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RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION WORK
PLAN ADDENDUM ZONE K CNC CHARLESTON SC
9/1/2000
CH2M HILL

RCRA Facility Investigation Work Plan Addendum -- Zone K Naval Station Annex



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

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

CH2M-Jones

September 2000

***Revision 0
Contract N62467-99-C-0960***



CH2MHILL

March 30, 2001

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John Litton, P.E.
Director
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

Subject: RCRA Facility Investigation Work Plan Addendum, Revision 1
Zone K – Naval Station Annex
Response to SCDHEC Comments
Charleston Naval Complex, North Charleston, South Carolina

Dear Mr. Litton:

Pursuant to your March 23, 2001 approval of the draft *Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan Addendum, Zone K – Naval Station Annex*, dated September 2000, CH2M-Jones is submitting the enclosed information which will serve as the final revision to the referenced document. These pages are to be used as replacement pages to the sections indicated. The information includes the response to comments made by you, dated December 27, 2000, and by Paul Bergstrand, dated December 20, 2000. These documents are provided in Enclosure 1.

Enclosure 2 provides South Carolina Department of Health and Environmental Control (SCDHEC)'s approval of the referenced document in the form of letters from David Scaturro and Paul Bergstrand. In addition, Table 2-5A and Figures 2-1A, 2-2A, 2-5, 2-6, and 2-7, created to address SCDHEC comments, are enclosed with this letter.

If you have any questions, comments or require additional information please do not hesitate to contact us.

Sincerely,

CH2M HILL

Dean Williamson, P.E.
Senior Project Manager

enclosures

cc: BCT Document Distribution List

5090/11
Code 18B1
2 April 2001

Mr. John Litton, P.E.
Director, Division of Hazardous and Infectious Waste Management
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

Subj: SUBMITTAL OF ZONE K RCRA FACILITY INVESTIGATION WORK PLAN

Dear Mr. Litton,

The purpose of this letter is to submit the RCRA Facility Investigation Work Plan Addendum (Revision 1) for Zone K, located at Naval Station Annex in Charleston, SC. The work plan addendum is submitted to fulfill the requirements of condition II.C.1 of the RCRA Part B permit issued to the Navy by the South Carolina Department of Health and Environmental Control and the U.S. Environmental Protection Agency (EPA).

The pages forwarded by this letter modify the original submittal (Revision 0). The enclosure included page changes, responses to DHEC comments, DHEC's approval of referenced documents, and additional figures to response to DHEC comments. This document has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process and has been distributed under separate cover letter by CH2M Hill. Appropriate certification is provided under that correspondence. We request that the Department and the EPA review this document and provide comments or approval whichever is appropriate.

If you should have any questions, please contact, Matthew Humphrey or myself at (843) 743-9985 and (843) 820-5551 respectively.

Sincerely,

ROBERT A. HARRELL, JR., P.E.
Environmental Engineer
BRAC Division

Copy to:
SCDHEC (4)
USEPA (Dann Spariosu)
CSO Naval Base Charleston (Matt Humphrey)
CH2M-Hill (Dean Williamson)



DEPARTMENT OF THE NAVY

SOUTHERN DIVISION
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5090/11
Code 18B1
29 September, 2000

Mr. John Litton, P.E.
Director, Division of Hazardous and Infectious Waste Management
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

Subj: SUBMITTAL OF ZONE K RCRA FACILITY INVESTIGATION WORK PLAN

Dear Mr. Litton,

The purpose of this letter is to submit the RCRA Facility Investigation Work Plan Addendum for Zone K located at Naval Station Annex in Charleston, SC. The work plan addendum is submitted to fulfill the requirements of condition II.C.1 of the RCRA Part B permit issued to the Navy by the South Carolina Department of Health and Environmental Control and the U.S. Environmental Protection Agency.

This document has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process and has been distributed under separate cover letter by CH2M Hill. Appropriate certification is provided under that correspondence. We request that the Department and the EPA review this document and provide comments or approval whichever is appropriate. If you should have any questions, please contact Matthew Humphrey or myself at (843) 743-9985 and (843) 820-5525 respectively.

Sincerely,

A handwritten signature in cursive script that reads "Matthew A. Hunt".

Matthew A. Hunt, P.E.
Environmental Engineer
BRAC Division

Copy to:
SCDHEC (4),
USEPA (Dann Spariosu)
CSO Naval Base Charleston (Matt Humphrey)
CH2M-Hill (Dean Williamson)

ENCLOSURE 1

CH2M-JONES RESPONSE TO SCDHEC COMMENTS

**DRAFT RCRA FACILITY INVESTIGATION WORK PLAN ADDENDUM, DATED
SEPTEMBER 2000**

Comment:

1. Section 2.0. Scope of Work. Page 2-1.

Please note that the CNC-CAFB off site groundwater contamination/source investigation is currently ongoing. The area of investigation is W-NW boundary of the Zone K-Annex. Based on this evaluation additional field investigation may be necessary to characterize the groundwater contamination at Zone K Annex.

Response:

CH2M-Jones will evaluate the results and findings from EnSafe's CNC-CAFB offsite groundwater investigation prior to initiation of the proposed Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) field activities. If a dense non-aqueous phase liquid (DNAPL) or source of chlorinated solvent contamination is not detected during EnSafe's investigation, CH2M-Jones will not recommend additional data collection to address potential impacts to the Naval Annex from offsite property. After evaluation of the results from the offsite investigation, CH2M-Jones will notify SCDHEC of its proposed strategy. SCDHEC approval of the future proposed course of action is necessary prior to implementation of the RFI field activities.

Comment:

2. Section 2.1.1, Historic Groundwater Investigation Summary. Page 2-2.

Please provide adequate figures to illustrate the text description in this section. The Department recommends that the figures used during the Zone K Annex scoping meeting illustrating the known groundwater plume boundaries be included in this work plan. Figures presented in this work plan should also indicate the road names as they are used in the text as landmarks for sample identification. This information will be very useful in understanding the data gaps and rationale for additional field investigation. Please revise the work plan accordingly.

Response:

The location of the 45 groundwater monitoring well, 82 geoprobe, and 6 vertical profile points installed or advanced at Solid Waste Management Unit (SWMU) 166 are provided in Figures 2-1 and 2-2. As stated in lines 8 through 10 on page 2-3, "Figures 2-1 and 2-2 present a summation of the detected concentrations of VOCs in the shallow (less than 20 feet below land surface [ft bls]) and deep (20 to 36 ft bls) intervals of the saturated zone at each sample collection location." CH2M-Jones provided only figures representing the nature and extent of chemicals of concern (COCs) that required additional data collection. The figures were used to support our discussion in Sections 2.1 and 2.2 of known data gaps associated with SWMU 166 and the Naval Annex boundaries. Site figures depicting the nature and extent of each identified COC at a particular site will be provided in the revised RFI report.

Figures 2-1A and 2-2A, added to the Work Plan Addendum, depict the interpreted areal extent of chlorinated solvents in the shallow and deep portions of the surficial aquifer, respectively. CH2M-Jones and SCDHEC used these color representations of the total chlorinated solvent plume, developed by EnSafe, to evaluate areas at the Annex that required additional investigation. These figures show the Annex road names.

Comment:

3. Figure 2.1.3. Sampling and Analysis Plan. Page 2-5.

The referenced section identifies some of the wells as "166GP0105, 166GP0108, etc". Please clarify the labeling rationale especially with the "0" between P and 105. Also, some of the well numbers do not correspond with the wells shown on Figure 2-1 and Figure 2-2. Please revise the figures and text as necessary.

Response:

The correct geoprobe identification nomenclature has 3 numerical and/or alphanumerical positions following the geoprobe or "GP" designation. As a result, the two references of proposed vertical profiler locations 166GP0105 and 166GP0108 provided in Section 2.1.3 will be changed to 166GP105 and 166GP108, respectively.

Comment:

4. Section 2.2.2. Groundwater Data Gaps. Page 2-7.

Lines 3-5 state that the Northwest corner of the Naval Annex is characterized. This does not accurately reflect the current status of groundwater characterization (refer to comment # 1). Please change the referenced section to address this concern.

Response:

Refer to response number 1.

Comment:

5. Section 2.3. SWMU 161, Vehicle Maintenance Shop. Page 2-10.

Lines 1-3 recommend not taking sample of the OWS contents as it would not be representative of the life span of the OWS. This is not an acceptable justification. It is considered as a primary source that could have released contamination into the environment through time. The Department recommends that the Navy obtain the referenced sample in order to understand the current use of the OWS and the possibilities of correlation with the past release at this SWMU. Please revise the document accordingly. Please provide adequate figures to illustrate the text description in this section. The Department recommends that the figures used during the Zone K Annex scoping meeting illustrating the known groundwater plume boundaries be included in this work plan. Figures presented in this work plan should also indicate the road names as they are used in the text as landmarks for sample identification. This information will be very useful in understanding the data gaps and rationale for additional field investigation. Please revise the work plan accordingly.

Response:

CH2M-Jones does not agree with SCDHEC's position of collection of the oil/water separator (OWS) contents as a means "to understand the current use of the OWS and the possibilities of correlation with the past release at this SWMU." Currently there is no indication that SWMU 161 has been impacted by a release or spill associated with historic operation of the OWS. Volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), dioxins, polychlorinated biphenyls (PCBs), and pesticides were not detected in any of the groundwater samples collected from monitoring well 161GW001, which is located immediately adjacent to the OWS, or in the groundwater samples

collected from geoprbe 166GP005, which is located approximately 80 feet west of the OWS.

In addition, there have not been any known impacts to the surrounding soil as evident in the analytical results from the surface and subsurface soil samples collected from the 13 locations at SWMU 161. Specifically, surface and subsurface soil sample locations 161SB006 through 161SB011 were collected in the immediate area surrounding the OWS. Soil samples were collected from locations 161SB006 through 161SB008 on November 20, 1996, during the RFI field activities. These samples were analyzed for cyanide, metals, PCBs, pesticides, SVOCs, VOCs, and gasoline and diesel-range total petroleum hydrocarbons. On October 12, 1999, a second surface and subsurface soil sample identified by location 161SB08T were collected in the former sample location 161SB008 and analyzed for metals. To further evaluate the potential presence of contaminants related to a spill or release from the OWS or its associated equipment, surface and subsurface soil samples were collected on November 17, 1999 from locations 161SB009 through 161SB011 during the RFI addendum field activities. These samples were analyzed for VOCs.

VOCs, SVOCs, PCBs, and cyanide were not detected in any of these surface or subsurface soil samples above their corresponding laboratory method detection limits. The pesticide 4,4-DDE was detected in the surface soil samples 161SB006 and 161SB008 at concentrations of 6.8 micrograms per kilogram ($\mu\text{g}/\text{kg}$) and 5.5 $\mu\text{g}/\text{kg}$, respectively. In addition, the pesticide 4,4-DDT was detected at a concentration of 13.5 $\mu\text{g}/\text{kg}$ in the surface soil sample collected from 161SB008. However, these detected concentrations do not exceed the residential risk-based concentration (RBC) for 4,4-DDE and 4,4-DDT established at 1,900 $\mu\text{g}/\text{kg}$.

Aluminum, arsenic, barium, chromium, copper, lead, manganese, and vanadium were detected in one or a combination of the three surface and subsurface samples collected in the immediate area surrounding the OWS that were analyzed for metals (i.e., 161SB006, 161SB007, 161SB008, and 161SB08T). However, none of the detected concentrations in the surface soil samples exceed the greater concentration when compared to the residential RBC and the surface background concentration. In addition, none of the detected concentrations in the subsurface soil samples exceed the greater concentration when compared to the site-specific soil-to-groundwater soil screening level (SSL) concentration and the subsurface background concentration.

On the basis of the analytical results from the soil samples collected from the six locations in the immediate area surrounding the OWS, there is no impact to vadose zone soil as a result of historic OWS operation. Table 2-5A presents the estimated and detected contaminant concentrations from the soil samples collected at SWMU 161 during the RFI.

Unless petroleum hydrocarbon constituents are detected in the samples collected from the proposed vertical profiler locations immediately downgradient of the OWS, CH2M-Jones will not recommend sample collection and analysis of the OWS contents.

Figure 2-3 presented in this section was used to depict the proposed locations of the vertical profiler points. Since there are no groundwater COCs, the nature and extent of groundwater contaminants were not depicted in this figure. Figure 2-3 will be revised to present the road names within and adjacent to the Annex property boundary.

Comment:

6. Section 2.3.2. Groundwater Data Gaps. Page 2-11.

It would be beneficial to reference the figures in the text that describe the data gaps in the section. It would facilitate and expedite the review.

Response:

Line 17 on page 2-11 of the draft RCRA Facility Investigation Work Plan Addendum, Zone K Naval Station Annex (RFI Work Plan Addendum), will be revised to include the following text.

"Figures 2-1 and 2-2 present these monitoring well locations and a summation of the detected concentrations of VOCs in the shallow (less than 20 ft bls) and deep (20 to 36 ft bls) intervals of the saturated zone, respectively."

Figure 2-3 presents the location of the three proposed vertical profiler points downgradient of the OWS.

Comment:

7. Section 2.4.3. Sampling and Analysis Plan. SWMU 163. Page 2-14.

Lines 25-32 discuss the approach for the PAH contamination at this site. It should be noted that the CNC BCT is currently developing the site wide background and reference values. Zone K Annex background values should be developed and approved expeditiously in order to agree upon the characterization strategy for this site. In absence of the background PAH numbers the nature and extent of PAH contamination should be characterized to residential RBCs. Please revise all pertinent sections of the referenced document to address this comment adequately.

Response:

CH2M-Jones is currently evaluating and developing an approach for a polycyclic aromatic hydrocarbon (PAH) background value at the Zone K Annex. Until the approach is presented and approved by SCDHEC, CH2M-Jones will continue with characterization of the nature and extent of surface soil PAHs to residential RBCs. Based on the September 6, 2000 scoping meeting, SWMU 163 remains the only site at the Annex where additional investigation is required to characterize the nature and extent of PAHs in the surface soil.

Since the revised RFI Work Plan Addendum will be submitted to SCDHEC and the RFI investigation will commence prior to finalization of the background PAH approach for the Annex, CH2M-Jones will not revise the document. However, it is noted that development of the PAH background value will be used to evaluate if additional characterization is required beyond the proposed surface soil investigation. In addition, development of the PAH background value will be used in future corrective action evaluations for PAHs in surface soil at the applicable Annex sites.

Comment:

8. Section 2.5. SWMU 162. Former Sludge Drying Field. Page 2-16.

Lines 3-14 discuss the site specific SSLs for chromium and its leaching potentials. There were three subsurface sample (sic) where chromium was detected above the site specific SSL of 4.2 mg/kg. Additional field investigation is not recommended based on SPLP analysis.

The Department has not evaluated nor approved this information and therefore, it should be noted that after a detailed review of the RFI report additional work may be necessary.

Response:

As a conservative position, the site-specific SSL evaluation assumed all chromium was present as hexavalent chromium. CH2M-Jones has re-evaluated this position and has concluded that this initial approach is not appropriate because there is no indication that processes or activities involving hexavalent chromium were utilized at the Annex. Therefore, CH2M-Jones will develop a site-specific SSL for trivalent chromium, which will be provided in the revised RCRA Facility Investigation Report.

Comment:

9. Section 2.8. AOC 696. Transformer Area Near Building 2509. Page 2-19.

Lines 23-27 indicate that the Navy will conduct the post interim measures evaluation of this site at a later date. Please revise this section to clearly state the RFI report for Zone K Annex will provide current condition of this site and show that the risk in all media are below acceptable levels for justifying the path forward.

Response:

The last sentence in the second paragraph of Section 2.8 will be replaced with the following text:

“The nature and extent of arsenic and aroclor-1260 in surface soil were characterized by confirmation soil samples collected during the IM and as a result of soil samples collected during the RFI activities. Figures 2-5 and 2-6 present the nature and extent of arsenic delineated to its background concentration of 3.0 mg/kg, and aroclor-1260 defined to its residential RBC value of 0.32 mg/kg, respectively.

Arsenic and aroclor-1260 were not detected above their calculated site-specific SSLs in any of the subsurface soil samples collected at the site. In addition, arsenic and aroclor-1260 were not detected above laboratory detection limits in the groundwater samples collected from MWs 696GW001 through 696GW003. Based on the results of the completed IM and the analytical results from the subsurface soil and groundwater samples collected at AOC 696 during the RFI sample collection activities, CH2M-Jones does not recommend additional investigation of these constituents in any media. The analytical results from the soil samples collected during the IM will be used with the data collected during the RFI to evaluate risk exposure from site groundwater and surface and subsurface soil.”

Comment:

10. General Comment. RCRA Facility Investigation Work Plan Addendum.

The referenced work plan clearly describes the decision rules necessary to conduct expedited field investigation and provides more flexibility during the field implementation. Overall the format of the referenced work plan was appropriate. The Department acknowledges that the Navy and its contractor incorporated the recommendations that were discussed during the Zone K Annex work plan scoping meeting.

Comment:

1. General Comment

This document should include cross section representation compiled from all core and vertical profile data collected to date.

Response:

Figure 2-5 Lithostratigraphic Cross Sections A-A and B-B Monitoring Wells and Solid Waste Management Unit (SWMU) 166 Plume Data, and Figure 2-6 Elevation of Top of Ashley Formation will be modified in the revised RCRA Facility Investigation (RFI) report for SWMU 166. However, it is important to note that the advancement of vertical profiler and membrane interface probe (MIP) borings do not provide the core samples necessary to characterize the subsurface lithology. Soil conductivity response data obtained during the Phase I and II MIP pilot study investigations will be used to evaluate the top of the Ashley Formation at SWMU 166.

Comment:

2. Page 2-11, Lines 18 - 28

This section describes the numerical decrease of analytical data from the anaerobic/aerobic sequencing treatability study. Please note that follow up analysis, which was part of the study has not been conducted. Follow up analysis is important to document the rebound effect after a system such as this is switched off. This important data has not been collected.

Response:

CH2M-Jones understands the potential for rebound effect following the completion of the anaerobic/aerobic sequencing treatability study. The effects of the chlorinated solvent plume in the area of the former treatability study were monitored with the collection of samples from the downgradient monitoring wells 166GW016 and 166GW16D as outlined in the Interim Measure Work Plan for Groundwater Monitoring. Groundwater samples were collected from these wells on July 17, 2000. Trichloroethene (TCE) and 1,2-dichloroethene (1,2-DCE) were detected in the sample collected from monitoring well 166016 at concentrations of 1,600 micrograms per liter ($\mu\text{g/L}$). These same constituents were detected in the sample collected from monitoring well 16616D at concentrations of 1,100 $\mu\text{g/L}$ and 120 $\mu\text{g/L}$, respectively.

In addition, this area is targeted for investigation using the MIP instrument to characterize the magnitude and extent of a TCE dense non-aqueous phase liquid (DNAPL) source area and areas of elevated chlorinated solvent contamination at SWMU 166. The source area delineation information obtained from these activities will be used to identify the target treatment areas to be addressed using the six-phase heating process.

The third sentence in the fourth paragraph on page 2-11, beginning on line 23, will be revised to state the following:

The final sample obtained as part of the treatability study was collected in February 2000. Chlorinated solvents TCE and 1,2-DCE were detected at concentrations of only 9 $\mu\text{g/L}$ and 14 $\mu\text{g/L}$, respectively. The results of the anaerobic/aerobic sequencing treatability study

are documented in *A-A Sequencing Treatability Study Report for SWMU 166* (EnSafe, June 2, 2000).

During the most recent groundwater sample collection event completed in July 2000 as part of the interim measure for groundwater monitoring, the chlorinated solvents 1,2-DCE and TCE increased 1 and 3 orders of magnitude, respectively. TCE and 1,2-DCE were detected in the sample collected from monitoring well 16616D at concentrations of 1,100 µg/L and 120 µg/L.

ENCLOSURE 2

**SCDHEC APPROVAL LETTERS – DAVID SCATURO and PAUL BERGSTRAND
DRAFT RCRA FACILITY INVESTIGATION WORK PLAN ADDENDUM, DATED
SEPTEMBER 2000**

March 23, 2001

CERTIFIED MAIL

Matthew Humphrey
Caretaker Site Office
NAVFACENGCOCM, Southern Division
P. O. Box 190010
North Charleston, SC 29419-9010

Re: RCRA Facility Investigation (RFI) Work Plan Addendum for Zone K Naval Station Annex of the Charleston Naval Complex, SCO 170 022 560, Revision 0, dated September 2000, received September 29, 2000. Revised Response to Comments received via e-mail dated 3/16/01 at 3:26 pm.

Dear Mr. Humphrey:

The South Carolina Department of Health and Environmental Control (Department) has reviewed the above referenced document and revised response to comments according to applicable State and Federal Regulations, and the Charleston Naval Complex Hazardous Waste Permit, effective September 17, 1998. Based on this review the Department has no additional comments and therefore, approves the referenced RFI Work Plan addendum for field implementation.

The Department does not believe that the response to comments require a complete revision of the referenced work plan however, the Navy should provide an official package of the response to comments and associated figures for the administrative record within thirty (30) calendar days of the receipt of this letter.

Further, the CNC should note that the Department's approval is based on the information provided to date. Any new information found to be contradictory may require further action.

Should you have any questions regarding these comments, please contact Mihir Mehta at (803) 896-4088 or Paul Bergstrand at (803) 896-4016.

Sincerely,

David Scaturo, PE, PG
Manager, Corrective Action Engineering Section
Division of Waste Management
Bureau of Land & Waste Management

Attachments:

1. Memorandum from Paul M. Bergstrand to Mihir Mehta dated March 23, 2001.

cc: Paul Bergstrand, Hydrogeology
Rick Richter, Trident EQC
Dean Williamson, CH2MHILL
Gary Foster, CH2MHILL
Dann Spariosu, EPA Region IV
Tony Hunt, SOUTHDIV
Rob Harrell, SOUTHDIV

MEMORANDUM

TO: Mihir Mehta, Environmental Engineer Associate
Corrective Action Engineering Section
Division of Waste Management
Bureau of Land and Waste Management

FROM: Paul M. Bergstrand, P.G., Hydrogeologist
RCRA Hydrogeology Section
Division of Hydrogeology
Bureau of Land and Waste Management

DATE: 23 March 2001

RE: Charleston Naval Base (CNAV)
Charleston County, South Carolina
SC0-170-022-560

Response to Comments
Zone K, RFI Work Plan Addendum
Dated September 2000

The materials referenced above have been reviewed with respect to the requirements of R.61-79 of the South Carolina Hazardous Waste Management Regulations, The Environmental Protection Agency's (EPA) RCRA Facility Investigation Guidance Document dated May 1989, the EPA Region IV Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual (SOP/QAM) dated May 1996, the CNAV Final Comprehensive Sampling and Analysis Plan dated 30 August 1994, CERFA 120(h) as amended.

