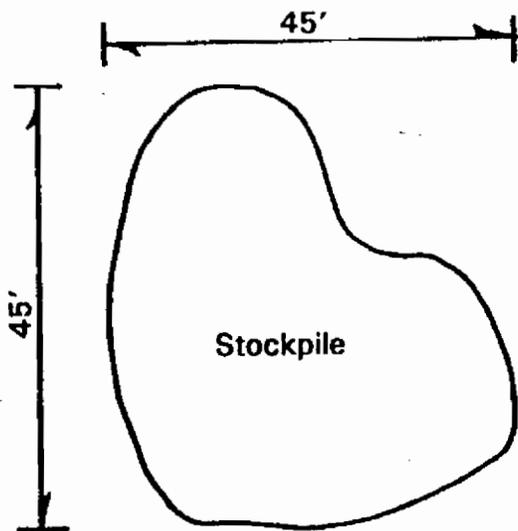
Charleston Naval Shipyard -- Building 1279

Sheet Title

Site Layout Plan

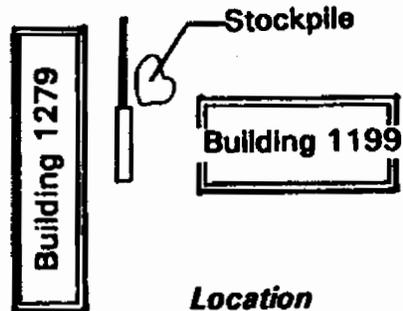
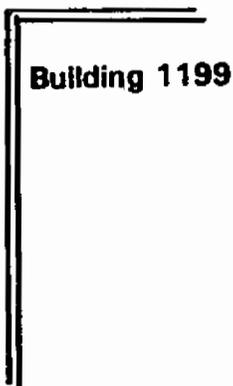
Scale
1" = 10'

Date
8/24/92



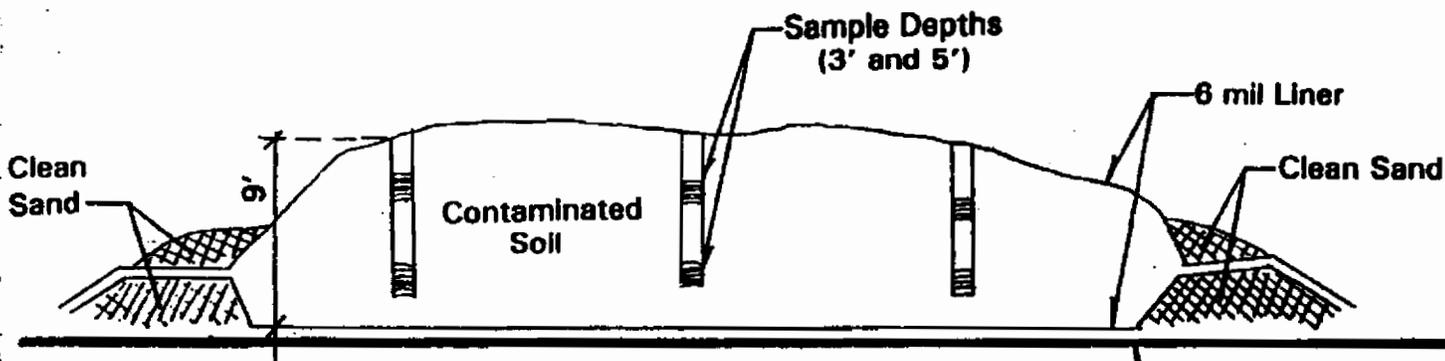
Plan View

Scale: 1" = 20'



Location

No Scale



Elevation

Scale: 1" = 10'



Job Title

Charleston Naval Shipyard -- Building 1279

Sheet Title

Stockpile

Scale

Date

8/25/92

James H. Carr & Associates, Inc.
Office & Laboratories
P.O. Box 90209
Columbia, SC 29290

08/22/92

Mr. Paul Calvo
Lard Rec., Inc.
P.O. Box 50528
Columbia, SC 29250

Dear Mr. Calvo:

The following are the results of the parameters you requested we check on your SHIPYARD samples listed below.