The response to comments are suitable for this investigation. A monitoring well request has been previously addressed. The workplan is approvable.



CH2MHILL

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September 28, 2000

John Litton, P.E.
Director
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

Dear Mr. Litton:

Enclosed please find four copies of a RCRA Facility Addendum Work Plan Addendum, Revision 0, for Zone K - Naval Station Annex, at the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

Please contact me if you have any questions or comments.

Sincerely,

Dean Williamson, P.E.

xc: Tony Hunt/Navy, w/att
Mihir Mehta/SCDHEC
Gary Foster/CH2M HILL w/att

RCRA Facility Investigation Work Plan Addendum -- Zone K Naval Station Annex



*Charleston Naval Complex
North Charleston, South Carolina*

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

PREPARED BY
CH2M-Jones

E092000020GNV

*September 2000
158814.ZK.PR.00*

*Revision 0
Contract N62467-99-C-0960*

Certification Page for RFI Work Plan Addendum Zone K Naval Station Annex, Revision 1

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

Temporary Permit No. T2000342



Dean Williamson, P.E.



Date



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1 **Acronyms and Abbreviations**

2	1,2-DCA	1,2-dichloroethane
3	1,1-DCE	1,1-dichloroethene
4	CNC	Charleston Naval Complex
5	COPC	contaminant of potential concern
6	CSAP	Comprehensive Sampling and Analysis Plan
7	Detachment	U.S. Naval Detachment
8	DMP	Data Management Plan
9	DNAPL	dense non-aqueous phase liquid
10	DPT	Direct Push Technology
11	Ensafe	Ensafe, Inc.
12	EPA	United States Environmental Protection Agency
13	ESDSOPQAM	EPA Environmental Services Division <i>Standard Operating</i>
14		<i>Procedures and Quality Assurance Manual</i>
15	ft bls	feet below land surface
16	GC/MS	gas chromatograph/mass spectrometer
17	IDW	investigative-derived waste
18	µg/L	micrograms per liter
19	MCL	maximum concentration limit
20	mg/L	milligrams per liter
21	MW	monitoring well
22	NSA	Naval Station Annex
23	OCDD	octachlorodibenzo-p-dioxin

1 **Acronyms and Abbreviations, Continued**

2	OWS	oil-water separator
3	PCB	polychlorinated biphenyl
4	PCE	perchloroethylene
5	pg/L	picograms per liter
6	QAP	Quality Assurance Plan
7	RBC	risk-based concentration
8	RCRA	Resource Conservation and Recovery Act
9	RFI	RCRA Facility Investigation
10	SCDHEC	South Carolina Department of Health and Environmental Control
11	SPLP	synthetic precipitation leaching procedure
12	SVOC	semi-volatile organic compound
13	SWMU	Solid Waste Management Unit
14	TCDD TEQ	tetrachlorodibenzo-p-dioxin toxicity equivalent
15	TCE	trichloroethene
16	TPH	total petroleum hydrocarbon
17	UST	underground storage tank
18	VOC	volatile organic compound

SECTION 1.0

Introduction

1 1.0 Introduction

2 This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work
3 Plan Addendum has been prepared for Zone K Naval Station Annex (NSA) at the
4 Charleston Naval Complex (CNC). The RFI Work Plan Addendum addresses sampling
5 and analyses requirements specific to sites and areas within Zone K NSA and will be
6 used in conjunction with the *Final Comprehensive RFI Work Plan*, the *Final Zone K RFI*
7 *Work Plan*, and the *Final Zone K Work Plan Addendum* prepared for CNC. These
8 documents were prepared by EnSafe, Inc. (EnSafe). Solid Waste Management Unit
9 (SWMU) 161, SWMU 163, SWMU 166, and regions adjacent to the CNC property
10 boundaries were identified as areas within Zone K NSA requiring additional
11 investigation.

12 The original extent of Zone K included the Naval Annex and Clouter Island, as
13 provided for in a letter from Mihir Mehta/South Carolina Department of Health and
14 Environmental Control (SCDHEC) to Henry Shepard/Navy, dated August 24, 2000.
15 This Work Plan Addendum addresses only sites located at the Zone K Naval Station
16 Annex.

17 This Work Plan Addendum presents the proposed locations and analyses required to
18 delineate the volatile organic compounds (VOCs) in the groundwater at SWMU 166 and
19 at the Annex property boundaries. Several data gaps exist at the interpreted boundaries
20 of the dissolved groundwater contaminant plume in these areas, which exceed the
21 contaminant-specific maximum concentration limit (MCL). Groundwater sample
22 collection will continue at SWMU 166 and at the Naval Annex property boundaries
23 until the horizontal and vertical extent of each groundwater contaminant is below their
24 corresponding MCL or until offsite restriction or physical obstructions prevent the
25 collection of additional samples. The Work Plan Addendum outlines the proposed
26 locations and analyses required to investigate the saturated zone immediately
27 downgradient of the existing oil/water separator (OWS) at SWMU 161. In addition, the
28 Work Plan Addendum will provide the strategy for additional sample collection in the
29 event contaminants are detected in groundwater samples above their respective MCL.

30 Finally, the Work Plan Addendum presents the technical approach for the collection of
31 additional soil samples at SWMU 163, specifically the further delineation of PAHs in

1 surface soil and the investigation of the drainage ditch immediately southeast of a
2 concrete-bermed area formerly used as a wash rack.

3 The remaining contaminants of potential concern (COPCs) were identified, and the
4 nature and extent has been subsequently delineated, as outlined in the *Draft Zone K*
5 *RCRA Facility Investigation Report*, (EnSafe, June 1999) and as part of the additional
6 investigation activities documented in the *Final Zone K RCRA Facility Investigation Work*
7 *Plan Addendum* (EnSafe, November 1999).

8 Site-specific information for SWMUs 161, 163, and 166, including the site history,
9 geology, hydrogeology, soil and groundwater sampling, and risk assessment evaluation
10 are provided in the *Draft Zone K RCRA Facility Investigation Report* (EnSafe, June 1999).

11 Analytical results from samples collected at these sites were used to characterize and
12 evaluate the additional sampling locations required to further delineate or investigate
13 known or potential contaminants in soil or groundwater. The proposed scope of work
14 presented in this addendum was discussed during the July and August CNC Partnering
15 Meetings and in a subsequent task team meeting held on September 6, 2000, at the
16 SCDHEC offices in Columbia, South Carolina. The task team, consisting of members
17 from the Navy, EnSafe, CH2M-Jones, and SCDHEC, was assembled to evaluate the
18 scope of work required to further investigate any identifiable data gaps and to evaluate
19 the need for additional characterization at each site on the Naval Annex.

20 Proposed soil and groundwater sample collection locations were selected on the basis of
21 existing soil and groundwater data, site access, and subsurface features such as utilities
22 and building foundations. The site-specific figures present contingency sample
23 locations, which will be used should the initial locations not define the vertical or
24 horizontal extent of groundwater VOCs below the MCLs or the soil contaminants below
25 the residential risk-based concentration (RBC) or background concentration.

26 This Work Plan Addendum consists of the following six sections, including this
27 introductory section:

28 **1.0 Introduction** — Presents the purpose of the report and background information
29 relating to the Work Plan Addendum.

30 **2.0 Scope of Work** — Provides a description of the scope of work to complete the
31 delineation of chlorinated solvents in the groundwater at SWMU 166 and at the Annex

1 property boundaries and complete the investigation of the surficial aquifer immediately
2 downgradient of the existing OWS at SWMU 161.

3 **3.0 Sampling Protocol and Analysis** — Describes the procedures to be implemented for
4 sampling during the investigation of groundwater.

5 **4.0 Monitoring Well and Piezometer Installation** —Discusses the proposed location
6 and installation of monitoring wells (MWs) and piezometer.

7 **5.0 Investigative-Derived Waste** —Describes collection and analysis of investigative-
8 derived waste.

9 **6.0 References** — Lists the references used in this document.

10 **Appendix** — The appendix presents the response to SCDHEC comments on *the Final*
11 *Zone K RCRA Facility Investigation Work Plan Addendum* (EnSafe, November 1999).

12 All tables and figures appear at the end of their respective sections.

SECTION 2.0

Scope of Work

2.0 Scope of Work

This section outlines the scope of work to complete the delineation of chlorinated solvents in the groundwater at SWMU 166 and at the Annex property boundaries and to complete the investigation of the surficial aquifer immediately downgradient of the existing OWS at SWMU 161. A vertical profiler will be used to collect groundwater samples during the investigation. The vertical profiler equipment will be standard Geoprobe Direct Push Technology (DPT) devices equipped with a 6-inch-long well screen or sampling points for discrete groundwater sample collection.

In addition, this section outlines the scope of work to complete the RFI investigation at SWMU 163. The proposed scope of work includes the further delineation of polynuclear aromatic hydrocarbons (PAHs) in the surface soil in the immediate area surrounding soil sample 163SB019 and the investigation of potential environmental impacts to the drainage ditch immediately southeast of the former concrete-bermed wash rack area as a result of stormwater runoff.

The underground utilities in the areas surrounding the proposed vertical profiler points, including the contingency locations, will be identified and properly labeled prior to initiating the field investigation.

2.1 SWMU 166, Automobile Service Shop

This section outlines the proposed locations and analyses required to delineate the VOCs in the groundwater at SWMU 166. In addition, an evaluation was completed to link potential environmental site impacts from SWMU 166 to existing site features such as sanitary sewers, stormwater sewers, railroad lines, surface water bodies, drainage ditches, and OWSs. Groundwater in the immediate areas of the sanitary sewer lines and surface water drainage ditches was investigated and characterized during the initial RFI field activities completed by EnSafe. There are no existing or known previous railroad lines or an OWS at the site.

The stormwater drainage system, including the stormwater junction boxes and the surface and subsurface soil in the area of the former auto service rack, was investigated by EnSafe during its RFI field activities. The results of the investigation are presented in

1 in November 1996 and during five phases in 1997. Groundwater samples were collected
2 from the Geoprobe locations at shallow (approximately 8 to 11 ft bls), intermediate (22-26
3 ft bls), and deep (33-36 ft bls) intervals in the saturated zone. Continuous groundwater
4 sample collection was performed every 3 feet in the vertical profiler locations from the
5 groundwater table to approximate depths ranging from 29 to 35 ft bls. Tables 2-2 and 2-3
6 present summaries of the concentrations of VOCs detected in the samples collected
7 during the advancement of the Geoprobe and vertical profiler locations, respectively.

8 Figures 2-1 and 2-2 present a summation of the detected concentrations of VOCs in the
9 shallow (less than 20 ft bls) and deep (20 to 36 ft bls) intervals of the saturated zone at
10 each sample collection location. The maximum summation concentration is represented
11 for each location where two or more samples were collected, such as the Geoprobe and
12 vertical profiler locations. However, not all of the analytical results from the Geoprobe
13 samples collected during the RFI and analyzed by Alpha Environmental Services, Inc.
14 were used to evaluate the nature and extent of chlorinated solvents in the saturated
15 zone due to “false positives” and the detection of elevated levels of VOCs when
16 compared to confirmation samples sent off site for VOC analysis by United States
17 Environmental Protection Agency (EPA) Method 8260B.

18 **2.1.2 Groundwater Data Gaps**

19 Data gaps exist along the north, west, and south interpreted areal boundaries of the
20 deep chlorinated solvent plume. In general, the data gaps exist in areas where
21 chlorinated solvents were detected above their corresponding MCL at the interpreted
22 areal boundaries or when a large separation between sample collection locations make it
23 difficult to evaluate the interpreted areal extent of the chlorinated solvent plume.

24 **North Boundary**

25 The northern boundary is defined by groundwater samples collected from MWs
26 16609D, 16606D, and Geoprobe 166GP012. Chlorinated solvents were not detected
27 above laboratory detection limits in the groundwater samples collected from the deep
28 MWs during the most recent sampling event completed July 1998 and in the samples
29 collected from Geoprobe 166GP012. However, TCE and 1,2-dichloroethene (1,2-DCE)
30 were detected at concentrations of 56 micrograms per liter ($\mu\text{g}/\text{L}$) and 67 $\mu\text{g}/\text{L}$,
31 respectively, in the groundwater sample collected from MW 16624D during its most
32 recent sampling event conducted in October 1999.

1 **West Boundary**

2 The west portion of the deep chlorinated solvent plume requires further delineation to
3 evaluate the chlorinated solvent plume boundaries between SWMUs 163 and 166.
4 Currently, deep MWs 16602D, 16603D, 16604D, 16605D, and 16622D define the
5 boundary between the SWMUs. TCE was detected above its MCL of 5 µg/L in the
6 samples collected from 16604D (120 µg/L) and 16605D (55.5 µg/L) during its most
7 recent sampling event completed in April 1998. Although 1,2-DCE was detected in
8 samples collected from MWs 16603D, 16604D, and 16622D during the most recent
9 sampling event, the values were below its MCL of 70 µg/L.

10 **South Boundary**

11 The interpreted areal extent of the southern boundary of the deep chlorinated solvent
12 plume is defined by MWs 16611D and 16612D, Geoprobos 166GP069 and 166GP071, and
13 by the vertical profiler location GDKGP002. TCE and 1,2-DCE were detected at
14 concentrations of 100 µg/L and 21 µg/L, respectively, from the sample collected from
15 16611D and at concentrations of 31 µg/L and 6 µg/L, respectively, from the sample
16 collected from 16612D during its most recent sampling event completed in April 1998.
17 TCE detected at a concentration of 5 µg/L in the deep groundwater sample from
18 166GP069 was the only VOC detected above laboratory detection limits in the samples
19 collected from 166GP069 and 166GP071. TCE and 1,2-DCE were each estimated at
20 4 µg/L in the sample collected at 28 ft bls from GDKGP002.

21 **Southeast Area**

22 The shallow portion of the chlorinated solvent plume will be further delineated in the
23 southeast corner of the Naval Annex and off site along Interstate 26 due to the low-level
24 concentrations detected in the groundwater samples collected from MWs 166017, 166018,
25 and 166021. Offsite property is defined as area outside the boundaries of the Naval
26 Annex property. Tetrachloroethene (PCE) and TCE were detected at concentrations of 2
27 µg/L and 7 µg/L, respectively, in the groundwater sample collected from MW 166017
28 during the January 1997 sampling event. However, VOCs were not detected above the
29 laboratory detection limits in the sample collected from 166017 during its most recent
30 sampling event completed in April 1998. TCE and 1,2-DCE were detected at
31 concentrations of 35 µg/L and 1 µg/L, respectively, in the sample collected in MW
32 166018 during the its most recent sampling event completed April 1998. In addition, TCE

1 was detected at a concentration of 5 $\mu\text{g}/\text{L}$ in the sample collected in MW 166021 during
2 the most recent sampling event completed in April 1998.

3 **2.1.3 Sampling and Analysis Plan**

4 Twelve vertical profiler locations, identified as 166GP094 through 166GP0105, will be
5 advanced to define the vertical and horizontal extent of the deep chlorinated solvent
6 plume in the area of SWMU 166. Groundwater samples will be collected every 5 feet
7 from approximately 20 ft bls to the top of the Ashley Formation. Groundwater samples
8 will be collected in the vertical profiler location 166GP105 every 5 feet from
9 approximately 10 ft bls to the top of Ashley Formation.

10 Fifteen contingency vertical profiler locations, including the vertical profiler points
11 166GP106 and 166GP107, which are proposed to evaluate the shallow portion of the
12 saturated zone, have been identified should additional sample collection locations be
13 required to further delineate the extent of the deep plume. If required, the location of the
14 contingency point(s) and sample collection depth(s) will be evaluated in the field, based
15 on the analytical results obtained from the samples collected from the proposed 12
16 vertical profiler locations. An additional sample will be collected from the location(s)
17 and analyzed for VOCs at the specific depth where the greatest concentration is
18 detected from the sample location that initiated the need for the contingency sample.
19 Figure 2-2 presents the location of the 12 vertical profiler points with the 15 contingency
20 locations, which are identified as 166GP-C.

21 Four vertical profiler locations, identified as 166GP105 through 166GP0108, will be
22 advanced to define the vertical and horizontal extent of the shallow chlorinated solvent
23 plume in the southeast corner of the Naval Annex and off site along Interstate 26.
24 Groundwater samples will be collected at approximately 10 and 15 ft bls. Five
25 contingency vertical profiler locations have been identified should additional sample
26 collection locations be required to further delineate the extent of the deep plume. Figure
27 2-1 presents the location of the 4 vertical profiler points with the 5 contingency
28 locations, which are identified as 166GP-C.

29 **2.2 Property Boundaries, Naval Annex**

30 Groundwater investigation activities at the Naval Annex have focused on the
31 chlorinated solvent plumes in the surficial aquifer at SWMUs 163 and 166. A localized

1 dissolved phase PCE plume in the west-central portion of the Naval Annex, with a
2 radius of 25 to 30 feet, was identified and subsequently delineated (EnSafe, 2000). The
3 chlorinated solvent plume in this area, identified as SWMU 163, appears to be a result of
4 releases from a concrete pit used for less than 90-day hazardous waste storage (EnSafe,
5 2000). Groundwater investigation activities completed during the RFI, and during the
6 subsequent *Zone K RCRA Facility Investigation Work Plan Addendum*, dated November 16,
7 1999, identified low levels of chlorinated solvents upgradient of SWMUs 163 and 166 in
8 the deep portion of the surficial aquifer. The upgradient low-level chlorinated solvent
9 contamination appears to be unrelated to the two known onsite source areas, suggesting
10 another source is present (EnSafe, 2000).

11 **2.2.1 Historic Groundwater Investigation Summary**

12 In December 1999, the saturated zone along the western portion of the Naval Annex
13 was characterized horizontally and vertically by 12 grid Geoprobe locations
14 (GDKGP002-GDKGP013) that were advanced using a groundwater profiler.
15 Groundwater samples were collected every 3 feet from approximately 7 ft bls to the top
16 of the Ashley Formation in each profiler (i.e., Geoprobe) location. The samples were
17 analyzed in the field using a gas chromatograph (GC). Low levels of chlorinated
18 solvents, primarily TCE and 1,2-DC, were detected in 10 of the grid locations, with the
19 maximum concentration of TCE detected at 150 $\mu\text{g}/\text{L}$ in the grid sample collected at an
20 approximate depth of 34 ft bls in the grid location GDKGP011. The transformation
21 product 1,2-DCE was detected at a maximum concentration of 44 $\mu\text{g}/\text{L}$ in the sample
22 collected at an approximate depth of 13 ft bls in the grid location GDKGP003, near the
23 intersection of Avenue D and Sixth Street, downgradient of SWMU 163.

24 Table 2-4 presents the concentrations of VOCs detected in the samples collected during
25 the advancement of the grid-based Geoprobe locations.

26 Figures 2-1 and 2-2 present a summation of the detected concentrations of VOCs in the
27 shallow (less than 20 ft bls) and deep (20 to 36 ft bls) intervals of the saturated zone at
28 each sample collection location. The maximum summation concentration for each grid-
29 based location is depicted on the figures.

30 **2.2.2 Groundwater Data Gaps**

31 Data gaps associated with the chlorinated solvent plume exist along the northern,
32 western, and southern boundaries of the Naval Annex. Only the northwest corner of the

1 northern region of the Naval Annex has been investigated as a result of the low-level
2 concentrations of chlorinated solvents from the unknown source upgradient of SWMUs
3 163 and 166. The northwest corner of the Naval Annex is characterized by the samples
4 collected from the vertical profiler locations GDKGP011, GDKGP012, and GDKGP013,
5 and from samples collected from Geoprobe points 166GP024 and 166GP023D.

6 Currently, the western portion of the chlorinated solvent plume is defined by a series of
7 four vertical profiler points starting at the northwest corner of the Naval Annex with
8 GDKGP011 and following a southeast direction to GDKGP009, GDKGP005, and
9 terminating at the vertical profiler point GDKGP004, near the intersection of Air and
10 Sixth Streets. This transect of four vertical profiler points parallels the direction of
11 groundwater flow at the western portion of the Naval Annex.

12 TCE decreased in the samples collected at an approximate depth of 34 ft bls along this
13 transect, from a concentration of 150 $\mu\text{g}/\text{L}$ in the sample collected from GDKGP011 to
14 25 $\mu\text{g}/\text{L}$ in GDKGP005 to not being detected above the laboratory detection limit in the
15 sample collected from GDKGP004. However, the concentration of TCE increased as a
16 function of increasing depth in the samples collected from GDKGP004. TCE was
17 detected at concentrations of 8 $\mu\text{g}/\text{L}$ and 27 $\mu\text{g}/\text{L}$ in the samples collected from 37 and
18 40 ft bls, respectively. The detected TCE concentrations show some vertical migration of
19 the dissolved chlorinated solvent plume as it moves downgradient across the western
20 boundary, where the top of the Ashley Formation is located at a greater depth.

21 The shallow plume along the southern property boundary is defined by the presence of
22 1,2-DCE detected in the samples collected from the vertical profiler point GDKGP003,
23 located approximately 300 feet southwest of SWMU 163. This chlorinated solvent was
24 detected at concentrations of 44 $\mu\text{g}/\text{L}$ and 38 $\mu\text{g}/\text{L}$ in the samples collected from the
25 approximate depths of 13 and 16 ft bls. However, TCE and 1,2-DCE were detected at
26 concentrations of less than 5 $\mu\text{g}/\text{L}$ in the shallow samples collected from GDKGP007,
27 which lies approximately 100 feet southwest of SWMU 163. As such, it appears the
28 presence of 1,2-DCE is not related to the dissolved contaminant plume delineated at
29 SWMU 163.

30 The deep chlorinated solvent plume along the southern property is well defined;
31 however, low levels of chlorinated solvents were detected in the deep groundwater
32 samples collected from the vertical profiler locations GDKGP004, GDKGP005, and
33 GDKGP007. These 3 vertical profiler locations are separated by approximately 400 feet.

1 The significant distance between groundwater vertical profiler locations, and TCE
2 detection at or above its MCL of 5 $\mu\text{g}/\text{L}$ in each of these locations, necessitates
3 additional sample collection locations to further delineate the deep chlorinated solvent
4 plume downgradient of these locations along the existing southern property boundary.

5 **2.2.3 Sampling and Analysis Plan**

6 Four vertical profiler locations, identified as GDKGP020 through GDKGP023, will be
7 advanced along the northern property boundary to evaluate the shallow and deep
8 portions of the surficial aquifer for the presence/absence of VOCs. Groundwater
9 samples will be collected every 5 feet from the groundwater surface to the top of the
10 Ashley Formation. Ten contingency vertical profiler locations in the same area have
11 been identified should additional sample collection locations be required to further
12 delineate the horizontal and/or vertical extent of a potential plume. If required, the
13 location of the contingency point(s) and sample collection depth(s) will be evaluated in
14 the field, based on the analytical results obtained from the samples collected from the
15 proposed vertical profiler locations. An additional sample will be collected from the
16 location(s) and analyzed for VOCs at the specific depth where the greatest concentration
17 was detected from the sample location that initiated the need for the contingency
18 sample. Figures 2-1 and 2-2 present the location of the 4 vertical profiler points with the
19 10 contingency locations, which are identified as GDKGP-C.

20 Three vertical profiler locations, identified as GDKGP014 through GDKGP016, will be
21 advanced to define the vertical and horizontal extent of the dissolved chlorinated
22 solvent plume along the western property boundary. Groundwater samples will be
23 collected every 5 feet from approximately 35 ft bls to the top of the Ashley Formation.
24 Eight contingency vertical profiler locations, with three possible locations southeast of
25 the existing railroad lines, have been identified should additional sample collection
26 locations be required to further delineate the extent of the deep portion of the saturated
27 zone along the western boundary. Figure 2-2 presents the location of the 3 vertical
28 profiler points with the 8 local contingency locations, which are identified as GDKGP-C.

29 Three vertical profiler locations, identified as GDKGP017 through GDKGP019, will be
30 advanced to define the vertical and horizontal extent of the dissolved chlorinated
31 solvent plume upgradient of the southern boundary. Groundwater samples will be
32 collected every 5 feet from approximately 15 ft bls to the top of the Ashley Formation.
33 Eleven contingency vertical profiler locations in the same area have been identified

1 should additional sample collection locations be required to further delineate the extent
2 of the shallow and/or deep portions of the saturated zone. If the collection of
3 contingency samples is required from the deep portion of the saturated zone, and VOCs
4 are not detected above their corresponding MCL from samples collected in the shallow
5 portion of the saturated zone (i.e., less than 20 ft bls), additional shallow groundwater
6 samples will not be collected from any of the 11 contingency locations. Figures 2-1 and
7 2-2 present the locations of the 3 vertical profiler points with the 11 local contingency
8 locations, which are identified as GDKGP-C.

9 **2.3 SWMU 161, Vehicle Maintenance Shop, Naval Annex**

10 SWMU 161 consists of a gravel parking lot, a vehicle maintenance and wash bay with a
11 grease pit, and Building 2505. The wash bay has a drainage system and collection sump
12 that connects to an 800-gallon OWS. Waste oil from the separation process is stored in a
13 275-gallon aboveground storage tank. According to the *RFI Report*, the water from the
14 OWS discharges to the sanitary sewer system (EnSafe, June 1999). The OWS is located
15 adjacent to the chain-link fence along the eastern side of the Naval Annex, which
16 separates the Annex from the Interstate 26 right-of-way.

17 Thirteen soil sample locations identified as 161SB001 through 161SB013 were used to
18 characterize the surface and subsurface soils at SWMU 161. Based on the analytical
19 results from the soil samples collected at the site, the task team agreed in the September
20 6, 2000 meeting that no additional soil characterization was required at SWMU 161.
21 However, CH2M-Jones will provide the rationale in the Final Zone K RFI report as to
22 the decision not to collect additional surface soil samples in the immediate area
23 surrounding surface soil sample 161SB007, where total petroleum hydrocarbons (TPHs)
24 was detected at a concentration of 314 milligrams per kilogram (mg/kg).

25 An evaluation was completed to link potential environmental site impacts from SWMU
26 161 to existing site features such as sanitary sewers, stormwater sewers, railroad lines,
27 surface water bodies, drainage ditches, and OWSs. Surface and subsurface soil samples
28 were collected adjacent to the existing sanitary sewer lines and the OWS. This section
29 outlines the proposed locations and analyses required to investigate the saturated zone
30 immediately downgradient of the existing OWS. CH2M-Jones does not recommend the
31 collection of additional soil or groundwater samples, with the exception of the proposed
32 vertical profiler locations downgradient of the OWS, in the areas of known site features
33 presented in this paragraph.

1 CH2M-Jones does not recommend collecting a sample of the OWS contents at this time,
2 it a sample at this time would not be representative of the OWS contents over the life of
3 the facility.

4 **2.3.1 Historic Groundwater Investigation Summary**

5 MW 161001, positioned within 10 feet directly upgradient of the OWS, is the only MW
6 located at SWMU 161. Groundwater samples were collected from MW 161001 during six
7 sampling events conducted in January, April, July, and October 1997, and in January
8 and December 1999. Groundwater samples collected during the first two sampling
9 events were analyzed for VOCs, semi-volatile organic compounds (SVOCs), metals,
10 cyanide, pesticides, polychlorinated biphenyls (PCBs), and total petroleum
11 hydrocarbons. In addition, the sample collected during the first event was analyzed for
12 herbicides, organophosphorous pesticides, dioxins, and hexavalent chromium. The
13 groundwater samples collected during the third and fourth sampling events were
14 analyzed for VOCs, SVOCs, metals, cyanide, pesticides, and PCBs. Finally, the fifth
15 event groundwater sample was analyzed for dioxins and total suspended solids, while
16 the sample collected during the sixth event was analyzed for dioxins and VOCs.

17 Octachlorodibenzo-p-dioxin (OCDD) was detected in the sample collected during the
18 January 1997 sampling event at a concentration of 6.9 picograms per liter (pg/L).
19 However, during the subsequent sampling events conducted in January and December
20 1999, dioxin was not detected above laboratory detection limits in the groundwater
21 samples collected from MW 161001.

22 Based on the findings of the *Final RFI*, no COCs were identified as a result of the
23 samples collected from the one onsite MW (EnSafe, June 1999). Aluminum was detected
24 in the groundwater samples collected during the January, July, and October 1997
25 sampling events at concentrations of 540 $\mu\text{g/L}$, 381 $\mu\text{g/L}$, and 674 $\mu\text{g/L}$, respectively.
26 The secondary MCL and background concentration for aluminum at the Naval Annex is
27 50 $\mu\text{g/L}$ and 471 $\mu\text{g/L}$, respectively.

28 Table 2-5 presents the concentrations of constituents detected in the samples collected
29 from MW 161001 during the five groundwater sampling events.

30 **2.3.2 Groundwater Data Gaps**

31 The surficial aquifer has not been investigated immediately downgradient of the
32 existing OWS located along the eastern fence line separating the Naval Annex from

1 Interstate 26. Groundwater from the Naval Annex flows northeast to east toward
2 Interstate 26. However, once groundwater approaches the eastern fenceline near the
3 Interstate 26 right-of-way, it reaches a potentiometric low as it flows northwest to north
4 along the Interstate. This potentiometric low is a result of the existing stormwater sewer
5 system installed during Interstate 26 construction (EnSafe, June 1999).

6 MWs located near MW 161GW001 include the well pair 166GW016 and 166GW16D,
7 approximately 111 feet southeast or upgradient; deep well 166GW09D is located
8 approximately 118 feet northwest; MW pair 166GW015 and 166GW15D approximately
9 252 feet northwest or downgradient; and the well pair 166GW019 and 166GW19D
10 approximately 278 feet directly east on the east side of Interstate 26.

11 The most recent groundwater samples were collected from these MWs from April 14 to
12 17, 1998. Chlorinated solvents were not detected above laboratory detection limits in the
13 samples collected from MWs 166GW09D, 166GW015, 166GW15D, and 166GW019. TCE
14 and 1,2-DCE were detected at concentrations of 89 $\mu\text{g}/\text{L}$ and 26 $\mu\text{g}/\text{L}$, respectively, in the
15 sample collected from MW 166GW019D. In addition, these constituents were detected in
16 the groundwater sample collected from MW 166GW016 at concentrations of 1,600 $\mu\text{g}/\text{L}$
17 and 38 $\mu\text{g}/\text{L}$, respectively.

18 During the anaerobic-aerobic sequencing treatability study, groundwater samples were
19 collected from MW 166GW16D during four sampling events conducted from October
20 1999 to February 2000. The groundwater sample collected during the October 1999
21 sampling event was obtained prior to the startup of the treatability study on November
22 9, 1999. TCE, 1,2-DCE, and vinyl chloride were detected in this sample at concentrations
23 of 2,600 $\mu\text{g}/\text{L}$, 360 $\mu\text{g}/\text{L}$, and 57 $\mu\text{g}/\text{L}$, respectively. The most recent sample collected
24 during the February 2000 sampling event was obtained during the treatability study.
25 Chlorinated solvents TCE and 1,2-DCE were detected at concentrations of only 9 $\mu\text{g}/\text{L}$
26 and 14 $\mu\text{g}/\text{L}$, respectively. The results of the anaerobic-aerobic sequencing treatability
27 study are documented in *A-A Sequencing Treatability Study Report* for SWMU 166
28 (EnSafe, June 2, 2000).

29 Aluminum was detected in three of the four samples collected from MW 161GW001 at
30 an order of magnitude above secondary MCL of 50 $\mu\text{g}/\text{L}$ (Background 471 $\mu\text{g}/\text{L}$ and
31 tap-water RBC 3,700 $\mu\text{g}/\text{L}$). Detected concentrations were 540 $\mu\text{g}/\text{L}$, 381 $\mu\text{g}/\text{L}$, and
32 674 $\mu\text{g}/\text{L}$. Kriging, geostatistics, and/or risk assessment techniques will be used to

1 provide the rationale for aluminum detected above the MCL and background
2 concentrations in the groundwater samples.

3 **2.3.3 Sampling and Analysis Plan**

4 Three vertical profiler locations, identified as 161VP001 through 161VP003, will be
5 advanced to evaluate the shallow and deep portions of the surficial aquifer for the
6 absence/presence of VOCs immediately downgradient of the OWS. Each vertical
7 profiler point is located in the Interstate 26 right-of-way, approximately 25 feet east of
8 the eastern fence line, with 25 feet separating each point. Groundwater samples will be
9 collected every 5 feet from the groundwater surface to the top of the Ashley Formation.
10 Four contingency vertical profiler locations in the same area have been identified should
11 additional sample collection locations be required to further delineate the horizontal
12 and/or vertical extent of a potential plume. If required, the location of the contingency
13 point(s) and sample collection depth(s) will be evaluated in the field, based on the
14 analytical results obtained from the samples collected from the proposed vertical
15 profiler locations. One additional sample will be collected from the location(s) and
16 analyzed for VOCs at the specific depth where the greatest concentration was detected
17 from the sample location that initiated the need for the contingency sample. Figure 2-3
18 presents the location of the three vertical profiler points with the four contingency
19 locations, which are identified as 161VP-C.

20 **2.4 SWMU 163, Concrete Pit Area, Naval Annex**

21 SWMU 163 consists of a 10-foot by 10-foot uncovered concrete pit 2 feet deep, which lies
22 approximately 100 feet north of Building 2513. The pit was used as a less than 90-day
23 accumulation area for hazardous waste generation at the facility. Hazardous waste
24 consisting of solvents and paint wastes was accumulated in the unit from the mid 1980s
25 until spring 1994, when the facility was reclassified as a small-quantity hazardous waste
26 generator. No drains or sumps were observed in the pit during the RFI field activities.
27 Immediately southeast of the concrete pit is a concrete-bermed area that appeared to be
28 used as a wash rack (EnSafe, Inc., November 1999). A 4-inch steel stickup pipe is located
29 at the north end of the bermed area, and, according to utility maps, a water line ran to
30 the approximate location of the stickup. No drains or sumps associated with the wash
31 area were observed during the RFI field activities. Naval Annex records were
32 exhaustively searched and no additional information pertinent to SWMU 163 was

1 identified, particularly, information concerning the age or uses of the pit prior to the
2 mid 1980s (EnSafe, Inc., November 1999).

3 The dissolved chlorinated solvent contamination in the groundwater downgradient of
4 the concrete pit has been investigated and characterized by 3 groundwater MWs, a
5 multi-chamber well screened in the deep portion of the surficial aquifer, and 18 vertical
6 profiler points. In September and October 1999, EnSafe delineated the dissolved
7 chlorinated solvent contamination by advancing the 18 vertical profiler points in
8 shallow and deep portions of the surficial aquifer. In addition, the deep portion of the
9 surficial aquifer near the southern property boundary will be further investigated, as
10 outlined in Section 2.2 of this Work Plan Addendum. The analytical data from the
11 groundwater profiling investigations will clearly define the extent of chlorinated solvent
12 contamination in the surficial aquifer.

13 **2.4.1 Historic Soil Investigation Summary**

14 Three soil sampling events were completed at SWMU 163 to evaluate the soil in the
15 immediate area as a result of the previous hazardous waste accumulation activities. Five
16 surface (i.e., 0 to 1 ft bls) and five subsurface (i.e., 3 to 5 ft bls) soil samples were
17 collected during each of the first two soil sampling events completed in December 1996
18 and in January 1999. The second soil sampling event was conducted to evaluate the
19 organic constituents detected in the soil during the first sampling event.

20 Seven additional surface and subsurface soil samples (i.e., 163SB011 through 163SB016
21 and 163SB019) were collected in November and December 1999 to evaluate PAHs in the
22 surface soil in the immediate area of 163SB001 and 163SB008. In addition, three soil
23 samples (i.e., 163SB013, 163SB017, and 163SB018) were collected in November 1999 to
24 evaluate antimony and arsenic in the surface soil in the area of 163SB002.

25 The PAH concentrations detected in the surface soil sample 163SB019 had a
26 benzo(a)pyrene equivalent value of 13,950 µg/kg.

27 Antimony was detected in surface soil samples 163SB017 and 163SB018 at concentrations
28 of 0.35 mg/kg and 0.31 mg/kg, respectively, which is one order of magnitude less than
29 the residential RBC value of 3.1 mg/kg. Arsenic was detected in surface soil samples
30 163SB013, 163SB017, and 163SB018 at concentrations of 1.9 mg/kg, 7.7 mg/kg, and 0.86
31 mg/kg, respectively. Even though arsenic was detected in the surface soil sample
32 163SB017 at a concentration above the surface background concentration of 3 mg/kg,

1 arsenic was further delineated below the background concentration with the surface soil
2 sample 163SB018, which was collected approximately 5 feet northeast of 163SB017.

3 Table 2-6 presents the analytical results from the surface and subsurface soil samples
4 collected during the three sampling events.

5 **2.4.2 Soil Data Gaps**

6 The surface soil in the areas east, south, southeast, and southwest of surface soil sample
7 163SB019 has not been investigated for PAHs. In addition, an evaluation was completed
8 to link potential environmental site impacts to existing sanitary sewers, stormwater
9 sewers, railroad lines, surface water bodies, drainage ditches, and OWSs. As a result,
10 surface and subsurface soil has not been investigated immediately southeast of the
11 concrete-bermed wash rack area, specifically in the surface water drainage ditch adjacent
12 to Avenue C. The drainage ditch soil will be investigated to evaluate the potential impact
13 caused by stormwater runoff from the wash rack area. The other potential site features do
14 not or have not been known to exist at SWMU 163.

15 **2.4.3 Sampling and Analysis Plan**

16 Three surface soil samples, identified as 163SB020 through 162SB022, will be collected to
17 further delineate the elevated PAHs detected in soil sample 163SB019. The three surface
18 soil samples will be collected from 0 to 1 ft bls and analyzed for SVOCs using EPA
19 Method 8270. The proposed surface soil sample location 163SB021 will be placed
20 approximately 25 feet southwest of 163SB019, and soil samples 163SB020 and 163SB022
21 are proposed at approximately 25 feet west-northwest and east-southeast of the proposed
22 location 163SB020. Six contingency soil sample locations in the same area have been
23 identified should further delineation of the horizontal extent of PAHs in surface soil be
24 required. If required, the location of the contingency point(s) will be evaluated in the
25 field, based on the analytical results obtained from the samples collected from the
26 proposed surface soil locations. However, additional contingency surface soil samples
27 will not be recommended to delineate individual PAH constituents to the residential RBC
28 values. The CH2M-Jones approach will be to develop a trend of decreasing concentration.
29 If a decreasing trend is established for PAH constituents in surface soil, but the surface
30 soil has not been delineated to the residential RBC values, kriging, geostatistics, and/or
31 risk assessment techniques will be used to provide the rationale for not collecting
32 additional surface soil samples.

1 The surface soil sample, identified as 163SB023, will be collected to evaluate the
2 potential impact caused by stormwater runoff from the wash rack area to the surface
3 and subsurface soil in the drainage ditch adjacent to Avenue C, immediately southeast
4 of the concrete-bermed wash rack area. The surface and subsurface soil sample location
5 will be located within the drainage ditch approximately 10 feet from the concrete-
6 bermed area, and the samples will be collected from approximately 0 to 1 ft bls and 3 to
7 5 ft bls, respectively. The samples will be delivered to an offsite laboratory where they
8 will be analyzed for metals using EPA Method 6000 series, VOCs using EPA Method
9 8260, and SVOCs using EPA Method 8270. Only one surface and subsurface soil sample
10 will be collected, since the drainage ditch soil downgradient for surface water flow was
11 investigated and characterized as part of the RFI activities at SWMU 164.

12 Figure 2-4 presents the location of the four soil sample collection location with the six
13 contingency surface soil sample points, which are identified as 163SB-C.

14 **2.5 SWMU 162, Former Sludge Drying Field, Naval Annex**

15 SWMU 162, a former sludge drying field at the Naval Annex, was used to dewater
16 wastewater treatment sludge from an Air Force-operated sewage treatment plant. No
17 information is available regarding the operation period or the composition of the Air
18 Force waste stream (EnSafe, November 1999). A soccer field was constructed on the
19 former sludge drying field area, which is bound by Fifth and Sixth Streets, Air Street,
20 and Avenue D. According to EnSafe, no liner was encountered during the RFI field
21 activities, nor were records or other evidence of the use of a liner located. The Naval
22 Annex records were thoroughly searched and no additional information pertinent to
23 SWMU 162 was identified (EnSafe, November 1999).

24 The surface and subsurface soil at SWMU 162 was characterized by 21 soil sampling
25 locations identified as 162SB001 through 162SB021, and the groundwater was
26 investigated by the installation and subsequent sampling of the two site MWs
27 162GW001 and 162GW002. Based on the analytical results from the soil and
28 groundwater samples collected at the site, the task team agreed in the September 6, 2000
29 meeting that no additional soil and groundwater characterization was required at
30 SWMU 162. However, CH2M-Jones will provide the rationale in the Final Zone K RFI
31 report for the detected concentrations of aluminum and iron above their respective
32 MCLs in the samples collected from MWs 162GW001 and 162GW002. Kriging,
33 geostatistics, and/or risk assessment techniques will be used to provide the rationale for

1 metals detected above their respective MCLs and/or background concentration in the
2 groundwater samples.

3 Chromium and thallium were detected above site-specific SSLs in subsurface soil
4 samples. Site-specific SSLs were calculated by EnSafe as part of the additional
5 investigation activities, as outlined in its *Zone K Work Plan Addendum* (November 16,
6 1999). The calculations have not been submitted to SCDHEC. The calculated site-specific
7 SSLs for chromium used conservative hexavalent chromium parameters in the
8 calculations. There has been no evidence of a chromium plating operation at the Annex.
9 In addition, a partition equation SSL was used since chromium was not detected in the
10 synthetic precipitation leaching procedure (SPLP) samples. Because chromium was not
11 detected in the SPLP samples, chromium does not appear to be a potential leaching
12 concern. Chromium was detected in three subsurface samples at concentrations of
13 12 mg/kg (162SB001), 16.8 mg/kg (162SB010), and 10.1 mg/kg (162SB017). A site-
14 specific SSL for chromium was calculated at 4.2 mg/kg by EnSafe.

15 Thallium was detected in two subsurface samples at concentrations of 0.47 mg/kg
16 (162SB010) and 0.42 mg/kg (162SB011), which are above a site-specific SSL of 0.078 mg/kg,
17 as calculated by EnSafe. These estimated concentrations of less than 1.0 mg/kg were not
18 detected above the method detection limit and were reported by the laboratory with the
19 “J” flag. CH2M-Jones does not recommend the collection of additional subsurface soil
20 samples to further characterize chromium and thallium in the vadose zone.

21 An evaluation was completed to link potential environmental site impacts from SWMU
22 162 to existing site features such as sanitary sewers, stormwater sewers, railroad lines,
23 surface water bodies, drainage ditches, and OWSs. Surface and subsurface soil sample
24 locations 162SB016, 162SB018, 162SB020, and 162SB022 were used to investigate the soil
25 in the immediate area of the existing drainage ditches that parallel Air and Sixth Streets.
26 No other known site feature exists that would require the collection of additional soil or
27 groundwater samples. For this reason, CH2M-Jones does not recommend the collection
28 of additional soil or groundwater samples.

29 **2.6 SWMU 164, Blasting Operation, Naval Annex**

30 SWMU 164 consists of an abrasive sandblasting booth formerly located in Building 2556
31 at the Naval Annex. Building 2556 was constructed in 1983 and was used to repair and
32 store mines (EnSafe, November 1999). Various types of equipment were also

1 sandblasted to remove paint. The east side of Building 2556 housed the sandblasting
2 booth, a paint booth, and a tool shed that was once used as a drying booth (EnSafe,
3 November 1999); the building's west end was used for mine storage. Mine repair
4 continued at Building 2556 until 1993. A new blasting booth, installed in approximately
5 1986 on the site of the former basting booth, consisted of a metal structure on the
6 concrete floor (EnSafe, November 1999). The concrete floor in the building was
7 inspected by EnSafe on March 9, 1999, and was found to be in good condition with no
8 apparent cracks.

9 Thirty-five soil sampling locations identified as 164SB001 through 164SB035 were used
10 to characterize the surface and subsurface soil at SWMU 164. No contaminants were
11 detected above screening levels in the groundwater samples collected from grid well
12 GDKGW002, which is located approximately 130 feet downgradient of SWMU 164. In
13 addition, no VOCs were detected in the groundwater samples collected from the
14 shallow portion of the surficial aquifer at the DPT points 166GP018 and 166GP072,
15 which are located approximately 100 feet sidegradient and 40 feet downgradient,
16 respectively, of SWMU 164. Finally, metals were not detected above their respective
17 MCL in the filtered sample from 166GP018. Chlorinated solvents were not detected
18 above the method detection limit in the groundwater sample collected from deep
19 MW 16622D, located immediately northwest of the site or 60 feet sidegradient of SWMU
20 164. The task team agreed in the September 6, 2000 meeting that additional soil and
21 groundwater sample locations were not required to investigate potential soil and
22 groundwater contaminants associated with SWMU 164, including additional
23 investigation in the stormwater ditch area along Avenue C or the former aboveground
24 storage tank area.