Parameter	Analyst	Analysis Date	Analysis Time	Results	Lowest Detectable Level	Method #
08/17/92 In House # 08-3442-92	Source	SAMPLE A	Location	STOCKPILE		
TPH light fuel, 5030 prep - solid	AT	08/22/92	00:21	351.000 ug/kg	10.000 ug/kg	801.5
Benzene - solid -UET	AT	08/22/92	00:21	7300.000 ug/kg	25.000 ug/kg	824.0
Toluene - solid - UET	AT	08/22/92	00:21	5870.000 ug/kg	25.000 ug/kg	824.0
Ethylbenzene - solid -UET	AT	08/22/92	00:21	75.000 ug/kg	25.000 ug/kg	824.0
Xylenes - solid - UET	AT	08/22/92	00:21	35600.000 ug/kg	50.000 ug/kg	824.0

Comments:

For BTEX and TPH, detection limits and less than values are 3.33X those shown.

08/17/92 In House # 08-3443-92	Source	SAMPLE B	Location	STOCKPILE		
TPH light fuel, 5030 prep - solid	AT	08/22/92	00:47	327.000 ug/kg	10.000 ug/kg	801.5
Benzene - solid -UET	AT	08/22/92	00:47	2620.000 ug/kg	25.000 ug/kg	824.0
Toluene - solid - UET	AT	08/22/92	00:47	3970.000 ug/kg	25.000 ug/kg	824.0
Ethylbenzene - solid -UET	AT	08/22/92	00:47	75.000 ug/kg	25.000 ug/kg	824.0
Xylenes - solid - UET	AT	08/22/92	00:47	11700.000 ug/kg	50.000 ug/kg	824.0

Comments:

For BTEX and TPH, detection limits and less than values are 3.33X those shown.

08/17/92 In House # 08-3444-92	Source	SAMPLE C	Location	STOCKPILE		
TPH light fuel, 5030 prep - solid	AT	08/22/92	01:15	503.000 ug/kg	10.000 ug/kg	801.5
Benzene - solid -UET	AT	08/22/92	01:15	4199.000 ug/kg	25.000 ug/kg	824.0
Toluene - solid - UET	AT	08/22/92	01:15	1620.000 ug/kg	25.000 ug/kg	824.0
Ethylbenzene - solid -UET	AT	08/22/92	01:15	7200.000 ug/kg	25.000 ug/kg	824.0
Xylenes - solid - UET	AT	08/22/92	01:15	11500.000 ug/kg	50.000 ug/kg	824.0

Comments:

For BTEX and TPH, detection limits and less than values are 10X those shown.

08/17/92 In House # 08-3445-92	Source	SAMPLE D	Location	STOCKPILE		
TPH light fuel, 5030 prep - solid	AT	08/22/92	01:41	841.000 ug/kg	10.000 ug/kg	801.5
Benzene - solid -UET	AT	08/22/92	01:41	4300.000 ug/kg	25.000 ug/kg	824.0
Toluene - solid - UET	AT	08/22/92	01:41	8500.000 ug/kg	25.000 ug/kg	824.0
Ethylbenzene - solid -UET	AT	08/22/92	01:41	75.000 ug/kg	25.000 ug/kg	824.0
Xylenes - solid - UET	AT	08/22/92	01:41	30700.000 ug/kg	50.000 ug/kg	824.0

08/19/92 In House # 08-3445-92 Source SAMPLE D Location STOCKPILE
- CONTINUED -

Comments:

For BTEX and TPH, detection limits and less than values are 10X those shown.

08/19/92 In House # 08-3446-92	Source SAMPLE E	Location STOCKPILE				
TPH light fuel, 5030 prep - solid	AT	08/22/92 03:47	156.000 ug/kg	10.000 ug/kg	B01.5	
Benzene - solid -IST	AT	08/22/92 03:47	1870.000 ug/kg	25.000 ug/kg	B24.0	
Toluene - solid - IST	AT	08/22/92 03:47	8600.000 ug/kg	25.000 ug/kg	B24.0	
Ethylbenzene - solid -IST	AT	08/22/92 03:47	21500.000 ug/kg	25.000 ug/kg	B24.0	
Xylenes - solid - IST	AT	08/22/92 03:47	54400.000 ug/kg	50.000 ug/kg	B24.0	

Comments:

For BTEX and TPH, detection limits and less than values are 10X those shown.