25 Thallium was detected in five subsurface samples (164SB021-164SB024 and 164SB034) at
26 concentrations ranging from 0.44 mg/kg (164SB024) to 0.57 mg/kg (164SB034), which
27 are above a site-specific SSL of 0.22 mg/kg, as calculated by EnSafe. The estimated
28 concentrations of less than 1.0 mg/kg were not detected above the method detection
29 limit and were reported by the laboratory with the "J" flag. CH2M-Jones does not
30 recommend the collection of additional subsurface soil samples to further characterize
31 thallium in the vadose zone.

2.7 SWMU 185, Sewer System and Former Septic Tank System, Naval Annex

SWMU 185 is a former sanitary sewer and septic tank system. Four surface and subsurface soil samples identified as 166SB001 through 166SB004 were advanced in the area of the former septic tank/drainfield. No constituent concentration from the surface soil samples was above the higher value of its corresponding residential RBC or background concentration.

The pesticide alpha-Chlordane and lead were detected in the subsurface soil sample 166SB004 at a concentration of 3,120 µg/kg and 59.1 mg/kg, respectively, which are above their corresponding site-specific SSL values of 8.78 µg/kg and 49.2 mg/kg, respectively. Alpha-chlordane and lead were not detected above their respective site-specific SSL values in the three subsurface soil samples 166SB001 through 166SB003, that were collected north of 166SB004. CH2M-Jones will provide the rationale in the Final Zone K RFI for not further investigating the subsurface soil in the area of 166SB004. Kriging, risk assessment, future land use, and/or the calculations used to obtain the site-specific SSLs will be evaluated as potential sources used to demonstrate that additional subsurface soil samples at SWMU 185 are not required.

Thallium was detected at a concentration of 0.69 mg/kg in soil sample 166SB002. The site-specific SSL for thallium is 0.15 mg/kg calculated by EnSafe. These estimated concentrations of less than 1.0 mg/kg were not detected above the method detection limit and were reported by the laboratory with the "J" flag. CH2M-Jones does not recommend the collection of additional subsurface soil samples to further characterize thallium in the vadose zone.

A groundwater MW identified as 166GW001 is located in the former septic tank/drainfield location. Aluminum was detected at concentrations above its MCL in three of the four samples collected from 166GW001, and iron was detected in the sample collected during the initial sampling event at a concentration of above its MCL. However, kriging, geostatistics, and/or risk assessment techniques will be used to provide the rationale for metals detected above their respective MCLs and/or background concentration in the groundwater samples collected from MW 166GW001.

An evaluation was completed to link potential environmental site impacts from SWMU 185 to existing site features such as sanitary sewers, stormwater sewers, railroad lines,

1 surface water bodies, drainage ditches, and OWSs. Soil and groundwater in the
2 immediate area of the existing sanitary sewer, along the southern portion of SWMU 185,
3 has been investigated. No other known site feature exists, except the former sanitary
4 sewer and septic tank system, which would require the collection of additional soil or
5 groundwater samples. For this reason, CH2M-Jones does not recommend the collection
6 of additional soil or groundwater samples.

7 **2.8 AOC 696, Transformer Area Near Building 2509, Naval** 8 **Annex**

9 AOC 696 consists of an area where six former transformers were located on a 6-inch-
10 thick concrete slab immediately north of Building 2509 (EnSafe, November 1999).
11 Building 2509, constructed in 1962, housed a radar station that was operational until
12 1981. In 1981, the property was transferred from the Air Force to the Navy, and the
13 radar station was dismantled. The Navy used the eight-story tower for mine storage
14 until 1993.

15 In late 1997, the Environmental Detachment Charleston completed the Interim Measures
16 at AOC 696, which involved the demolition and disposal of the transformer station. The
17 transformer station consisted of the remaining transformers, fence, concrete slab; the
18 excavation and disposal of approximately 10 cubic yards of beryllium- and arsenic-
19 impacted soil; and the excavation and disposal of 40 cubic yards of PCB-impacted soil.
20 As part of the Interim Measures, confirmation soil samples were collected for analysis to
21 evaluate the limits of the soil excavation. Based on the confirmation samples, an
22 additional 30 cubic yards of arsenic- and PCB-impacted soil was removed and sent off
23 site for disposal (EnSafe, November 1999). As presented in the September 6, 2000
24 meeting, CH2M-Jones will verify that the horizontal and vertical limits of PCB-impacted
25 soil excavated during the Interim Measures and the analytical results of the
26 confirmation soil samples collected from the excavation boundary are not above the
27 RBC values for surface soil and the SSL values for subsurface soil.

28 Surface and subsurface soil was characterized at the site by the 27 soil sample locations
29 identified as 696SB001 through 696SB027; groundwater at the site was characterized by
30 samples collected from MWs 696GW001 through 696GW003. Based on the analytical
31 results from the soil and groundwater samples collected on the site, the task team
32 agreed in the September 6, 2000 meeting that no additional soil and groundwater

1 characterization was required at AOC 696. However, CH2M-Jones will provide the
2 rationale in the Final Zone K RFI report for the detected concentrations of aluminum,
3 iron, and maganese above their respective MCLs in the samples collected from MWs
4 696GW001 through 696GW003. Kriging, geostatistics, and/or risk assessment
5 techniques will be used to provide the rationale for metals detected above their
6 respective MCLs and/or background concentration in the groundwater samples.

7 The detected concentration of alcohol in a groundwater sample collected from the
8 vertical profiler location 166VP001 will be evaluated. CH2M-Jones will provide a
9 possible explanation or justification for the presence of the detected contaminant
10 concentration in the Final Zone K RFI report.

11 Chromium and thallium were detected above site-specific SSLs in subsurface soil
12 samples collected from the site. Site-specific SSLs for chromium, as calculated by EnSafe,
13 used conservative hexavalent chromium parameters in the calculation. There has been
14 no evidence of a chromium plating operation at the Annex. In addition, a partition
15 equation SSL was used since chromium was not detected in the SPLP samples. Because
16 chromium was not detected in the SPLP samples, chromium does not appear to be a
17 potential leaching concern. Chromium was detected in two subsurface samples at a
18 concentration of 14 mg/kg (696SB014) and 10 mg/kg (696SB020), which are above a
19 site-specific SSL of 9.6 mg/kg.

20 Thallium was detected in three subsurface samples at concentrations of 0.49 mg/kg
21 (696SB015), 0.67 mg/kg (696SB021), and 0.45 mg/kg (696SB023) which exceed site-
22 specific SSL of 0.178 mg/kg. These estimated concentrations of less than 1.0 mg/kg
23 were not detected above the method detection limit and were reported by the laboratory
24 with the "J" flag. CH2M-Jones does not recommend the collection of additional
25 subsurface soil samples to further characterize chromium and thallium in the vadose
26 zone.

27 An evaluation was completed to link potential environmental site impacts from AOC
28 696 to existing site features such as sanitary sewers, stormwater sewers, railroad lines,
29 surface water bodies, drainage ditches, and OWSs. Soil and groundwater in the
30 immediate area of the existing sanitary sewer at Building 2509 and the soil in the area of
31 the former 1,000-gallon fuel oil underground storage tank (UST) has been characterized.
32 No other known site feature exists that would require the collection of additional soil or

1 groundwater samples. For this reason, CH2M-Jones does not recommend the collection
2 of additional soil or groundwater samples.

3 **2.9 AOC 698, Building 2508, Boiler House, Naval Annex**

4 AOC 698, Building 2508, houses four boilers that formerly supplied steam to the
5 facilities located on the Annex. The building was constructed in 1955 and was originally
6 operated by the Air Force until it was transferred to the Navy in 1981. Currently, the
7 building is not being used and is in poor condition. Building 2508 is designated as an
8 AOC due to lead-based paint that is peeling from the interior and exterior surfaces. A
9 10,000-gallon fuel oil aboveground storage tank was formerly located on the northeast
10 side of Building 2508 (EnSafe, November 1999). The containment berm, which was
11 added in the late 1970s, and the concrete tank supports currently remain at the site; the
12 tank was removed in the mid 1990s.

13 Surface and subsurface soil was characterized at the site by the 38 soil sample locations
14 identified as 698SB001 through 698SB036, 698SB042, and 698SB043. Samples collected
15 from Geoprobe locations 698GP001 through 698GP006, and the samples collected from
16 the existing MWs 698GW001 and 698GW002 characterized the groundwater in the area
17 of AOC 698. Based on the analytical results from the soil and groundwater samples
18 collected at the site, the task team agreed in the September 6, 2000 meeting that
19 additional soil and groundwater characterization may not be required at AOC 698.
20 However, CH2M-Jones will provide the rationale in the Final Zone K RFI report for the
21 detected concentrations of aluminum and iron above their respective MCLs in the
22 samples collected from MWs 698GW001 and 698GW002. Kriging, geostatistics, and/or
23 risk assessment techniques will be used to provide the rationale for metals detected
24 above their respective MCLs and/or background concentration in the groundwater
25 samples.

26 CH2M-Jones will provide rationale in the Final Zone K RFI report to justify that
27 additional surface soil samples are not required for dioxin analysis even though dioxin
28 compounds were detected above their corresponding residential RBC values in surface
29 soil samples 698SB030, 698SB031, and 698SB032. Dioxin compound concentrations from
30 analysis of subsurface soil samples in these sample locations were not above SSLs.

31 In addition, CH2M-Jones will provide in the Final Zone K RFI report a scientific
32 explanation for and understanding of the sporadic detentions of arsenic in the surface

1 soil samples above the residential RBC value. CH2M-Jones does not recommend the
2 collection of additional surface soil samples for further characterization of arsenic below
3 the residential RBC value.

4 Thallium was detected in the subsurface sample 698SB042 at a concentration of 0.50
5 mg/kg, which is above a site-specific SSL of 0.125 mg/kg. This estimated concentration of
6 less than 1.0 mg/kg was not detected above the method detection limit and was reported
7 by the laboratory with the “J” flag. CH2M-Jones does not recommend the collection of
8 additional subsurface soil samples to further characterize thallium in the vadose zone.

9 An evaluation was completed to link potential environmental site impacts from AOC
10 698 to existing site features such as sanitary sewers, stormwater sewers, railroad lines,
11 surface water bodies, drainage ditches, and OWSs, if present. Soil and groundwater in
12 the immediate area of the former 10,000-gallon fuel oil tank has been characterized. No
13 other known site feature exists that would require the collection of additional soil or
14 groundwater samples. For this reason, CH2M-Jones does not recommend the collection
15 of additional soil or groundwater samples.

TABLE 2-1
 SWMU 166 Groundwater Monitor Wells - Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample ID	Date		Acetone	Bromodichloromethane	Benzene	Toluene	Chloromethane	1,1-Dichloroethene	1,1-Dichloroethene (Total)	Methyl ethyl Ketone	Methylene Chloride	Perchloroethene	Trichloroethene	Chloroform	Vinyl Chloride	Xylene (Total)
	Collected															
166GW0021A	05/23/97	10 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	8	10 U	5 U
166GW00201	07/30/97	10 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00202	10/14/97	10 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00203	01/23/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00204	04/07/98	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW0031A	05/23/97	10 U	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	4 J	3 J	10 U	5 U
166GW00301	07/24/97	1,500 J	5 U	5 U	5 U	41 J	5 U	5 U	10 U	5 U	5 U	5 U	6	5 U	5 U	5 U
166GW00302	10/14/97	11 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	3 J	5 U	5 U	5 U
166GW00303	01/14/98	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	5 U
166GW00304	04/07/98	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	3 J	5 U	5 U	5 U
166GW0041A	05/22/97	10 U	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U
166GW00401	07/24/97	10 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00402	10/15/97	10 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00403	01/15/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00404	04/08/98	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW0051A	05/22/97	10 U	5 U	5 U	5 U	10 U	5 U	2 J	10 U	5 U	5 U	5 U	120	5 U	10 U	5 U
166GW00501	07/24/97	10 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00502	10/15/97	10 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00503	01/23/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00504	04/07/98	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW0061A	05/22/97	10 U	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	2 J	10 U	5 U
166GW00601	07/25/97	10 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00602	10/16/97	10 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00603	01/15/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00604	04/09/98	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW0071A	05/22/97	10 U	3 J	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	2 J	24	10 U	5 U
166GW00701	07/25/97	10 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00702	10/16/97	10 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00703	01/22/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00704	04/09/98	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW0081A	05/22/97	10 U	5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	9	10 U	5 U
166GW00801	07/28/97	10 UJ	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00802	10/17/97	10 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW00803	01/22/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5	5 U	5 U	5 U
166GW00804	04/10/98	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4 J	5 U	5 U	5 U
166GW0131A	01/22/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW01302	04/14/98	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW0141A	01/22/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	3 J	5 U	5 U	5 U
166GW01402	04/15/98	6 J	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	3 J	5 UJ	5 U	5 U	5 U	5 U	5 U
166GW01501*	01/28/98		5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW01502*	04/7/98	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 UJ	5 U	5 U	5 U	5 U	5 U
166GW01601*	01/28/98		5 U	5 J	5 U	5 U	5 U	2 J	40	5 U	5 U	2 J	3,400	5 U	5 U	5 U
166GW01602*	04/7/98	5 U	5 U	4 J	5 U	5 U	5 U	1 J	38	5 U	10 U	2 J	1,600	4 J	5 U	5 U
166GW01701*	01/28/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 J	7	5 U	5 U	5 U
166GW01702*	04/21/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 J	5 U	5 U	5 U	5 U

TABLE 2-1
 SWMU 166 Groundwater Monitor Wells - Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample ID	Date		Acetone	Bromodichloromethane	Benzene	Toluene	Chloromethane	1,1-Dichloroethene	1,1-Dichloroethene (Total)	Methylethyl Ketone	Methylene Chloride	Perchloroethene	Trichloroethene	Chloroform	Vinyl Chloride	Xylene (Total)
	Collected															
166GW01801*	01/29/98			5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	44 J	2 J	5 U	5 U	5 U
166GW01802*	04/21/98			5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	35	5 U	5 U	5 U	5 U
166GW01901*	01/26/98			5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW01902*	04/16/98	5 U		5 U	5 U	5 U	5 U	5 U	2 J	5 U	11 U	5 UJ	5 U	5 U	5 U	5 U
166GW02001*	01/29/98			5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW02002*	04/15/98	5 U		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW02101*	01/26/98			5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U
166GW02102*	04/16/98	5 U		5 U	5 U	5 U	5 U	5 U	5 U	5 U	12 U	5 UJ	5 J	5 U	5 U	5 U
166GW02D1A	05/23/97	10 U		5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	3 J	8	10 U	5 U
166GW02D01	07/30/97	10 U		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	6	5 U	5 U	5 U
166GW02D02	10/14/97	10 U		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	6	5 U	5 U	5 U
166GW02D03	01/23/98			5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	9	5 U	5 U	5 U
166GW02D04	04/07/98	5 U		5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	4 J	5 U	5 U	5 U
166GW03D1A	05/23/97	10 U		5 U	5 U	5 U	10 U	5 U	13	10 U	5 U	5 U	5 J	1 J	10 U	5 U
166GW03D01	07/24/97	10 U		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5	5 U	5 U	5 U
166GW03D02	10/14/97	10 U		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	4 J	5 U	5 U	5 U
166GW03D03	01/14/98			5 U	5 U	5 U	5 U	5 U	12	5 U	5 U	5 U	4 J	5 U	5 U	5 U
166GW03D04	04/07/98	5 U		5 U	5 U	5 U	5 UJ	5 U	15	5 U	5 U	5 U	1 J	5 U	5 U	5 U
166GW04D1A	05/22/97	10 U		5 U	5 U	5 U	10 U	5 U	10	10 U	5 U	5 U	60	1 J	10 U	5 U
166GW04D01	07/24/97	10 U		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	79	5 U	5 U	5 U
166GW04D02	10/15/97	10 U		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	96	5 U	5 U	5 U
166GW04D03	01/15/98			5 U	5 U	5 U	5 U	5 U	9	5 U	5 U	5 U	98	5 U	5 U	5 U
166GW04D04	04/08/98	5 U		5 U	5 U	5 U	5 UJ	5 U	3 J	5 U	5 U	5 U	120	5 U	5 U	5 U
166GW05D1A	05/22/97	10 U		5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	10 U	5 U
166GW05D01	07/24/97	10 U		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	47	5 U	5 U	5 U
166GW05D02	10/15/97	10 U		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	44	5 U	5 U	5 U
166GW05D03	01/16/98			5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	37	5 U	5 U	5 U
166GW05D04	04/07/98	5 U		5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	54	5 U	5 U	5 U
166GW06D1A	05/22/97	10 U		5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	4 J	5 U	10 U	5 U
166GW06D01	07/25/97	10 UJ		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW06D02	10/16/97	10 U		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW06D03	01/15/98			5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5 U	5 U
166GW06D04	04/09/98	5 U		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW07D1A	05/22/97	10 U		5 U	5 U	5 U	10 U	5 U	27	10 U	5 U	5 U	1,000	2 J	10 U	5 U
166GW07D01	07/25/97	10 U		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	930	5 U	5 U	5 U
166GW07D02	10/16/97	10 U		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	1,200	5 U	5 U	5 U
166GW07D03	01/22/98	5 U		5 UJ	3 J	5 UJ	5 UJ	3 J	66 J	5 UJ	5 UJ	3 J	2,000	5 U	5 UJ	1 J
166GW07D04	04/09/98	5 U		5 U	5 U	5 U	5 U	3 J	97	5 U	5 U	1 J	3,800	5 U	5 U	5 U
166GW08D1A	05/22/97	10 U		1 J	5 U	5 U	10 U	5 U	2 J	10 U	5 U	5 U	38	16	10 U	5 U
166GW08D01	07/28/97	10 UJ		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	94	5 U	5 U	5 U
166GW08D02	10/17/97	10 U		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	87	5 U	5 U	5 U
166GW08D03	01/22/98			5 U	5 U	5 U	5 U	5 U	7	5 U	5 U	5 U	88	5 U	5 U	5 U
166GW08D04	04/10/98	5 U		5 U	5 U	5 U	5 U	5 U	8	5 U	5 U	5 U	110	5 U	5 U	5 U
166GW09D1A	05/22/97	10 U		5 U	5 U	5 U	10 U	5 U	5 U	10 U	5 U	5 U	5 U	3 J	10 U	5 U
166GW09D01	07/28/97	10 UJ		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW09D02	10/16/97	10 U		5 U	5 U	5 U	5 U	5 U	5 U	10 U	5 U	5 U	5 U	5 U	5 U	5 U

TABLE 2-1
 SWMU 166 Groundwater Monitor Wells - Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample ID	Date Collected	Acetone	Bromodichloromethane	Benzene	Toluene	Chloromethane	1,1-Dichloroethene	1,1-Dichloroethene (Total)	Methylethyl Ketone	Methylene Chloride	Perchloroethene	Trichloroethene	Chloroform	Vinyl Chloride	Xylene (Total)
166GW09D03	01/16/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW09D04	04/14/98	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ	5 U	5 U	5 U	5 U	5 U
166GW10D1A	05/22/97	10 U	5 U	5 U	5 U	10 U	2 J	140	10 U	5 U	5 U	2,200	5 U	10 U	5 U
166GW10D01	07/30/97	10 U	5 U	5 U	5 U	5 U	2 J		10 U	5 U	5 U	1,900	5 U	5 U	5 U
166GW10D02	10/17/97	10 U	5 U	5 U	5 U	5 U	2 J		10 U	5 U	5 U	3,200	5 U	5 U	5 U
166GW10D03	01/23/98		100 U	100 U	100 U	100 U	100 U	69 J	100 U	100 U	100 U	2,000	100 U	100 U	100 U
166GW10D04	04/14/98	5 U	5 U	5 U	5 U	5 U	5 U	110	5 U	5 U	5 U	3,400	5 U	5 U	5 U
166GW11D1A	05/22/97	10 U	5 U	5 U	1 J	10 U	5 U	24	10 U	5 U	5 U	89	7	10 U	5 U
166GW11D01	07/30/97	10 U	5 U	5 U	5 U	5 U	5 U		10 U	5 U	5 U	90	5 U	5 U	5 U
166GW11D02	10/17/97	10 U	5 U	5 U	5 U	5 U	5 U		10 U	5 U	5 U	91	5 U	5 U	5 U
166GW11D03	01/22/98		5 U	5 U	5 U	5 U	5 U	6	5 U	5 U	5 U	59	5 U	5 U	5 U
166GW11D04	04/08/98	5 U	5 U	5 U	5 U	5 UJ	5 U	21	5 U	5 U	5 U	100	5 U	5 U	5 U
166GW12D1A	05/22/97	10 U	5 U	5 U	5 U	10 U	5 U	14	10 U	5 U	5 U	31	10	10 U	5 U
166GW12D01	07/30/97	10 U	5 U	5 U	5 U	5 U	5 U		10 U	5 U	5 U	34	5 U	5 U	5 U
166GW12D02	10/17/97	10 U	5 U	5 U	5 U	5 U	5 U		10 U	5 U	5 U	27	5 U	5 U	5 U
166GW12D03	01/22/98		5 U	5 U	5 U	5 U	5 U	4 J	5 U	5 U	5 U	12	5 U	5 U	5 U
166GW12D04	04/08/98	5 U	5 U	5 U	5 U	5 UJ	5 U	6	5 U	5 U	5 U	31	5 U	5 U	5 U
166GW13D1A	01/22/98		5 U	5 U	5 U	5 U	1 J	130	5 U	5 U	5 U	2,700	5 U	2 J	5 U
166GW13D02	04/14/98	5 U	5 U	5 U	5 U	5 U	1 J	160	5 UJ	5 UJ	5 U	7,200	5 U	1 J	5 U
166GW14D1A	01/22/98	4 J	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	18 J	5 UJ	5 UJ	5 UJ	320	5 U	5 UJ	5 UJ
166GW14D02	04/15/98	10 UJ	10 UJ	10 U	10 U	10 U	10 U	22	10 U	2 J	10 UJ	410	10 U	10 U	10 U
166GW15D01*	01/28/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW15D02*	04/17/98	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	11 U	5 UJ	5 U	5 U	5 U	5 U
166GW16D01*	01/28/98		5 U	5 U	5 U	5 U	2 J	67	5 U	5 U	5 U	2,600	5 U	5 U	5 U
166GW16D02*	04/17/98	5 U	5 U	5 U	5 U	5 U	1 J	89	5 U	10 U	5 UJ	1,700	5 U	5 U	5 U
166GW17D01*	01/28/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW17D02*	04/21/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW18D01*	01/29/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5 U	5 U	5 U
166GW18D02*	04/21/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
166GW19D01*	01/26/98		5 U	5 U	5 U	5 U	5 U	24	5 U	5 U	110	72	5 U	1 J	5 U
166GW19D02*	04/16/98	5 U	5 U	5 U	5 U	5 U	5 U	26	5 U	11 U	120 J	89	5 U	5 U	5 U
166GW20D1A*	01/22/98		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	190	13	5 U	5 U	5 U
166GW20D02*	04/15/98	10 UJ	10 UJ	10 U	10 U	10 U	10 U	10 U	10 U	6 U	290 J	15	10 U	10 U	10 U
166GW21D01*	01/26/98		5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	44	2 J	5 U	5 U	5 U
166GW21D02*	04/16/98	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	29 J	4 J	5 U	5 U	5 U
166GW22D01	07/10/98		5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	5 U	4 J	5 U	5 U	5 U
166GW23D01	07/10/98	5 U	5 U	5 U	14	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5 U	5 U

Compound concentrations in micrograms per liter (µg/L).

* Indicates an offsite well. 166GW019, 020, 021, 20D, and 21D are installed on the east side of Interstate 26. 166GW015, 016, 017, 018, 15D, 16D, 17D, and 18D are installed on the west side of I26 between the Naval Annex and Interstate 26

J Indicates that the compound was detected and the concentration is an estimated value.

U Indicates that the compound was not detected.

UJ Indicates that the compound was not detected and the value provided is estimated.

TABLE 2-2
 SWMU 166 Geoprobe Locations -- Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample Location	Sample Depth	PCE	TCE	1,1-DCE	1,2-DCE	VC	MEK	1,1,2-TCA	CF	STY	MC	BEN	EB	TOL	XYL (Total)	CDS
166GP011 Groundwater Screening^a																
166GP011	S	ND	53	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phase I – February 1997^b																
166GP032	S	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	ND	ND
	I	ND	3	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	D	ND	1,400	2	170	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
166GP033	S	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	I	ND	35	ND	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	D	ND	1,600	2	150	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
166GP034	I	ND	ND	ND	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	D	ND	1,800	2	140	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
166GP035	S	ND	640	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	ND
	I	ND	ND	ND	2	ND	ND	ND	ND	ND	ND	ND	2	ND	11	ND
	D	ND	250	ND	540	ND	ND	ND	ND	ND	ND	1	ND	ND	ND	ND
166GP036	I	ND	27	ND	2	ND	ND	ND	ND	ND	2	ND	ND	3	ND	ND
	D	ND	96	ND	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE 2-2
 SWMU 166 Geoprobe Locations -- Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample Location	Sample Depth	PCE	TCE	1,1-DCE	1,2-DCE	VC	MEK	1,1,2-TCA	CF	STY	MC	BEN	EB	TOL	XYL (Total)	CDS
Phase II – March 1997^c																
166GP037	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	391	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP038	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	180	NA	1,116	2,486	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
166GP039	S	NA	ND	NA	14,957	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		(1)	(3,000)	(1)	(100)	ND	ND	(3)	(3)	ND	ND	(2)	(4)	(17)	(11)	ND
	I	NA	10	NA	ND	681	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D	NA	40	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP041	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	954	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 2-2
 SWMU 166 Geoprobe Locations -- Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample Location	Sample Depth	PCE	TCE	1,1-DCE	1,2-DCE	VC	MEK	1,1,2-TCA	CF	STY	MC	BEN	EB	TOL	XYL (Total)	CDS
166GP042	S	NA	ND	NA	598	214	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		ND	(60)	ND	(130)	ND	ND	ND	ND	ND	(2)	ND	ND	ND	ND	ND
	D	NA	ND	NA	ND	375	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		ND	288	NA	17	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		ND	(1,400)	(2)	(570)	ND	ND	ND	ND	ND	(2)	(2)	ND	(1)	ND	ND
166GP045	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	22	NA	ND	1639	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		ND	(1)	ND	ND	ND	ND	ND	ND	ND	ND	ND	(3)	ND	(2)	ND
166GP046	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	167	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	846	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP047	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	6,149	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP048	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		ND	(3)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	D	NA	75	NA	704	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 2-2
 SWMU 166 Geoprobe Locations -- Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample Location	Sample Depth	PCE	TCE	1,1-DCE	1,2-DCE	VC	MEK	1,1,2-TCA	CF	STY	MC	BEN	EB	TOL	XYL (Total)	CDS
166GP049	S	NA	ND	NA	ND	300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	59	NA	9,374	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		(2)	(1,400)	(1)	(22)	ND	(5)	ND	ND	ND	ND	ND	ND	(2)	ND	ND
	D	NA	99	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP051	S	NA	ND	NA	ND	1,227	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	925	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	ND	(5)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		NA	ND	NA	ND	699	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP052	S	NA	ND	NA	ND	216	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		ND	(2)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	I	NA	36	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	476	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP053	S	NA	ND	NA	ND	832	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	1,011	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	137,765	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ND		(15,000)	ND	(170)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	

TABLE 2-2
 SWMU 166 Geoprobe Locations -- Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample Location	Sample Depth	PCE	TCE	1,1-DCE	1,2-DCE	VC	MEK	1,1,2-TCA	CF	STY	MC	BEN	EB	TOL	XYL (Total)	CDS
166GP054	S	NA	ND	NA	ND	1,825	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	610	NA	85,858	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		(2)	(1,600)	(2)	(120)	ND	ND	ND	(4)	ND	ND	(5)	ND	ND	(1)	ND
	D	NA	4,709	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ND		(3,700)	(2)	(120)	ND	ND	ND	ND	ND	ND	ND	(1)	ND	ND	ND	
166GP055	S	NA	6	NA	ND	1,356	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	162	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP058	S	NA	718	NA	660	4,435	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		ND	(160)	ND	(4)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	I	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	2,052	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP059	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	1,082	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	1,242	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP060	S	NA	8	NA	ND	454	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	1,307	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 2-2
 SWMU 166 Geoprobe Locations -- Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample Location	Sample Depth	PCE	TCE	1,1-DCE	1,2-DCE	VC	MEK	1,1,2-TCA	CF	STY	MC	BEN	EB	TOL	XYL (Total)	CDS
166GP061	S	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	1,008	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	1,582	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		ND	(940)	ND	(55)	ND	ND	ND	ND	(4)	ND	ND	ND	ND	ND	ND
166GP062	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	310	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		ND	(140)	ND	(76)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
166GP063	S	NA	ND	NA	ND	1301	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	20	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	43,583	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		ND	(2,000)	ND	(37)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phase III – April 1997^d																
166GP064	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP065	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 2-2
 SWMU 166 Geoprobe Locations -- Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample Location	Sample Depth	PCE	TCE	1,1-DCE	1,2-DCE	VC	MEK	1,1,2-TCA	CF	STY	MC	BEN	EB	TOL	XYL (Total)	CDS
166GP066	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	1,343	NA	ND	681	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	2,492	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP067	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	242	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA ND	NA
		ND	(370)	ND	(5)	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
D	NA	294	NA	ND	954	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
166GP068	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	2.4	NA	ND	375	NA	NA	NA	NA	NA	NA	NA	NA	NA ND	NA
		ND	(3)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
D	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
166GP069	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	5	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA ND	NA
ND		(6)	ND	(19)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
166GP071	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 2-2
 SWMU 166 Geoprobe Locations -- Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample Location	Sample Depth	PCE	TCE	1,1-DCE	1,2-DCE	VC	MEK	1,1,2-TCA	CF	STY	MC	BEN	EB	TOL	XYL (Total)	CDS
166GP072	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP073	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
166GP074	S	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	I	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	D	NA	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

1,2-DCE	1,2-dichloroethane	MEK	2-butanone
1,1-DCE	1,1-dichloroethene	NA	compound not included in onsite analysis
1,1,2-TCA	1,1,2-trichloroethane	ND	compound not detected
BEN	benzene	PCE	perchloroethylene
CDS	carbon disulfide	S	shallow (8-11 feet bgs)
CF	chloroform	STY	styrene
D	deep (33 to 36 feet bgs)	TCE	trichloroethene
EB	ethylbenzene	TOL	toluene
I	intermediate (22-26 feet bgs)	VC	vinyl chloride
MC	methylene chloride		

Compounds detected in micrograms per liter ($\mu\text{g/L}$).

^a November 1996 (Only shallow groundwater screening samples were collected at locations 166GP001 through 166GP031.).

^b Samples from locations 166GP032 through 166GP036 were sent to an offsite laboratory for analysis.

^c Samples from 166GP037 through 166GP063 were analyzed on site for TCE, 1,2-DCE, and vinyl chloride. A portion was submitted to an offsite laboratory for confirmatory analysis. The offsite analytical results are reported in parentheses.

^d Samples from 166GP064 through 166GP074 were analyzed on site for TCE, 1,2-DCE, and vinyl chloride. A portion was submitted to an offsite laboratory for confirmatory analysis. The offsite analytical results are reported in parentheses.

TABLE 2-3
 SWMU 166 Vertical Profiler--Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Identification	Depth (ft bgs)	Elevation (ft msl)	PCE	TCE	C-1,2-DCE	1,2-DCE (Total)	BEN	TOL	EB	XYL Total
Ground Elevation		41.2								
166VP00105	5	36.2	ND	ND	ND	ND	ND	ND	ND	ND
166VP00108	8	33.2	ND	ND	ND	ND	ND	ND	ND	ND
166VP00111	11	30.2	ND	ND	ND	ND	ND	ND	ND	ND
166VP00114	14	27.2	ND	ND	ND	ND	ND	ND	ND	ND
166VP00117	17	24.2	ND	ND	ND	ND	ND	ND	ND	ND
166VP00120	20	21.2	ND	ND	ND	ND	ND	ND	ND	ND
166VP00123	23	18.2	ND	ND	ND	ND	ND	ND	ND	ND
166VP00126	26	15.2	ND	ND	ND	ND	ND	ND	ND	ND
166VP00129	29	12.2	ND	7.3	ND	ND	ND	ND	ND	ND
166VP00132	32	9.2	ND	ND	ND	ND	ND	ND	ND	ND
Ground Elevation		40.5								
166VP00205	5	35.5	ND	ND	ND	ND	ND	ND	ND	ND
166VP00208	8	32.5	ND	ND	ND	ND	ND	ND	ND	ND
166VP00211	11	29.5	ND	ND	ND	ND	ND	ND	ND	ND
166VP00214	14	26.5	ND	ND	ND	ND	ND	ND	ND	ND
166VP00217	17	23.5	ND	ND	ND	ND	ND	ND	ND	ND
166VP00220	20	20.5	ND	ND	ND	ND	ND	ND	ND	ND
166VP00223	23	17.5	ND	1	ND	ND	ND	ND	ND	ND
166VP00226	26	14.5	ND	5.2	ND	ND	ND	ND	ND	ND
166VP00230	30	10.5	ND	ND	ND	ND	ND	ND	ND	ND

TABLE 2-3
 SWMU 166 Vertical Profiler--Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Identification	Depth (ft bgs)	Elevation (ft msl)	PCE	TCE	C-1,2-DCE	1,2-DCE (Total)	BEN	TOL	EB	XYL Total
Ground Elevation		39.9								
166VP00305	5	34.9	ND	ND	ND	ND	ND	ND	ND	ND
166VP00308	8	31.9	ND	ND	ND	ND	ND	ND	ND	ND
166VP00311	11	28.9	ND	ND	ND	ND	ND	ND	ND	ND
166VP00314	14	25.9	ND	ND	ND	ND	ND	ND	ND	ND
166VP00317	17	22.9	ND	ND	ND	ND	ND	ND	ND	ND
166VP00320	20	19.9	ND	ND	ND	ND	ND	ND	ND	ND
166VP00323	23	16.9	ND	ND	ND	ND	ND	ND	ND	ND
166VP00326	26	13.9	ND	9.2	ND	ND	ND	ND	ND	ND
166VP00329	29	10.9	ND	1.6	ND	ND	ND	ND	ND	ND
Ground Elevation		39.8								
166VP00405	5	34.8	ND	ND	ND	ND	ND	ND	ND	ND
166VP00408	8	31.8	ND	ND	ND	ND	ND	ND	ND	ND
166VP00411	11	28.8	ND	ND	ND	ND	ND	ND	ND	ND
166VP00414	14	25.8	ND	ND	ND	ND	ND	ND	ND	ND
166VP00417	17	22.8	ND	ND	ND	ND	ND	ND	ND	ND
166VP00420	20	19.8	ND	ND	ND	ND	ND	ND	ND	ND
166VP00423	23	16.8	ND	ND	ND	ND	ND	ND	ND	ND
166VP00426	26	13.8	ND	7.6	ND	ND	ND	ND	ND	ND
166VP00429	29	10.8	ND	ND	ND	ND	ND	ND	ND	ND
166VP00432	32	7.8	ND	ND	ND	ND	ND	ND	ND	ND

TABLE 2-3
 SWMU 166 Vertical Profiler--Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Identification	Depth (ft bgs)	Elevation (ft msl)	PCE	TCE	C-1,2-DCE	1,2-DCE (Total)	BEN	TOL	EB	XYL Total
Ground Elevation		39.6								
166VP00505	5	34.6	ND	ND	ND	ND	ND	ND	ND	ND
166VP00508	8	31.6	ND	ND	ND	ND	ND	ND	ND	ND
166VP00511	11	28.6	ND	ND	ND	ND	ND	ND	ND	ND
166VP00514	14	25.6	ND	ND	ND	ND	ND	ND	ND	ND
166VP00517	17	22.6	ND	ND	ND	ND	ND	ND	ND	ND
166VP00520	20	19.6	ND	ND	ND	ND	ND	ND	ND	ND
166VP00523	23	16.6	ND	3.5	ND	ND	ND	ND	ND	ND
166VP00526	26	13.6	ND	ND	ND	ND	ND	ND	ND	ND
166VP00529	29	10.6	ND	ND	ND	ND	ND	ND	ND	ND
166VP00532	32	7.6	ND	ND	ND	ND	ND	ND	ND	ND

1,2-DCE (total) 1,2-dichloroethene (total)
 BEN benzene
 C-1,2-DCE CIS-1,2-dichloroethene
 EB ethylbenzene
 ft bgs feet below ground surface
 ft msl feet mean sea level
 PCE perchloroethylene
 TCE trichloroethylene
 TOL toluene
 XYL (total) xylene (total)

Compounds detected in micrograms per liter ($\mu\text{g/L}$).

TABLE 2-4
 Grid Vertical Profiler - Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample ID	Depth (ft bgs)	Elevation (ft msl)	Acetone	Bromodichloromethane	Benzene	Toluene	Chloromethane	1,1-Dichloroethene	1,1-Dichloroethene (Total)	Methylethyl Ketone	Methylene Chloride	Perchloroethene	Trichloroethene	Chloroform	Vinyl Chloride	Xylene (Total)
Ground Elevation																
39.5																
GDKGP00207	7	32.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00210	10	29.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00213	13	26.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00216	16	23.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00219	19	20.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00222	22	17.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00225	25	14.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00228	28	11.5	5 U	5 U	5 U	5 U	5 U	5 U	4 J	5 U	5 U	5 U	4 J	5 U	5 U	5 U
Ground Elevation																
38.8																
GDKGP00310	10	28.8	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00313	13	25.8	5 U	5 U	5 U	5 U	5 U	5 U	44	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00316	16	22.8	5 U	5 U	5 U	5 U	5 U	5 U	38	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00319	19	19.8	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00322	22	16.8	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00325	25	13.8	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00331	31	7.8	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ground Elevation																
38.3																
GDKGP00407	7	31.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00410	10	28.3	5 U	5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00413	13	25.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00416	16	22.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00419	19	19.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00422	22	16.3	5 U	5 U	5 U	5 U	5 U	5 U	3 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00425	25	13.3	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00428	28	10.3	5 U	5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00431	31	7.3	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00434	34	4.3	5 U	5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00437	37	1.3	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5 U	5 U	8	5 U	5 U	5 U
GDKGP00440	40	(1.70)	5 U	5 U	1 J	5 U	5 U	5 U	2 J	5 U	5 U	1 J	27	5 U	5 U	5 U
Ground Elevation																
38.3																
GDKGP00507	7	31.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00510	10	28.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00513	13	25.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00516	16	22.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00519	19	19.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00522	22	16.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00525	25	13.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00528	28	10.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00531	31	7.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00534	34	4.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25	5 U	5 U	5 U
GDKGP00537	37	1.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	35	5 U	5 U	5 U
GDKGP00540	40	(1.70)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ground Elevation																
38.2																
GDKGP00607	7	31.2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00610	10	28.2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00613	13	25.2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00616	16	22.2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00619	19	19.2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00622	22	16.2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00625	25	13.2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00628	28	10.2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00631	31	7.2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

TABLE 2-4
 Grid Vertical Profiler - Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample ID	Depth (ft bgs)	Elevation (ft msl)	Acetone	Bromodichloromethane	Benzene	Toluene	Chloromethane	1,1-Dichloroethene	1,1-Dichloroethene (Total)	Methylethyl Ketone	Methylene Chloride	Perchloroethene	Trichloroethene	Chloroform	Vinyl Chloride	Xylene (Total)
GDKGP00634	34	4.2	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	7	5 U	5 U	5 U
GDKGP00637	37	1.2	5 U	5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00540	40	(1.80)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ground Elevation		39.6														
GDKGP00707	7	32.6	5 U	5 U	5 U	5 U	5 U	5 U	4 J	5 U	4 J	2 J	2 J	5 U	5 U	5 U
GDKGP00710	10	29.6	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5	1 J	2 J	5 U	5 U	5 U
GDKGP00713	13	26.6	5 U	5 U	5 U	5 U	5 U	5 U	6	5 U	1 J	4 J	4 J	5 U	5 U	5 U
GDKGP00716	16	23.6	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	2 J	5 U	5 U	5 U	5 U	5 U
GDKGP00719	19	20.6	5 U	5 U	5 U	5 U	5 U	5 U	5	5 U	5	1 J	2 J	5 U	5 U	5 U
GDKGP00722	22	17.6	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	4 J	5 U	4 J	5 U	5 U	5 U
GDKGP00725	25	14.6	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	4 J	2 J	5	5 U	5 U	5 U
GDKGP00728	28	11.6	5 U	5 U	5 U	5 U	5 U	5 U	7	5 U	5 U	5 U	5	5 U	5 U	5 U
Ground Elevation		39.5														
GDKGP00807	7	32.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00810	10	29.5	5 U	5 U	5 U	5 U	5 U	5 U	4 J	5 U	4 J	1 J	3 J	5 U	5 U	5 U
GDKGP00813	13	26.5	5 U	5 U	3 J	5 U	5 U	5 U	4 J	5 U	3 J	1 J	2 J	5 U	5 U	5
GDKGP00816	16	23.5	5 U	7	5 U	5 U	5 U	5 U	3 J	5 U	5	2 J	2 J	5	5 U	5 U
GDKGP00819	19	20.5	5 U	5 U	5 U	5 U	5 U	5 U	4 J	5 U	5	2 J	1 J	5 U	5 U	5 U
GDKGP00822	22	17.5	5 U	5 U	5 U	5 U	5 U	5 U	5	5 U	4 J	1 J	3 J	5 U	5 U	5 U
GDKGP00825	25	14.5	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5	2 J	3 J	5 U	5 U	5 U
GDKGP00828	28	11.5	5 U	5 U	5 U	5 U	5 U	5 U	3 J	5 U	4 J	3 J	4 J	5 U	5 U	5 U
GDKGP00834	34	5.5	5 U	5 U	5 U	5 U	5 U	5 U	4 J	5 U	5	2 J	10	5 U	5 U	5 U
GDKGP00837	37	2.5	5 U	8	8	3 J	5 U	5 U	3 J	5 U	4 J	2 J	2 J	10	5 U	2 J
Ground Elevation		40.1														
GDKGP00904	4	36.1	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00908	8	32.1	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00912	12	28.1	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00916	16	24.1	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00920	20	20.1	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00924	24	16.1	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00928	28	12.1	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	8	5 U	5 U	5 U
GDKGP00932	32	8.1	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25	5 U	5 U	5 U
GDKGP00936	36	4.1	5 U	5 U	3 J	5 U	5 U	5 U	2 J	5 U	5 U	5 U	14	5 U	5 U	5 U
GDKGP00940	40	0.1	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP00944	44	(3.90)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ground Elevation		39.1														
GDKGP01007	7	32.10	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01010	10	29.10	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01013	13	26.10	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01016	16	23.10	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01019	19	20.10	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01022	22	17.10	3 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01025	25	14.10	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01028	28	11.10	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01031	31	8.10	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01034	34	5.10	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01037	37	2.10	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01040	40	(0.90)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ground Elevation		40.6														
GDKGP01107	7	33.6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01110	10	30.6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01113	13	27.6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

TABLE 2-4
 Grid Vertical Profiler - Volatile Organic Compound Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Sample ID	Depth (ft bgs)	Elevation (ft msl)	Acetone	Bromodichloromethane	Benzene	Toluene	Chloromethane	1,1-Dichloroethene	1,1-Dichloroethene (Total)	Methylethyl Ketone	Methylene Chloride	Perchloroethene	Trichloroethene	Chloroform	Vinyl Chloride	Xylene (Total)
GDKGP01116	16	24.6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01119	19	21.6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01122	22	18.6	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	4 J	5 U	5 U	5 U	5 U	5 U
GDKGP01125	25	15.6	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	4 J	5 U	5 U	5 U	5 U	5 U
GDKGP01128	28	12.6	5 U	5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	2 J	12	5 U	5 U	5 U
GDKGP01131	31	9.6	5 U	5 U	5 U	5 U	5 U	5 U	4 J	5 U	5 U	2 J	62	5 U	5 U	5 U
GDKGP01134	34	6.6	5 U	5 U	8	5 U	5 U	5 U	27	5 U	5 U	1 J	150	5 U	5 U	5 U
GDKGP01137	37	3.6	5 U	5 U	4 J	5 U	5 U	5 U	20	5 U	5 U	1 J	48	5 U	5 U	5 U
GDKGP01140	40	0.6	49	10	5 U	5 U	5 U	5 U	4 J	5 U	5 U	1 J	7	8	5 U	5 U
Ground Elevation		39.7														
GDKGP01207	7	32.7	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5 U	1 J	2 J	5 U	5 U	5 U
GDKGP01210	10	29.7	5 U	5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	1 J	1 J	5 U	5 U	5 U
GDKGP01213	13	26.7	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	5 U	5 U
GDKGP01216	16	23.7	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5	5 U	5 U	5 U
GDKGP01219	19	20.7	5 U	5 U	5 U	5 U	5 U	5 U	3 J	5 U	5 U	5 U	5	5 U	5 U	5 U
GDKGP01222	22	17.7	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5 U	1 J	2 J	5 U	5 U	5 U
GDKGP01225	25	14.7	5 U	5 U	5 U	5 U	5 U	5 U	3 J	5 U	5 U	2 J	1 J	5 U	5 U	5 U
GDKGP01228	28	11.7	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5 U	1 J	5 U	5 U	5 U	5 U
GDKGP01231	31	6.7	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01234	34	5.7	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5 U	5 U	3 J	5 U	5 U	5 U
GDKGP01237	37	2.7	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01240	40	(0.30)	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ground Elevation		40.5														
GDKGP01307	7	33.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01310	10	30.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01313	13	27.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01316	16	24.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01319	19	21.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01322	22	18.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
GDKGP01325	25	15.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	3 J	5 U	5 U	5 U
GDKGP01328	28	12.5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	22	1 J	5 U	5 U	5 U

Compound concentrations in micrograms per liter (mg/L).