08/19/92 In House # 08-3447-92	Source SAMPLE F	Location STOCKPILE				
TPH light fuel, 5030 prep - solid	AT	08/22/92 02:06	< 10.000 ug/kg	10.000 ug/kg	B01.5	
Benzene - solid -IST	AT	08/22/92 02:06	1849.000 ug/kg	25.000 ug/kg	B24.0	
Toluene - solid - IST	AT	08/22/92 02:06	5920.000 ug/kg	25.000 ug/kg	B24.0	
Ethylbenzene - solid -IST	AT	08/22/92 02:06	18500.000 ug/kg	25.000 ug/kg	B24.0	
Xylenes - solid - IST	AT	08/22/92 02:06	44400.000 ug/kg	50.000 ug/kg	B24.0	

Comments:

For BTEX and TPH, detection limits and less than values are 20X those shown.

08/19/92 In House # 08-3448-92	Source SAMPLE G	Location STOCKPILE				
TPH light fuel, 5030 prep - solid	AT	08/22/92 04:14	< 10.000 ug/kg	10.000 ug/kg	B01.5	
Benzene - solid -IST	AT	08/22/92 04:14	2640.000 ug/kg	25.000 ug/kg	B24.0	
Toluene - solid - IST	AT	08/22/92 04:14	5470.000 ug/kg	25.000 ug/kg	B24.0	
Ethylbenzene - solid -IST	AT	08/22/92 04:14	6310.000 ug/kg	25.000 ug/kg	B24.0	
Xylenes - solid - IST	AT	08/22/92 04:14	24600.000 ug/kg	50.000 ug/kg	B24.0	

Comments:

For BTEX and TPH, detection limits and less than values are 20X those shown.

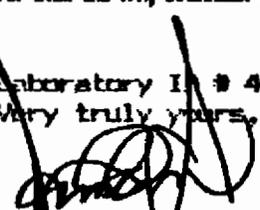
08/19/92 In House # 08-3449-92	Source SAMPLE H	Location STOCKPILE				
TPH light fuel, 5030 prep - solid	AT	08/22/92 04:37	2870.000 ug/kg	10.000 ug/kg	B01.5	
Benzene - solid -IST	AT	08/22/92 04:37	12200.000 ug/kg	25.000 ug/kg	B24.0	
Toluene - solid - IST	AT	08/22/92 04:37	9900.000 ug/kg	25.000 ug/kg	B24.0	
Ethylbenzene - solid -IST	AT	08/22/92 04:37	46700.000 ug/kg	25.000 ug/kg	B24.0	
Xylenes - solid - IST	AT	08/22/92 04:37	109.000 ug/kg	50.000 ug/kg	B24.0	

Comments:

For BTEX and TPH, detection limits and less than values are 10X those shown. 01 denotes result is in ug/kg.

Laboratory In # 40111

Very truly yours,


James H. Carr, Jr.
Chemist

James H. Carr & Associates, Inc.
 Office & Laboratories
 P.O. Box 90209
 Columbia, SC 29290

08/22/92

Mr. Paul Calvo
 Land Rec., Inc.
 P.O. Box 50528
 Columbia, SC 29250

Dear Mr. Calvo:

The following are the results of the parameters you requested we check on your SHIPYARD samples listed below.

Parameter	Analyst	Analysis Date	Analysis Time	Results	Lowest Detectable Level	Method #
08/19/92 In House # 08-3450-92	Source SAMPLE I	Location SHIPYARD				
TPH light fuel, 5030 prep - solid	AT	08/22/92	05:05	6750.000 ug/kg	10.000 ug/kg	801.5
Benzene - solid - UST	AT	08/22/92	05:05	4940.000 ug/kg	25.000 ug/kg	824.0
Toluene - solid - UST	AT	08/22/92	05:05	1260.000 ug/kg	25.000 ug/kg	824.0
Ethylbenzene - solid - UST	AT	08/22/92	05:05	6400.000 ug/kg	25.000 ug/kg	824.0
Xylenes - solid - UST	AT	08/22/92	05:05	8170.000 ug/kg	50.000 ug/kg	824.0

Comments:

For BTEX and TPH, detection limits and less than values are 10% those shown.