- J Indicates that the compound was detected and the concentration is an estimated value.
- U Indicates that the compound was not detected.
- UJ Indicates that the compound was not detected and the value provided is estimated.

TABLE 2-5
 SWMU 161 Monitoring Well 161GW001--Groundwater Analytical Results
 Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	January 1997	April 1997	July 1997	October 1997	January 1999	December 1999	Tap Water RBC/MCL	Shallow Background
Dioxin Compounds (pg/L)									
TCDD TEQs	161GW001	0.0069	NA	NA	NA	ND	ND	4.3/NL	NA
OCDD	161GW001	6.9	NA	NA	NA	ND	ND	450/NL	NA
Inorganics (µg/L)									
Aluminum	161GW001	479	153 U	381	545 J	NT	NT	3,700/50*	471
Barium	161GW001	16.4 J	17.5 J	14.6 J	13.2 J	NT	NT	260/2,000	31.2
Calcium	161GW001	51,100	30,800	48,900	45,600	NT	NT	NL/NL	NA
Copper	161GW001	1.1 U	4.3 U	1 UJ	0.89 U	NT	NT	150/1,000*	2.81
Iron	161GW001	150	285 J	54.9 J	64.2 J	NT	NT	1,100/300*	235
Lead	161GW001	0.89 U	1.3 U	1.7 U	1.9 U	NT	NT	NL/15	1.94
Magnesium	161GW001	822 J	1,730 J	820 J	677 J	NT	NT	NL/NL	NA
Manganese	161GW001	6.8 J	8.5 U	1.1 J	2.2 U	NT	NT	73/50*	9.33
Potassium	161GW001	1,040 J	661 U	438 J	600 J	NT	NT	NL/NL	NA
Silver	161GW001	1.8 J	3.2 U	1.8 U	1.7 U	NT	NT	18/100*	NA
Sodium	161GW001	2,190 J	7,500 U	3,300 J	2,500 U	NT	NT	NL/NL	NA
Zinc	161GW001	4.6 U	60.2 UJ	27.3	41.9 UJ	NT	NT	1,100/5,000*	NA

* secondary MCL
 µg/L micrograms per liter
 J Indicates that the compound was not detected and the concentration is an estimated value.
 pg/L picograms per liter
 NA not available (Insufficient number of detections in background samples to calculate background concentration.)

ND not detected
 NL not listed (No primary or secondary MCL has been published by EPA for the parameter.)
 OCDD octachlorodibenzo-p-dioxin
 TCDD TEQs tetrachlorodibenzo-p-dioxin toxicity equivalents
 U Indicates that the compound was not detected.
 UJ Indicates that the compound was not detected and the value provided is estimated.

TABLE 2-5A
SWMU 161
 Surface and Subsurface Soil Analytical Results – Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC (THQ=0.1)	Surface Background	Subsurface Concentration	Site Specific Soil-to-Groundwater SSL	Subsurface Background
Volatile Organic Compounds (µg/kg)							
1,2-Dichloroethane	161SB004	5U	7,000	NA	4.0J	6.5	NA
Acetone	161SB002	11U	780,000	NA	8.0J	3,800	NA
	161SB006	11U			7.0J		
2-Hexanone	161SB013	5.6J	310,000	NA	27U	2,110	NA
Semivolatile Organic Compounds (µg/kg)							
4,4-DDE	161SB005	4.3	1,900	NA	3.48U	16,500	NA
	161SB006	6.8			3.86U		
	161SB008	5.5			3.58U		
4,4-DDT	161SB006	10.8J	1,900	NA	3.86U	9,700	NA
	161SB008	13.5			3.58U		
Dioxin Compounds (ng/kg)							
TCDD TEQ	161SB002	NT	4.3	NA	1.06J	NA	NA
	161SB012	2.59J			13.06J		
	161SB013	1.90J			1.67J		
2378-TCDD	161SB012	0.82J	4.3	NA	6.52U	1,200	NA
11234678-HpCDD	161SB002	NT	430	NA	4.97J	101,000	NA
	161SB012	8.59			1.694U		
	161SB013	9.57			0.396U		
OOCDD	161SB002	NT	4,300	NA	414J	101,000	NA
	161SB012	284.74			68.94		
	161SB013	360.70			27.40		
OCDF	161SB012	9.75	4,300	NA	0.51U	47,000	NA
	161SB013	8.80			0.422U		

TABLE 2-5A
SWMU 161
 Surface and Subsurface Soil Analytical Results – Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC (THQ=0.1)	Surface Background	Subsurface Concentration	Site Specific Soil-to-Groundwater SSL	Subsurface Background
TPH-DRO (mg/kg)							
Diesel	161SB005	5.35U	100a	NA	8.3	NL	NA
	161SB006	11.8			11		
	161SB007	314			5.33U		
Inorganics (mg/kg)							
Aluminum (Al)	161SB001	6,220	7,800	11,200	2,800	161,000	10,500
	161SB002	6,000			4,020		
	161SB003	5,450			5,470		
	161SB004	6,630			4,550		
	161SB005	5,970			2,750		
	161SB006	5,130			4,680		
	161SB007	6,460			4,050		
	161SB008	5,840			4,940		
	161SB08T	6,020			6,470		
Arsenic (As)	161SB001	0.85J	0.43	3.0	0.4U	159	1.98
	161SB002	0.69J			0.6J		
	161SB003	0.70J			0.5J		
	161SB004	1.0J			0.4U		
	161SB005	0.94J			0.4U		
	161SB006	1.1J			0.43U		
	161SB007	1.1J			0.41J		
	161SB008	1.9J			0.73J		
	161SB08T	2.5			2.2		
Barium (Ba)	161SB001	10.5J	550	25.6	1.8J	8,720	6.83
	161SB002	8.0J			2.2J		
	161SB003	5.5J			2.6J		
	161SB004	9.2J			3.4J		
	161SB005	13.7J			1.8J		
	161SB006	16.8J			4.5J		
	161SB007	7.2J			2.5J		
	161SB008	9.1J			7.5J		
	161SB08T	8.9			9.9		

TABLE 2-5A

SWMU 161

Surface and Subsurface Soil Analytical Results – Naval Annex Zone K

Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC (THQ=0.1)	Surface Background	Subsurface Concentration	Site Specific Soil-to-Groundwater SSL	Subsurface Background
Beryllium (Be)	161SB001	0.04J	16	0.17	0.02UJ	16.1b	0.12
	161SB004	0.06J			0.02UJ		
	161SB005	0.07J			0.02UJ		
	161SB006	0.03J			0.02UJ		
	161SB007	0.04J			0.02UJ		
	161SB008	0.07J			0.03J		
	161SB08T	0.03J			0.01UJ		
Cadmium (Cd)	161SB008	0.11	7.8	0.13	0.04U	1.92b	**
	161SB08T	0.14J			0.04UJ		
Inorganics (mg/kg)							
Calcium (Ca)	161SB001	2,490J	NL	NA	64.8J	NA	NA
	161SB002	7,770J			2,030J		
	161SB003	2,860J			2,620J		
	161SB004	9,390J			772J		
	161SB005	31,000J			755J		
	161SB006	2,990J			384J		
	161SB007	9,850J			614J		
	161SB008	67,400J			22,700J		
	161SB08T	88,100J			31,000J		
Chromium (Cr)	161SB001	4.7J	23c	8.4	3.7J	9.8b,c	8.76
	161SB002	4.0J			3.2J		
	161SB003	4.3J			3.7J		
	161SB004	5.0J			3.6J		
	161SB005	4.5J			3.1J		
	161SB006	3.5J			4.4J		
	161SB007	4.8J			4.0J		
	161SB008	5.6J			4.7J		
	161SB08T	7.2			6.8		
Cobalt (Co)	161SB001	1.5J	470	0.34	0.42J	8,250	0.62
	161SB002	0.12UJ			0.17J		
	161SB003	0.13UJ			0.25J		
	161SB004	0.18J			0.40J		

TABLE 2-5A

SWMU 161

Surface and Subsurface Soil Analytical Results – Naval Annex Zone K

Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC (THQ=0.1)	Surface Background	Subsurface Concentration	Site Specific Soil-to-Groundwater SSL	Subsurface Background
Copper (Cu)	161SB005	0.17J			0.13UJ		
	161SB006	0.13UJ			0.22J		
	161SB007	0.13UJ			0.42J		
	161SB008	0.51J			0.28J		
	161SB08T	1.0J			0.59J		
	161SB001	0.94J	310	3.86	0.28J	7,720	0.34
	161SB002	0.27J			0.33J		
	161SB003	0.17UJ			0.35J		
	161SB004	0.50J			0.23J		
	161SB005	0.92J			0.56J		
	161SB006	1.3J			0.18UJ		
	161SB007	0.68J			0.27J		
	161SB008	1.5J			0.88J		
	161SB08T	1.7J			5.5		
Inorganics (mg/kg)							
Iron (Fe)	161SB001	2,830J	2,300	7,060	467J	58,800	5,130
	161SB002	2,650J			666J		
	161SB003	2,470J			739J		
	161SB004	3,090J			1,480J		
	161SB005	2,890J			421J		
	161SB006	2,960J			1,610J		
	161SB007	3,250J			828J		
	161SB008	2,770J			1,710J		
	161SB08T	2,950			2,550		
Lead (Pb)	161SB001	5.8	400d	39.6	2.9	59.8	6.43
	161SB002	4.1			2.0		
	161SB003	2.6			2.3		
	161SB004	6.2			2.5		
	161SB005	14.1			2.3		
	161SB006	19.5			3.0		
	161SB007	4.0			2.5		
	161SB008	12.3			10		
	161SB08T	22.9			22.3		

TABLE 2-5A

SWMU 161

Surface and Subsurface Soil Analytical Results – Naval Annex Zone K

Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC (THQ=0.1)	Surface Background	Subsurface Concentration	Site Specific Soil-to-Groundwater SSL	Subsurface Background
Magnesium (Mg)	161SB001	196J	NL	NA	23.5J	NA	NA
	161SB002	219J			62.5J		
	161SB003	111J			66.1J		
	161SB004	309J			89.3J		
	161SB005	517J			67.2J		
	161SB006	171J			95.9J		
	161SB007	304J			68.5J		
	161SB008	1,220			519J		
	161SB08T	1,540			629		
Manganese (Mn)	161SB001	10.1J	1,100	26.4	3.8J	99,300	5.93
	161SB002	10.6J			3.2J		
	161SB003	5.6J			3.5J		
	161SB004	14.0J			3.8J		
	161SB005	29.5J			3.3J		
	161SB006	7.4J			5.7J		
	161SB007	12.2J			3.7J		
	161SB008	58.4J			25.6J		
	161SB08T	78.2			31.9		
Mercury (Hg)	161SB003	0.15	2.3	NA	0.05U	19.8	**
	161SB08T	0.03			0.04		
Inorganics (mg/kg)							
Nickel (Ni)	161SB001	2.7J	160	1.7	0.81J	660	2.64
	161SB002	1.7J			1.4J		
	161SB003	1.3J			2.5J		
	161SB004	2.2J			2.7J		
	161SB005	2.6J			0.89J		
	161SB006	1.4J			2.3J		
	161SB007	2.0J			2.2J		
	161SB008	3.6J			2.4J		
	161SB08T	4.3J			3.1J		
Potassium (K)	161SB001	95.8J	NL	NA	17.2J	NA	NA
	161SB002	60.0J			23.4J		

TABLE 2-5A

SWMU 161

Surface and Subsurface Soil Analytical Results – Naval Annex Zone K

Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC (THQ=0.1)	Surface Background	Subsurface Concentration	Site Specific Soil-to-Groundwater SSL	Subsurface Background
	161SB003	33.3J			29.6J		
	161SB004	73.9J			49.6J		
	161SB005	124J			31.3J		
	161SB006	43.4J			39.7J		
	161SB007	77.1J			42.1J		
	161SB008	246J			100J		
	161SB08T	305			139		
Selenium (Se)	161SB006	0.44J	39	0.84	0.43UJ	1.33b	0.52
Silver (Ag)	161SB004	0.25J	39	0.44	0.19UJ	7.8b	0.42
Sodium (Na)	161SB001	27.5J	NL	NA	12.7J	NA	NA
	161SB002	27.9J			13.3J		
	161SB003	25.5J			25.2J		
	161SB004	27.3J			22.3J		
	161SB005	29.4J			15.1J		
	161SB006	18.2J			27.1J		
	161SB007	29.1J			20.6J		
	161SB008	58.5J			36.0J		
	161SB08T	69.2			36.7J		
Vanadium (V)	161SB001	7.7J	55	15.8	2.9J	1,130	12.2
	161SB002	7.0J			2.9J		
	161SB003	6.6J			3.6J		
	161SB004	8.4J			6.0J		
	161SB005	7.7J			2.2J		
	161SB006	7.5J			7.6J		
	161SB007	8.0J			4.3J		
	161SB008	7.7J			6.1J		
	161SB08T	8.2			7.7		
Zinc (Zn)	161SB001	5	2,300	14.8	1.3U	49,200	**
	161SB08T	47.9J			30.3J		

Notes:

* Residential RBCs (THQ=0.1) were used as reference concentrations for upper interval samples (i.e., surface soil). Site specific soil-to-groundwater SSLs derived from soil/water partition equation for organics and SPLP leach ratios for inorganics, except as noted, were used as reference concentrations for upper and lower interval samples.

** Lack of detected concentrations prevented the evaluation of background concentrations.

^a Charleston Naval Complex project team screening level

^b Partition equation SSL (Constituents analyzed using the SPLP were not detected above the laboratory method detection limit).

^c The screening value for hexavalent chromium was used as a conservative approach.

^d A screening level of 400 mg/kg has been set for lead based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities* (USEPA, 1994).

NT = Collected soil sample was not analyzed for the contaminant

NL = Not listed

NA = Not applicable/not available

µg/kg = Micrograms per kilogram

mg/kg = Milligrams per kilogram

ng/kg = Nanograms per kilogram

For surface concentrations, bolded values exceed both RBC and the surface background (when available for inorganics); italicized values exceed the site specific SSL and surface background. For subsurface concentrations, italicized values exceed both the SSL and subsurface background (when available for inorganics).

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

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 process, and to consider the numeric value as estimated.

U - Indicates the compound was not detected above the laboratory method detection limit.

UJ - Indicates the compound was not detected above the laboratory method detection limit and the concentration is estimated.

TABLE 2-6
 SWMU 163
 Surface and Subsurface Soil Analytical Results--Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC ^a (THQ=0.1)	Surface Background	Subsurface Concentration	Site-Specific Soil-to-Groundwater SSL ^a	Subsurface Background
Volatile Organic Compounds (µg/kg)							
Acetone	163SB010	2,700 J	780,000	NA	6 U	1,600	NA
Carbon Disulfide	163SB010	1.0 J	780,000	NA	6 U	4,800	NA
Tetrachloroethene	163SB001	14	12,000	NA	6.0	13.3	NA
	163SB002	16			6 U		
	163SB003	990			6 U		
	163SB004	28 J			6 U		
Trichloroethene	163SB002	5.0 J	58,000	NA	6 U	13.7	NA
	163SB003	22			6 U		
	163SB004	6.0			6 U		
Semivolatile Organic Compounds (µg/kg)							
BEQs	163SB001	113	87	123	ND	NA	123
	163SB006	15.0			ND		
	163SB007	21.8			ND		
	163SB008	390			312		
	163SB009	63.7			ND		
	163SB010	21.2			ND		
	163SB012	473			ND		
	163SB019	13,950			ND		
	Benzo(a)anthracene	163SB001			280 J		
163SB008		160 J	400 U				
163SB009		39 J	400 U				
163SB012		330 J	390 U				
163SB019		12,000 J	360 U				
Benzo(a)pyrene	163SB001	83 J	87	NA	380 U	2,730	NA
	163SB008	180 J			400 U		
	163SB009	37 J			400 U		
	163SB012	320 J			390 U		
	163SB019	9,300			360 U		

TABLE 2-6
SWMU 163
 Surface and Subsurface Soil Analytical Results--Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC ^a (THQ=0.1)	Surface Background	Subsurface Concentration	Site-Specific Soil-to-Groundwater SSL ^a	Subsurface Background					
Benzo(b)fluoranthene	163SB007	57 J	870	NA	380 U	1,980	NA					
	163SB008	190 J			400 U							
	163SB009	62 J			400 U							
	163SB010	52 J			360 U							
	163SB012	350 J			390 U							
	163SB019	7,700			360 U							
Benzo(k)fluoranthene	163SB001	180 J	8,700	NA	380 U	19,800	NA					
	163SB008	140 J			400 U							
	163SB009	56 J			400 U							
	163SB012	270 J			390 U							
	163SB019	8,000			360 U							
	Chrysene	163SB001			400 J			87,000	NA	380 UJ	64,000	NA
163SB007		52 J	380 U									
163SB008		180 J	400 U									
163SB009		65 J	400 U									
163SB010		43 J	360 U									
163SB012		400	390 U									
163SB019		10,000	360 U									
Dibenz(a,h)anthracene		163SB008	150 J	87	NA	400 U	611			NA		
		163SB012	62 J			390 U						
	163SB019	2200 J	360 U									
Indeno(1,2,3-cd)pyrene	163SB006	150 J	870	NA	370 U	5,580	NA					
	163SB007	160 J			380 U							
	163SB008	230 J			400 U							
	163SB009	160 J			360 U							
	163SB010	160 J			360 U							
	163SB012	200 J			390 U							
	163SB019	3,900			360 U							
	Acenaphthene	163SB008			46 J			470,000	NA	400 U	210,000	NA
		163SB012			33 J					390 U		
163SB019		6,500	360 U									
Acenaphthylene	163SB001	88 J	160,000	NA	380 U	30,600	NA					

TABLE 2-6
 SWMU 163
 Surface and Subsurface Soil Analytical Results--Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC ^a (THQ=0.1)	Surface Background	Subsurface Concentration	Site-Specific Soil-to-Groundwater SSL ^a	Subsurface Background
Anthracene	163SB008	65 J	2,300,000	NA	400 U	4,353,00	NA
	163SB012	66 J			390 U		
	163SB019	9,900			360 U		
bis(2-Ethylhexyl)phthalate(BEHP)	163SB007	41 J	46,000	NA	380 U	1,214,000	NA
	163SB008	56 J			400 U		
	163SB009	440			400 U		
	163SB019	3,900 U			30 J		
Butylbenzylphthalate	163SB009	160 J	1,600,000	NA	400 U	5,628,000	NA
Dibenzofuran	163SB007	54 J	31,000	NA	380 U	4,500	NA
	163SB008	380 U			400 U		
	163SB019	4,100			360 U		
Di-n-butylphthalate	163SB009	39 J	780,000	NA	400 U	1,682,000	NA
Fluoranthene	163SB001	600 J	310,000	NA	380 U	2,151,000	NA
	163SB007	53 J			380 U		
	163SB008	330 J			400 UJ		
	163SB009	92 J			400 U		
	163SB010	57 J			360 U		
	163SB012	590			390 U		
	163SB019	27,000			360 U		
Fluorene	163SB008	42 J	310,000	NA	400 U	278,000	NA
	163SB019	5,300			360 U		
2-Methylnaphthalene	163SB007	280 J	160,000	NA	380 U	12,100	NA
	163SB019	1,500 J			360 U		
Naphthalene	163SB007	140 J	160,000	NA	380 U	19,900	NA
	163SB019	2,800 J			360 U		
N-Nitroso-di-n-propylamine	163SB002	370 U	91	NA	330 J	0.009	NA
	163SB003	380 U			620		
Phenanthrene	163SB007	150 J	160,000	NA	380 U	443,000	NA
	163SB008	210 J			400 UJ		
	163SB012	290 J			390 U		
	163SB019	29,000			360 U		

TABLE 2-6
 SWMU 163
 Surface and Subsurface Soil Analytical Results--Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC ^a (THQ=0.1)	Surface Background	Subsurface Concentration	Site-Specific Soil-to-Groundwater SSL ^a	Subsurface Background																																																																																																																												
Phenol	163SB004	120 J	4,700,000	NA	300 J	17,700	NA																																																																																																																												
	163SB005	240 J			260 J			Pyrene	163SB001	400	230,000	NA	380 U	1,548,000	NA	163SB007	54 J	380 U	163SB008	250 J	400 UJ	163SB009	93 J	400 U	163SB010	58 J	360 U	163SB012	440	390 U	163SB019	19,000	360 U	Pesticides/PCBs (µg/kg)								4,4-DDD	163SB002	8.2	2,700	NA	3.88 U	4,700	NA	163SB004	6.6	3.74 U	4,4-DDE	163SB001	5.1	1,900	NA	3.83 U	15,000	NA	163SB002	53	3.88 U	163SB004	7.0	3.74 U	4,4-DDT	163SB001	9.1	1,900	NA	3.83 U	8,800	NA	163SB002	25.3	3.88 U	163SB004	55.3	3.74 U	Dioxin Compounds (ng/kg)								TCDD TEQ	163SB005	0.07	4.3	NA	NT	NA	NA	1234678-HpCDD	163SB005	1.76	430	NA	NT	92,000	NA	1234678-HpCDF	163SB005	0.58	430	NA	NT	46,000	NA	234678-HxCDF	163SB005	0.24	43	NA	NT	183,000	NA	OCDD	163SB005	19.8	4,300	NA	NT	92,000	NA	OCDF	163SB005	0.69
Pyrene	163SB001	400	230,000	NA	380 U	1,548,000	NA																																																																																																																												
	163SB007	54 J			380 U																																																																																																																														
	163SB008	250 J			400 UJ																																																																																																																														
	163SB009	93 J			400 U																																																																																																																														
	163SB010	58 J			360 U																																																																																																																														
	163SB012	440			390 U																																																																																																																														
	163SB019	19,000			360 U																																																																																																																														
Pesticides/PCBs (µg/kg)																																																																																																																																			
4,4-DDD	163SB002	8.2	2,700	NA	3.88 U	4,700	NA																																																																																																																												
	163SB004	6.6			3.74 U																																																																																																																														
4,4-DDE	163SB001	5.1	1,900	NA	3.83 U	15,000	NA																																																																																																																												
	163SB002	53			3.88 U																																																																																																																														
	163SB004	7.0			3.74 U																																																																																																																														
4,4-DDT	163SB001	9.1	1,900	NA	3.83 U	8,800	NA																																																																																																																												
	163SB002	25.3			3.88 U																																																																																																																														
	163SB004	55.3			3.74 U																																																																																																																														
Dioxin Compounds (ng/kg)																																																																																																																																			
TCDD TEQ	163SB005	0.07	4.3	NA	NT	NA	NA																																																																																																																												
1234678-HpCDD	163SB005	1.76	430	NA	NT	92,000	NA																																																																																																																												
1234678-HpCDF	163SB005	0.58	430	NA	NT	46,000	NA																																																																																																																												
234678-HxCDF	163SB005	0.24	43	NA	NT	183,000	NA																																																																																																																												
OCDD	163SB005	19.8	4,300	NA	NT	92,000	NA																																																																																																																												
OCDF	163SB005	0.69	4,300	NA	NT	43,000	NA																																																																																																																												

TABLE 2-6
 SWMU 163
 Surface and Subsurface Soil Analytical Results--Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC ^a (THQ=0.1)	Surface Background	Subsurface Concentration	Site-Specific Soil-to-Groundwater SSL ^a	Subsurface Background
Semivolatile Organic Compounds (µg/kg)							
Aluminum (Al)	163SB001	7,790	7,800	11,200	4,300	57,400	10,500
	163SB002	7,970			4,540		
	163SB003	5,210			5,260		
	163SB004	10,000			6,690		
	163SB005	8,450			3,430		
	163SB013	8,055			7,350		
	163SB017	5,000			6,250		
	163SB018	8,030			7,420		
Antimony (Sb)	163SB002	3.3	3.1	0.45	ND	6.98	NA
	163SB017	0.35			ND		
	163SB018	0.31			ND		
Arsenic (As)	163SB001	2.9	0.43	3.0	0.60	68	1.98
	163SB002	3.3			0.56		
	163SB003	1.2			ND		
	163SB004	1.9			1.8		
	163SB005	1.5			1.2		
	163SB013	1.9			1.0		
	163SB017	7.7			0.46		
	163SB018	0.86			1.5		
Barium (Ba)	163SB001	20.1	550	25.6	2.6	4,980	6.83
	163SB002	49.4			2.8		
	163SB003	23.3			5.3		
	163SB004	20.8			6.9		
	163SB005	13.75			3.7		
	163SB013	20.4			4.0		
	163SB017	26.6			6.6		
	163SB018	11.7			22.7		
Beryllium (Be)	163SB002	0.27	16	0.17	ND	6.3 ^b	0.12
	163SB013	0.17			0.07		
	163SB017	0.10			0.06		
	163SB018	0.06			0.10		

TABLE 2-6
 SWMU 163
 Surface and Subsurface Soil Analytical Results--Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC ^a (THQ=0.1)	Surface Background	Subsurface Concentration	Site-Specific Soil-to-Groundwater SSL ^a	Subsurface Background
Cadmium (Cd)	163SB001	0.53	7.8	0.13	ND	0.75 ^b	NA
	163SB002	0.73			ND		
	163SB003	1.0			ND		
	163SB013	0.16			ND		
	163SB017	2.2			0.05		
	163SB018	ND			0.22		
Inorganics (mg/kg)							
Aluminum (Al)	163SB001	7,790	7,800	11,200	4,300	57,400	10,500
	163SB002	7,970			4,540		
	163SB003	5,210			5,260		
	163SB004	10,000			6,690		
	163SB005	8,620			3,430		
	163SB013	7,980			7,350		
	163SB017	5,000			6,250		
	163SB018	8,030			7,420		
Antimony (Sb)	163SB002	3.30 J	3.10	0.45	0.39 UJ	6.98	NA
	163SB017	0.35 J			0.21 U		
	163SB018	0.31 J			0.20 U		
Arsenic (As)	163SB001	2.90	0.43	3.0	0.60 J	68	1.98
	163SB002	3.30			0.56 J		
	163SB003	1.20 J			0.46 UJ		
	163SB004	1.90 J			1.80 J		
	163SB005	1.80 J			1.20 J		
	163SB013	1.90			1.00 J		
	163SB017	7.70			0.46 J		
	163SB018	0.86 J			1.50		
Barium (Ba)	163SB001	20.1 J	550	25.6	2.6 J	4,980	6.83
	163SB002	49.4			2.8 J		
	163SB003	23.3 J			5.3 J		
	163SB004	20.8 J			6.9 J		
	163SB005	16.6 J			3.7 J		
	163SB013	20.1			4.0		
	163SB017	26.6			6.6		
	163SB018	11.7			22.7		

TABLE 2-6
 SWMU 163
 Surface and Subsurface Soil Analytical Results--Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC ^a (THQ=0.1)	Surface Background	Subsurface Concentration	Site-Specific Soil-to-Groundwater SSL ^a	Subsurface Background
Beryllium (Be)	163SB002	0.27	16	0.17	0.03 UJ	6.3 ^b	0.12
	163SB013	0.17			0.07 J		
	163SB017	0.10			0.06 J		
	163SB018	0.06			0.10 J		
Cadmium (Cd)	163SB001	0.53 J	7.8	0.13	0.04 U	0.75 ^b	NA
	163SB002	0.73 J			0.04 U		
	163SB003	1.00 J			0.05 U		
	163SB013	0.15 J			0.04 U		
	163SB017	2.20			0.05 J		
	163SB018	0.05 U			0.22 J		
Chromium (Cr)	163SB001	13.3 J	23 ^c	8.40	4.2 J	3.8 ^{b,c}	8.76
	163SB002	21.5 J			4.6 J		
	163SB003	5.6 J			4.8 J		
	163SB004	14.4 J			8.4 J		
	163SB005	8.0 J			2.9 J		
	163SB013	7.6 J			6.4 J		
	163SB017	14.3			6.7		
	163SB018	8.0			6.6		
	Cobalt (Co)	163SB001			0.66 J		
163SB002		1.40 J	0.89 J				
163SB003		2.10 J	1.10 J				
163SB004		5.40 J	1.30 J				
163SB005		0.50 J	0.80 J				
163SB013		0.59 J	0.58 J				
163SB017		0.60 J	0.53 J				
163SB018		0.78 J	0.48 J				
Copper (Cu)	163SB001	4.50 J	310	3.86	0.37 UJ	3,050	0.34
	163SB002	14.40			0.28 UJ		
	163SB004	4.20 J			0.46 UJ		
	163SB013	1.60 J			0.22 J		
	163SB017	17.80			0.40 J		
	163SB018	0.39 J			5.00		
Iron (Fe)	163SB001	5430 J	2,300	7,060	659 J	23,100	5,130
	163SB002	5300 J			2070 J		
	163SB003	2970 J			1360 J		

TABLE 2-6
SWMU 163
 Surface and Subsurface Soil Analytical Results--Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC ^a (THQ=0.1)	Surface Background	Subsurface Concentration	Site-Specific Soil-to-Groundwater SSL ^a	Subsurface Background
Lead (Pb)	163SB004	3860 J			2050 J		
	163SB005	3210 J			1670 J		
	163SB013	3,280			2,360		
	163SB017	3,630			1,360		
	163SB018	2,220			3,400		
	163SB001	20.1 J	400 ^d	39.6	3.0 J	76.7	6.43
	163SB002	149.0 J			3.5 J		
	163SB003	41.7 J			3.8 J		
	163SB004	25.3 J			4.1 J		
	163SB005	11.9 J			2.1 J		
	163SB013	16.8			3.2		
	163SB017	66.7 J			4.6 J		
	163SB018	5.4 J			27.3 J		
Magnesium (Mg)	163SB001	202.0 J	NL	NA	35.5 J	NA	NA
	163SB002	319.0 J			123.0 J		
	163SB003	72.6 J			168.0 J		
	163SB004	324.0 J			169.0 J		
	163SB005	305.0 J			143.0 J		
	163SB013	237.0 J			115.0 J		
	163SB017	292.0			199.0		
	163SB018	282.0			185.0		
Manganese (Mn)	163SB001	10.0	160	26.4	0.87 J	10,700	5.93
	163SB002	33.9			3.4		
	163SB003	4.6			11.2		
	163SB004	27.4			12.8		
	163SB005	19.2			3.6		
	163SB013	12.8 J			7.0 J		
	163SB017	24.4			7.7		
	163SB018	9.4			14.0		
Mercury (Hg)	163SB002	0.07 J	2.3	NA	0.06 U	7.75	NA
	163SB013	0.03			0.03		
	163SB017	0.08			0.02		
	163SB018	0.03			0.02		
Nickel (Ni)	163SB001	2.30 J	160	1.7	0.81 J	254	2.64
	163SB002	4.70 J			1.90 J		

TABLE 2-6
 SWMU 163
 Surface and Subsurface Soil Analytical Results--Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC ^a (THQ=0.1)	Surface Background	Subsurface Concentration	Site-Specific Soil-to-Groundwater SSL ^a	Subsurface Background
	163SB003	1.60 J			1.70 J		
	163SB004	3.20 J			2.30 J		
	163SB005	2.90 J			0.86 J		
	163SB013	3.30 J			4.0 J		
	163SB017	3.90 J			1.80 J		
	163SB018	2.50 J			2.30 J		
Potassium (K)	163SB001	110.0 J	NL	NA	32.6 UJ	NA	NA
	163SB002	134.0 J			52.3 J		
	163SB003	53.0 J			101.0 J		
	163SB004	130.0 J			100.0 J		
	163SB005	175.0 J			46.0 J		
	163SB013	106.0 J			59.7 J		
	163SB017	79.5 J			107.0 J		
	163SB018	144.0			97.7 J		
Selenium (Se)	163SB002	0.50 J	39	0.84	0.41 U	3.1 ^b	0.52
	163SB004	0.56 J			0.39 U		
	163SB013	0.54 J			0.28 U		
	163SB017	0.29 J			0.30 U		
	163SB018	0.30 U			0.37 J		
Silver (Ag)	163SB017	0.08 J	3.9	0.44	0.06 U	NA	NA
	163SB018	0.06 U			0.20 J		
Sodium (Na)	163SB001	96.80 J	NL	NA	9.40 U	NA	NA
	163SB002	72.40 J			8.50 U		
	163SB004	54.90 J			9.10 U		
	163SB005	66.90 J			6.30 U		
	163SB013	140.00 J			14.70 UJ		
Thallium (Tl)	163SB013	0.46 J	0.55	e	0.34 U	0.071 ^b	**
Tin (Sn)	163SB013	2.50 U	4,700	19.4	2.0 U	1,1009 ^a	NA
	163SB017	4.40 U			2.1 U		
	163SB018	2.00 U			2.5 U		

TABLE 2-6
 SWMU 163
 Surface and Subsurface Soil Analytical Results--Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Parameter	Location	Surface Concentration	Residential RBC ^a (THQ=0.1)	Surface Background	Subsurface Concentration	Site-Specific Soil-to-Groundwater SSL ^a	Subsurface Background
Vanadium (V)	163SB001	13.8	55	15.8	2.7 J	388	12.2
	163SB002	12.1			4.4 J		
	163SB003	7.9 J			4.0 J		
	163SB004	12.5			6.6 J		
	163SB005	11.7			4.4 J		
	163SB013	10.5			11.3		
	163SB017	10.9			7.2		
	163SB018	9.9			8.6		
Zinc (Zn)	163SB001	28.9	2,300	14.8	3.7 UJ	19,500	NA
	163SB002	124.0			11 UJ		
	163SB003	268.0			18.1		
	163SB004	22.9			4.5 UJ		
	163SB005	13.9			6.0 UJ		
	163SB013	15.4 J			3.4 J		
	163SB017	103.0 J			5.0 U		
	163SB018	4.8 U			23.1 U		

^a Residential RBCs (THQ=0.1) were used as reference concentrations for upper interval samples. Site specific soil-to-groundwater SSLs derived from soil/water partition equation for organics and SPLP leach ratios for inorganics, except as noted, were used as reference concentrations for upper and lower interval samples.

^b Partition equation SSL (SPLP samples were ND).

^c The screening value for hexavalent chromium was used as a conservative approach.

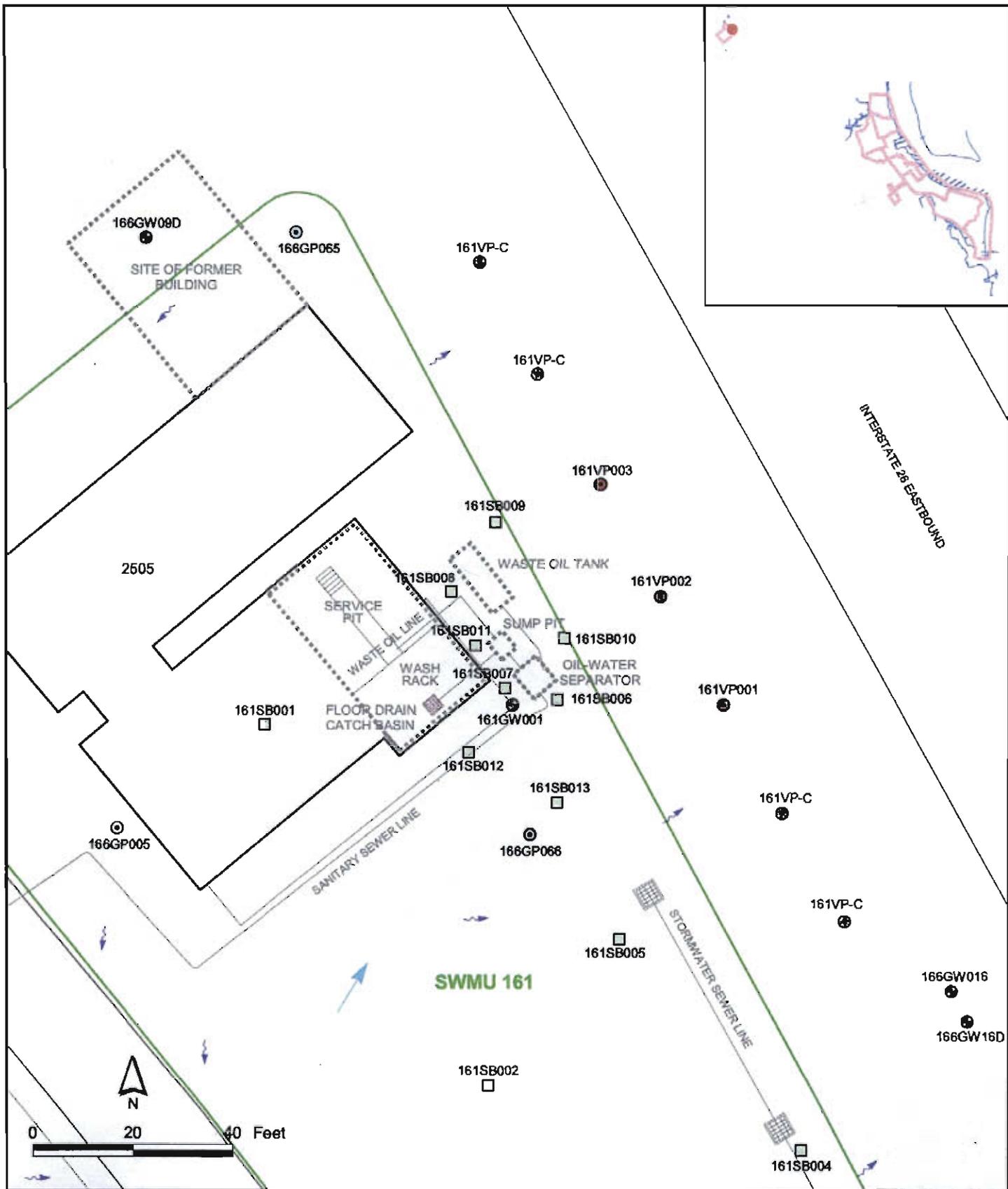
^d A screening level of 400 mg/kg has been set for lead based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities* (USEPA, 1994).

^e Number of nondetects prevented the determination of background concentrations.

For surface concentrations, bolded values exceed both RBC and the surface background (when available for inorganics); italicized values exceed the site-specific SSL and surface background. For subsurface concentrations, italicized values exceed both the SSL and subsurface background (when available for inorganics).

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

- J Indicates that the compound was detected and the concentration is an estimated value
- mg/kg milligrams per kilogram
- µg/kg micrograms per kilogram
- NA not applicable/not available
- ND not detected/not determined
- ng/kg nanograms per kilogram
- NL not listed
- NT not taken
- U Indicates that the compound was not detected
- UJ Indicates that the compound was not detected and the value provided is estimated



INTERSTATE 26 EASTBOUND

166GW09D

SITE OF FORMER BUILDING

166GP065

161VP-C

161VP-C

161VP003

161SB009

2505

WASTE OIL TANK

161VP002

SERVICE PIT

161SB008

SUMP PIT

161SB010

WASTE OIL LINE

161SB011

OIL-WATER SEPARATOR

WASH RACK

161SB007

161SB006

FLOOR DRAIN CATCH BASIN

161SB001

161GW001

161VP001

161SB012

166GP005

161SB013

161VP-C

SANITARY SEWER LINE

166GP066

161VP-C

SWMU 161

161SB005

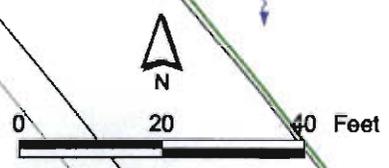
166GW016

166GW16D

STORMWATER SEWER LINE

161SB002

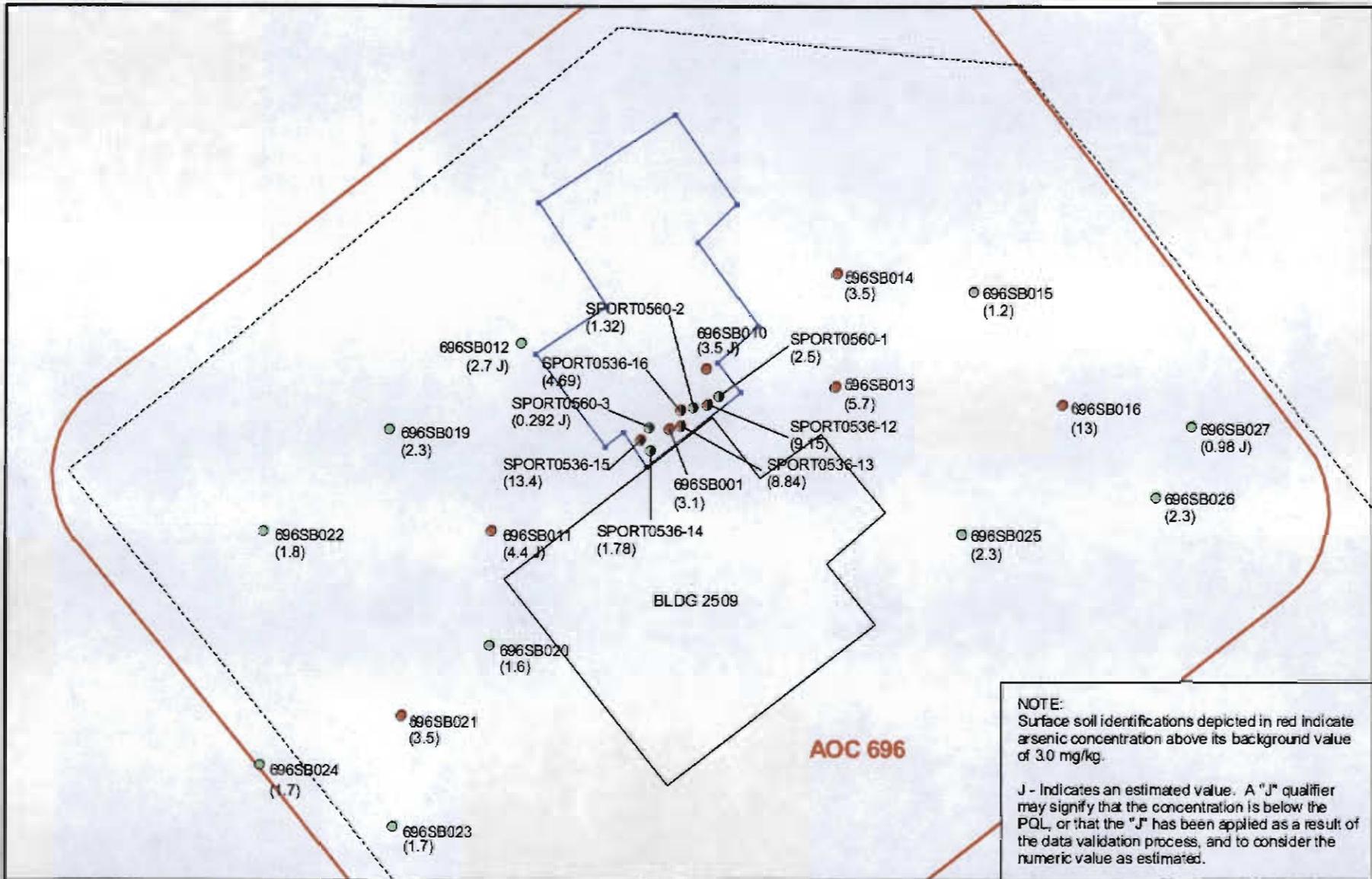
161SB004



- Proposed Sample Location
- Proposed Contingency Sample Location
- Soil Boring
- ⊙ Groundwater Probe
- ⊙ Groundwater Well
- ↗ Groundwater Flow
- ↗ Stormwater Surface Flow
- ↗ Misc. Utility Line
- ⬢ Site Feature Boundary
- ↗ Roads
- ▭ SWMU Boundary
- ▭ Buildings

Figure 2-3
Proposed Vertical Profile Sample Collection Locations
SWMU 161
Charleston Naval Complex Annex - Zone K

CH2MHILL



- Surface Soil
- IM Confirmation Sample
- Soil Excavation Corner Point
- Soil Excavation Boundary
- ⋈ Fence
- ▭ AOC Boundary
- ▭ Buildings