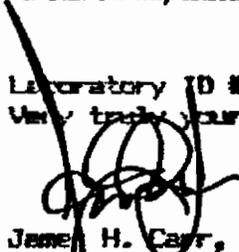
08/19/92 In House # 08-3451-92	Source SAMPLE J	Location SHIPYARD				
TPH light fuel, 5030 prep - solid	AT	08/22/92	05:30	733.000 ug/kg	10.000 ug/kg	801.5
Benzene - solid - UST	AT	08/22/92	05:30	395.000 ug/kg	25.000 ug/kg	824.0
Toluene - solid - UST	AT	08/22/92	05:30	340.000 ug/kg	25.000 ug/kg	824.0
Ethylbenzene - solid - UST	AT	08/22/92	05:30	25.000 ug/kg	25.000 ug/kg	824.0
Xylenes - solid - UST	AT	08/22/92	05:30	8350.000 ug/kg	50.000 ug/kg	824.0

Comments:

For BTEX and TPH, detection limits and less than values are 10% those shown.

Laboratory ID # 40111

Very truly yours,


 James H. Carr, Jr.
 Chemist

CARR
LABORATORIES

CHAIN OF CUSTODY RECORD

NAVAL SHIPYARD Bldg 1279

Client LANDREC INC. Project No. _____
 Contact Paul CALVO Phone No. 2541545
 Address P.O. Box 50528 Fax No. _____
 Collected By Paul CALVO Client P.O.# _____

MT (Matrix Type) AP (Analytical Program)
 L=Liquid W=Wastewater
 S=Soil G=Groundwater
 O=Oil D=Drinking Water
 X=Other S=Solid/Haz. Waste
 N=Nonregulated

Carr's Lab No.	Sample Source	Location	Date/Time 1992	Well	Grab	Composite	M	P	Number of Containers	Preserved Y or N	Analyses Requested
08-3442-9	Stockpile	A	8/19 / 2:30		X		S		1	N	GASOLINE TPH / BTEX
3443	Stockpile	B	8/19 / 2:42		X		S		1	N	
3444	Stockpile	C	8/19 / 2:57		X		S		1	N	WANTS REPORTS
3445	Stockpile	D	8/19 / 3:10		X		S		1	N	fax to NAVAL YARD
3446	Stockpile	E	8/19 / 3:22		X		S		1	N	8/24/92
3447	Stockpile	F	8/19 / 3:33		X		S		1	N	Andy Turner
3448	Stockpile	G	8/19 / 3:42		X		S		1	N	RI/ST
3449	Stockpile	H	8/19 / 3:50		X		S		1	N	
3450	Stockpile	I	8/19 / 3:58		X		S		1	N	
3451	Stockpile	J	8/19 / 4:06		X		S		1	N	

Requested by Paul A. Calvo Received by Dorothy White Date 8-20-92 Time 8:37
 1. _____
 2. _____
 3. _____
 Received In Lab By Dorothy White 8-20-92 8:37

JAMES H. CARR & ASSOCIATES, INC.
 Office and Laboratories
 P.O. Box 90209
 Columbia, South Carolina 29290
 (803) 776-7789 Fax: 783-2192

Attachment F

Site: AOC 569
Media: Surface Soil
Chemical: Arsenic
CASRN:
Units: mg/Kg

Station ID	Sample ID	Date Collected	Data	Qualifier	Adjusted Data	Detected
E569SB001	569SB00101	10/13/1995	14.8	=	14.8	YES
E569SB002	569SB00201	10/13/1995	1.8	=	1.8	YES
E569SB003	569SB00301	10/13/1995	1.7	=	1.7	YES
E569SB004	569SB00401	10/13/1995	12.1	=	12.1	YES
E569SB005	569SB00501	10/13/1995	0.87	J	0.87	YES
E569SB007	569SB00701b	09/14/1996	2.9	=	2.9	YES
E570SB002	570SB00201	11/06/1995	4	=	4	YES
E570SB003	570SB00301	11/14/1995	9.3	=	9.3	YES
E570SB004	570SB00401	11/15/1995	2.9	=	2.9	YES
E570SB005	570SB00501	01/16/1996	19.8	=	19.8	YES
E570SB006	570SB00601	01/16/1996	13.4	=	13.4	YES
E570SB007	570SB00701	01/16/1996	13.9	=	13.9	YES
E570SB008	570SB00801	01/16/1996	21.7	=	21.7	YES
E570SB009	570SB00901	01/16/1996	4	=	4	YES
E570SB010	570SB01001	01/16/1996	4.8	=	4.8	YES
E570SB011	570SB01101	11/20/1995	8.5	=	8.5	YES
E570SB012	570SB01201	11/15/1995	70.9	=	70.9	YES
E570SB013	570SB01301	11/06/1995	6.1	=	6.1	YES
E570SB014	570SB01401	11/06/1995	8	=	8	YES
E570SB015	570SB01501	11/14/1995	4.9	=	4.9	YES
E570SB0A4	570SB0A401	09/12/1996	4	=	4	YES
E578SB001	578SB00101	05/16/1996	1.1	=	1.1	YES
E578SB002	578SB00201	05/16/1996	1.7	=	1.7	YES
E578SB003	578SB00301	05/16/1996	18	=	18	YES
E578SB004	578SB00401	05/16/1996	1.7	=	1.7	YES
E578SB005	578SB00501	05/16/1996	3.8	=	3.8	YES
E578SB006	578SB00601	05/16/1996	2	=	2	YES

Summary

Site: AOC 569
 Media: Surface Soil
 Units: mg/Kg
 Chemical: Arsenic
 CASRN:

STATISTICS

N	27
Detects	27
FOD	100%
Mean of Detect	9.580
Min of Detect	0.8700
Max of Detect	70.90
Best Estimate of Mean (arithmetic)	13.9
Best Estimate of Mean (geometric)	5.4
Nondetects at 1/2 DL	YES

95% UPPER CONFIDENCE LIMITS FOR MEAN

UCL95 Normal	14.1
<i>t</i> -statistic	1.71
UCL95 Lognormal	13.9
<i>H</i> -statistic	2.51
UCL95 Nonparametric	2.9
UCL95 Bootstrap	13.9

95% UPPER TOLERANCE INTERVAL

UTL95 Normal	33.37658211
<i>coverage</i>	95%
UTL95 Lognormal	33.79762532
<i>coverage</i>	95%
UTL95 Nonparametric	70.90
<i>coverage</i>	96%

DISTRIBUTION TESTING

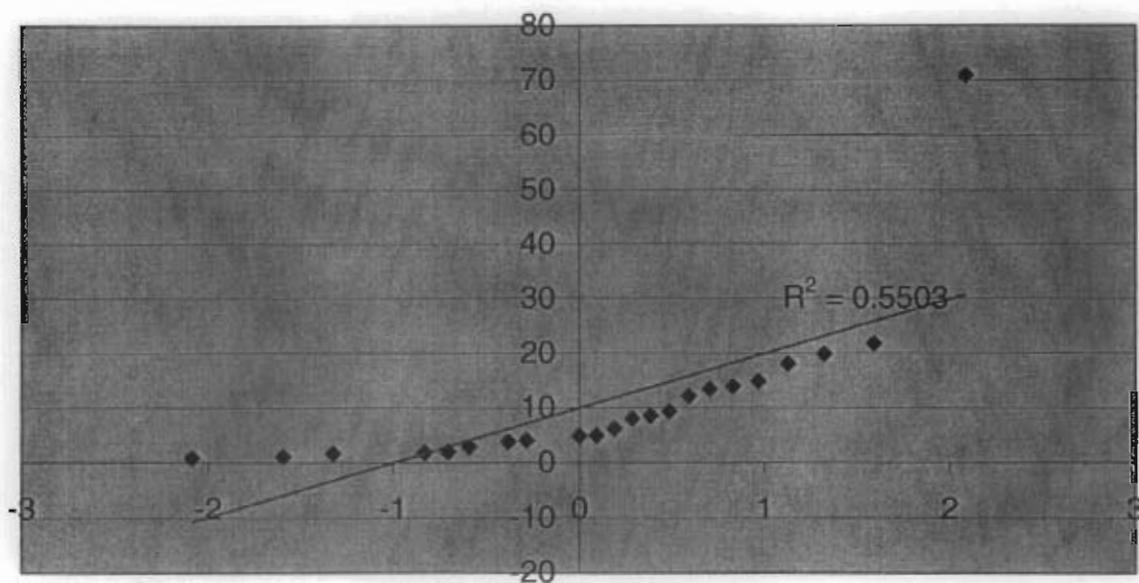
Population is best described as:	LOGNORMAL
W_{normal}	0.576
W_{log}	0.972
$W_{\alpha = 0.05}$	0.923

Notes:

1. If population does not fit normal or lognormal distribution, check Q-Q plots and W-test values. The population may be close enough to one of those distributions to subjectively select a normal or lognormal distribution.
2. For site data, if the selected UCL95 exceeds the Max Detect, the Max Detect should be chosen as the EPC.
3. Lognormal UCL or UTL values calculated for less than 30 samples may be widely inflated.
4. If there is >90% nondetection, it is generally impossible to calculate a UTL or UCL with any level of confidence.

Q-Q plots

Q-Q Plot of Untransformed Data (x)



Q-Q Plot of Log Transformed Data (y)

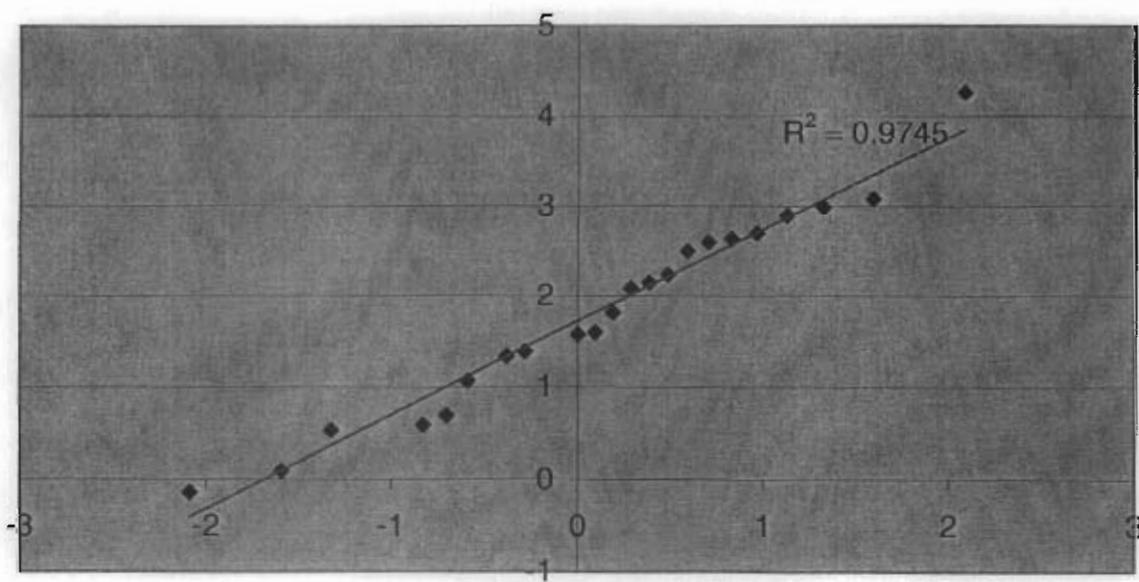


Table H-1
Leachate Transport Analysis Model
RFI Report Addendum and CMS Work Plan, AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

		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 carbon, 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)	70.1 m	ft
da	= Aquifer Thickness	7.6 m	ft
d	= Groundwater Mixing Zone thickness (paved)	7.51 m	24.6 ft
	(unpaved)	7.62 m	25.0 ft
i	= Groundwater Gradient	0.0022	(unitless)
Ks	= Saturated Hydraulic Conductivity	1112.5 m/yr	3650.0 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)	0.0086 m/yr	0.0283 ft/yr
	(unpaved)	0.1372 m/yr	0.4500 ft/yr
Partition Term, Cw/Csoil, (L/kg)		$\frac{C_{soil}}{C_w} = \left(\frac{\theta_w + K_s \rho_s + H\theta_v}{\rho_s} \right) \left(\frac{K_s i d + q_i S_w}{q_i S_w} \right)$	6.42E-01
Dilution Term, dimensionless	(paved)		8.64E+01
	(unpaved)		6.48E+00
Csoil/Cw = Partition term * Dilution term (mg/kg / mg/L) = L/kg	(paved)		5.55E+01
	(unpaved)		4.15E+00
Calculated Site Specific Target Level for Soil			
Csoil	calculated source soil concentration (SSL, mg/kg) Cw*(partion term)*(dilution term)	(paved)	0.277
		(unpaved)	0.021

Cwt 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, SW-NE) of AOC 570 (275 ft).
 d is calculated as $M = (0.0112 L^2/d^2 + da \{1 - e^{-L \sqrt{q_i K_s da}}\})$ or da, whichever is less.
 da is based on top of Ashley (-20 ft, GIS) and nearest isocontour line for groundwater level (5 ft msl, GIS).
 i Calculated from isocontour groundwater map for Zone E ((4.82-3.99)/134 = 0.006, CH2MHill, 2002).
 Ks Based on CH2MHill's hydraulic conductivity theme in the GIS (10 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.