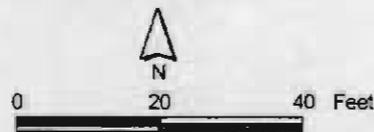
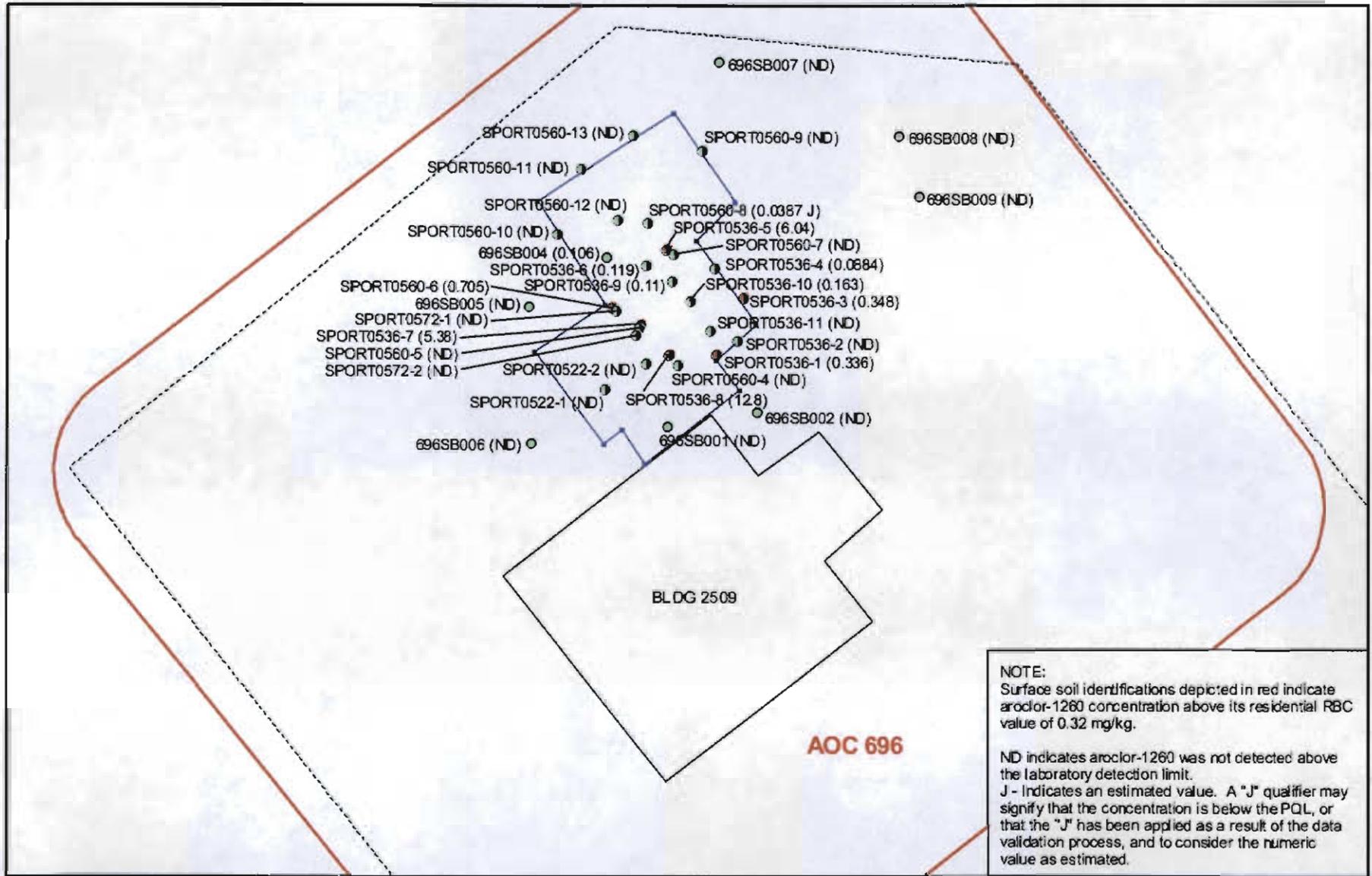


Figure 2-5
 Nature and Extent of Arsenic in Surface Soil
 AOC 696
 Charleston Naval Complex - Zone K



696SB007 (ND)
 SPORT0560-13 (ND)
 SPORT0560-11 (ND)
 SPORT0560-12 (ND)
 SPORT0560-10 (ND)
 696SB004 (0.106)
 SPORT0536-6 (0.119)
 SPORT0560-6 (0.705)
 696SB005 (ND)
 SPORT0572-1 (ND)
 SPORT0536-7 (5.38)
 SPORT0560-5 (ND)
 SPORT0572-2 (ND)
 SPORT0522-1 (ND)
 696SB006 (ND)
 SPORT0560-9 (ND)
 SPORT0560-8 (0.0387 J)
 SPORT0536-5 (6.04)
 SPORT0560-7 (ND)
 SPORT0536-4 (0.0884)
 SPORT0536-9 (0.11)
 SPORT0536-10 (0.163)
 SPORT0536-3 (0.348)
 SPORT0536-11 (ND)
 SPORT0536-2 (ND)
 SPORT0536-1 (0.336)
 SPORT0560-4 (ND)
 SPORT0536-8 (12.8)
 696SB002 (ND)
 696SB001 (ND)

NOTE:
 Surface soil identifications depicted in red indicate arochlor-1260 concentration above its residential RBC value of 0.32 mg/kg.
 ND indicates arochlor-1260 was not detected above the laboratory detection limit.
 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 process, and to consider the numeric value as estimated.

- Surface Soil
- IM Confirmation Sample
- Soil Excavation Corner Point
- Soil Excavation Boundary
- Fence
- AOC Boundary
- ▭ Buildings

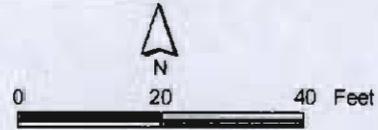
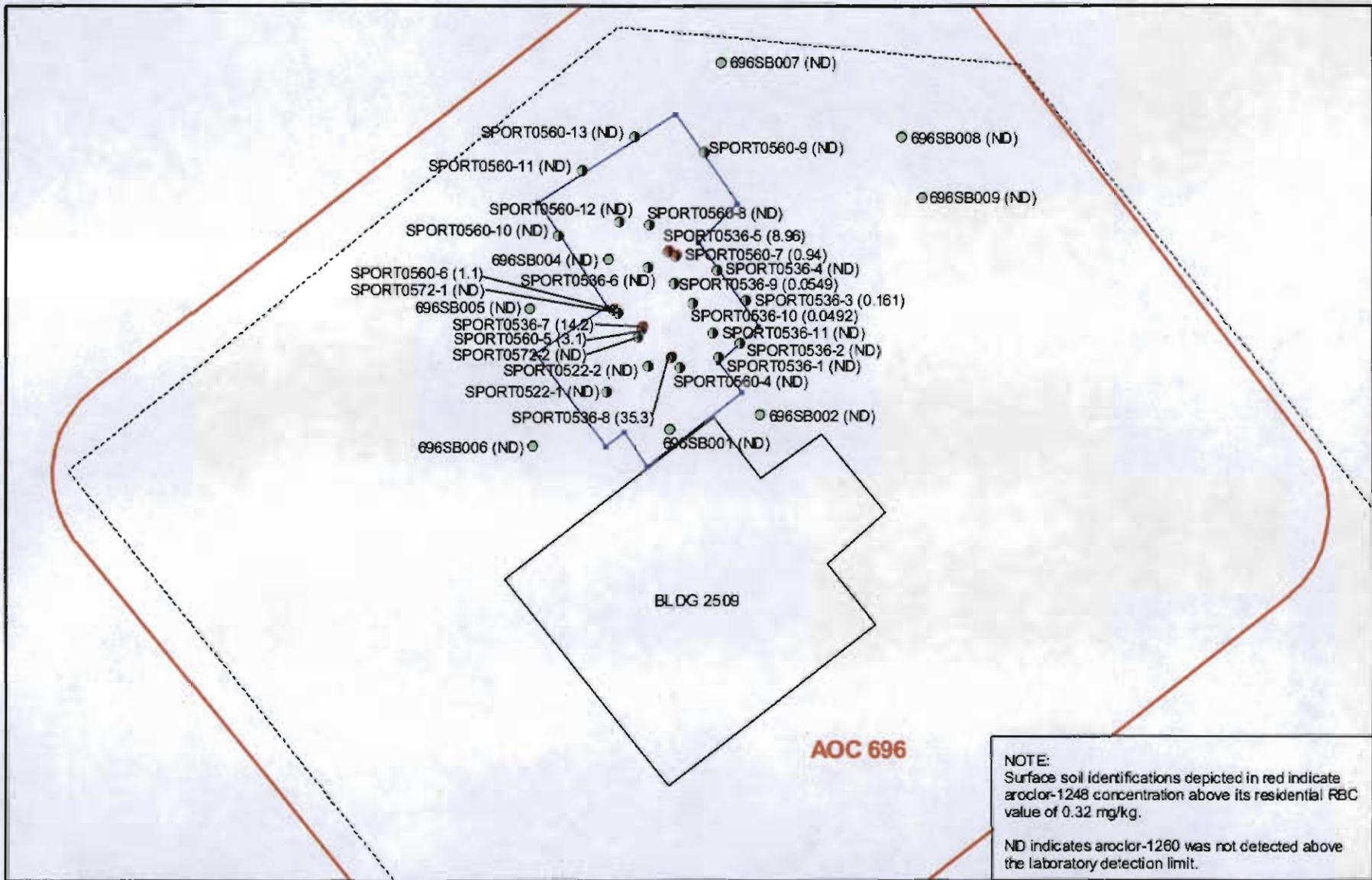


Figure 2-6
 Nature and Extent of Arochlor-1260 in Surface Soil
 AOC 696
 Charleston Naval Complex - Zone K



NOTE:
 Surface soil identifications depicted in red indicate arochlor-1248 concentration above its residential RBC value of 0.32 mg/kg.
 ND indicates arochlor-1260 was not detected above the laboratory detection limit.

- Surface Soil
- IM Confirmation Sample
- Soil Excavation Corner Point
- Soil Excavation Boundary
- ⋄ Fence
- ▭ AOC Boundary
- ▭ Buildings



Figure 2-7
 Nature and Extent of Arochlor-1248 in Surface Soil
 AOC 696
 Charleston Naval Complex - Zone K

SECTION 3.0

Sampling Protocol and Analysis

3.0 Sampling Protocol and Analysis

The discrete groundwater samples collected during the investigation using a profiler will be analyzed with an onsite gas chromatograph/mass spectrometer (GC/MS). In addition, split samples will be collected from approximately 10 percent of the groundwater sample locations and analyzed at an offsite laboratory for VOCs using EPA Method 8260B. Table 3-1 summarizes the additional sample collection locations and analysis proposed to investigate the saturated zone downgradient of the existing OWS at SWMU 161 and to delineate the chlorinated solvent plume in the area of SWMU 166 and at the Naval Annex property boundaries. In addition, Table 3-1 outlines the soil sample locations and analysis proposed at SWMU 163 to delineate the PAHs in the area of soil sample 163SB019 and the surface water drainage ditch southeast of the concrete-bermed area adjacent to Avenue C.

The groundwater sampling and analysis described in this RFI Work Plan Addendum will follow the procedures outlined in the approved Comprehensive Sampling and Analysis Plan (CSAP) portion of the RFI Work Plan (EnSafe Inc./Allen & Hoshall, 1994). The CSAP outlines all monitoring procedures to be performed during the investigation to characterize the environmental setting, source, and releases of hazardous constituents. In addition, the CSAP includes the Quality Assurance Plan (QAP) and Data Management Plan (DMP) to verify that all information and data are valid and properly documented. Unless otherwise noted, the sampling strategy and procedures will be performed in accordance with the EPA Environmental Services Division *Standard Operating Procedures and Quality Assurance Manual* (ESDSOPQAM, 1996). A copy of the ESDSOPQAM will be kept on site to supplement the CSAP during all field operations. Sample analyses will be conducted in accordance with the guidance in EPA *Test Methods for Evaluating Solid Waste, SW-846, 3rd ed.*, Office of Solid Waste and Emergency Response (SW-846) and in the EPA Environmental Services Division *Laboratory Operations and Quality Control Manual* (ESDLOPQCM, 1996). Sample analysis and data collection efforts will satisfy EPA DQO Level III protocol. A minimum of 5 percent of the samples will be analyzed at EPA DQO Level IV for confirmation purposes.

TABLE 3-1
 Proposed Sampling and Analysis Plan—Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Site	Proposed Sample Collection Location(s)	Matrix/Interval	Quantity	Analysis	Rationale
161	161VP001-161VP003	Groundwater/Every 5 feet from groundwater surface to top of Ashley Formation	TBD ^a	VOCs	Investigate surficial aquifer downgradient of existing OWS.
	3 Contingency Samples 161VP-C	Groundwater/ TBD ^b	One	VOCs	Contingency samples downgradient and up-gradient of existing OWS.
163	163SB020-163SB022	Surface Soil/0 to 1 ft bls	One	SVOCs	Delineate BEQs in surface soil in the area of 163SB019.
	6 Contingency Samples	Surface Soil	One	SVOCs	Delineate BEQs in surface soil in the area of 163SB019.
	163SB023	Surface Soil/0 to 1 ft bls	One	Metals, VOCs, SVOCs	Investigate surface water drainage ditch immediately southeast of the concrete- bermed wash rack area.
	163SB023	Subsurface Soil 3 to 5 ft bls	One	Metals, VOCs, SVOCs	Investigate surface water drainage ditch immediately southeast of the concrete- bermed wash rack area.

TABLE 3-1
 Proposed Sampling and Analysis Plan—Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Site	Proposed Sample Collection Location(s)	Matrix/Interval	Quantity	Analysis	Rationale
166	166GP094-166GP104	Groundwater/ Every five feet from 20 ft bls to the top of Ashley Formation.	TBD ^a	VOCs	Delineate deep portion of the surficial aquifer at interpreted boundaries of the dissolved chlorinated solvent plume.
	166GP105	Groundwater/ Every five feet from 10 ft bls to the top of Ashley Formation.	TBD ^a	VOCs	Delineate surficial aquifer at interpreted boundaries of the dissolved chlorinated solvent plume.
	16 Contingency Samples 166GP-C	Groundwater/ TBD ^b	One	VOCs	Delineate surficial aquifer at interpreted boundaries of the dissolved chlorinated solvent plume.
Annex Property Boundaries	GDKGP014-GDKGP016	Groundwater/ Every five feet from 35 ft bls to the top of Ashley formation.	TBD ^a	VOCs	Delineate deep portion of the surficial aquifer for chlorinated solvents near the western property boundary.
	8 Contingency Samples GDKGP-C	Groundwater/ TBD ^b	One	VOCs	Delineate deep portion of the surficial aquifer for chlorinated solvents near the western property boundary.

TABLE 3-1
 Proposed Sampling and Analysis Plan—Naval Annex Zone K
 Charleston Naval Complex, North Charleston, South Carolina

Site	Proposed Sample Collection Location(s)	Matrix/Interval	Quantity	Analysis	Rationale
Annex Property Boundaries	GDKGP017-GDKGP019	Groundwater/ Every five feet from 15 ft bls to the top of Ashley Formation	TBD ^a	VOCs	Delineate surficial aquifer for chlorinated solvents near the southern property boundary,
	8 Contingency Samples GDKGP-C	Groundwater/ TBD ^b	One	VOCs	Delineate surficial aquifer for chlorinated solvents near the southern property boundary.
	GDKGP020-GDKGP023	Groundwater/ Every five feet from the groundwater surface to the top of Ashley Formation	TBD ^a	VOCs	Investigate surficial aquifer for chlorinated solvents near the northern property boundary.
	10 Contingency Samples GDKGP-C	Groundwater/ TBD ^b	One	VOCs	Investigate surficial aquifer for chlorinated solvents near the northern property boundary.

TBD^a Quantity of samples will be determined during the sampling event and will be on the basis of groundwater and top of Ashley formation elevations.

TBD^b A single collection interval for contingency samples will be determined during the sampling event.

SECTION 4.0

Monitoring Well and Piezometer Installation

1 **4.0 Monitoring Well and Piezometer Installation**

2 Permanent MWs will be installed after completion of the groundwater profiling
3 activities as needed to allow for monitoring of the plume. Piezometers may also be
4 installed if needed. The locations of additional MWs and piezometers will be evaluated,
5 based on the analytical data obtained from the groundwater samples collected during
6 the RFI investigation. The location and construction details of the proposed MWs and
7 piezometers will be presented in the request for MW installation, which will follow the
8 content requirements as outlined in R.61-79.265 Subpart F of the South Carolina
9 Hazardous Waste Management Regulations and R.61-71 of the South Carolina Well
10 Standards and Regulations.

11 The proposed location of the wells and construction details will be discussed with the
12 BRAC cleanup team prior to submittal of the well installation request. The request will
13 be submitted to SCDHEC for approval at least two weeks prior to the scheduled
14 well/piezometer installation activities. This written request provides the purpose of the
15 MW and piezometer activities and consists of well construction details and a map
16 depicting the proposed MW and piezometer locations.

17 The well installation request process will be followed for the proposed vertical profiler
18 locations, as outlined in this Work Plan Addendum. However, because the vertical
19 profiler locations are considered temporary the request will provide the method used
20 for abandonment.

SECTION 5.0

Investigative-Derived Waste

1 **5.0 Investigative-Derived Waste**

2 Investigative-derived waste (IDW) consisting of purge water and drill cuttings from the
3 installation of subsequent groundwater MWs will be collected in a labeled 55-gallon
4 drum and left on site. After the analytical results have been reviewed, the 55-gallon
5 drum and its contents will be hauled by the U.S. Naval Detachment (Detachment) for
6 off site treatment. If arrangements cannot be made with the Detachment, CH2M-Jones
7 will haul the drums to a permitted and licensed facility for treatment of the solvent-
8 impacted groundwater and soil.

SECTION 6.0

References

1 **6.0 References**

- 2 EnSafe Inc./ Allen & Hoshall. *Final Comprehensive Corrective Action Management Plan.*
3 August 30, 1994.
- 4 EnSafe Inc. *Zone K RCRA Facility Investigation Report, Charleston Naval Complex, North*
5 *Charleston, SC.* June 11, 1999.
- 6 EnSafe Inc. *Final Zone K - RCRA Facility Investigation Work Plan Addendum, Charleston*
7 *Naval Complex, North Charleston, SC.* November 16, 1999.
- 8 EnSafe Inc. *A-A Sequencing Treatability Study Report, Zone K (SWMU 166), Charleston*
9 *Naval Complex, North Charleston, SC.* June 2, 2000.
- 10 EnSafe Inc. *Zone K - Naval Annex RCRA Facility Investigation Off-Site Groundwater*
11 *Sampling Strategy, Charleston Naval Complex, North Charleston, SC.* July 14, 2000.
- 12 United States Environmental Protection Agency (EPA). *Environmental Investigations*
13 *Standard Operating Procedures and Quality Assurance Manual.* Region IV, Environmental
14 Services Division. 1996.
- 15 United States Environmental Protection Agency (EPA). *Revised Interim Soil Lead*
16 *Guidance for CERCLA Sites and RCRA Corrective Action Facilities.* 1994.

APPENDIX

Response to SCDHEC Comments

1 **RESPONSE TO SOUTH CAROLINA DEPARTMENT OF**
2 **HEALTH AND ENVIRONMENTAL CONTROL (SCDHEC)**
3 **COMMENTS ON THE DRAFT FINAL ZONE K**
4 **RCRA FACILITY INVESTIGATION WORK PLAN ADDENDUM**
5 **DATED DECEMBER 22,1999**

6 General Comment

7 **Comment 1:**

8 *Several pump test wells and other type wells were not indicated on the figures. Please revise this*
9 *information and include in the final report.*

10 **Response 1:**

11 The air sparge, injection, and reinjection wells used in the Aerobic-Anaerobic
12 Sequencing Treatability Study conducted by EnSafe, Inc. (EnSafe) will be depicted on
13 the figures provided in the Final Zone K RFI report, which present the Annex and
14 SWMU 166.

15 **Comment 2:**

16 *Please note, the Navy should summarize the extent of contamination for all SWMUs. This must*
17 *be done on maps and figures with the use of hatching, coloring, or by contours.*

18 **Response 2:**

19 The extent of contamination will be shown for the contaminants of concern using
20 contours, shading, and/or coloring on the figures provided in the final Zone K RFI
21 report.

22 **Comment 3:**

23 *The Department suggests that all samples be analyzed for the full scan of contaminants to better*
24 *enhance the data for each site. Where unusual constituents were historically located (i.e.*
25 *explosives, fuel, pesticides, etc.) the analytical analysis should reflect these constituents in the*
26 *test run on the samples.*

27 **Response 3:**

28 Numerous samples have been collected at these SWMUs/AOCs for the full scan of
29 analytes as proposed in the original Zone K Work Plan. The contingency sampling
30 proposed in the Zone K RFI Work Plan Addendum prepared by EnSafe and this Work
31 Plan Addendum targets areas where specific contaminants were identified from the
32 previous sampling efforts as exceeding screening criteria and having not been
33 delineated. Samples collected in areas representing potentially new sources will be

1 analyzed for the full scan of contaminants or an abbreviated list of analyses, depending
2 on the site history.

3 **Comment 4:**

4 *Based on the proposed sample locations and the subsequent results, the Navy may need to*
5 *propose additional sampling locations to complete the characterization of the nature and extent of*
6 *contamination for some SWMUs. The Department would like to reiterate that characterization*
7 *of the nature and extent of contamination must be completed up to or below the MCL for all*
8 *SWMUs and AOCs.*

9 **Response 4:**

10 The Navy understands that additional sampling may be required to fully delineate soil
11 and groundwater. On the basis of the analytical data from the soil and groundwater
12 samples collected during EnSafe's investigation, and on the basis of proposed scope of
13 work presented in this Zone K RFI Work Plan Addendum, the groundwater impacted
14 by VOCs and SVOCs will be characterized to their respective MCL.

15 **SWMU 161**

16 **Comment 5:**

17 **Figure 2.1**

18 *The pump test wells observed during the field visit are not shown on map. Please revise the*
19 *figure for the report.*

20 **Response 5:**

21 These wells will be added to site maps in the final Zone K RFI report. See comment
22 Number 1.

23 **SWMU 162**

24 **Comment 6:**

25 **Page 2.2.4, Section 2.2.2 Data Gaps, Surface Soils, lines 1-2**

26 *This section states that Hg and As were found exceeding screening criteria but are not shown as*
27 *such on figure 2.2. Please revise in report.*

28 **Response 6:**

29 Mercury and arsenic were investigated and delineated to their respective residential
30 RBC or background concentration and will be presented on a nature and extent figure in
31 the Final Zone K RFI report if the contaminants are evaluated to be contaminants of
32 concern (COCs).

1 **Comment 7:**

2 *The table proposes sample 162003 as a shallow groundwater sample. This sample number cannot*
3 *be found on the figure.*

4 **Response 7:**

5 The groundwater monitoring well 162003 proposed in the Zone K RFI Work Plan
6 Addendum to characterize metals and SVOCs was not installed by EnSafe. It was
7 agreed in the September 6, 2000 meeting that additional downgradient monitoring wells
8 to characterize metals and SVOCs were not required, and the vertical profile location
9 GDKGP004 and the vertical profile points proposed in this Zone K Work Plan
10 Addendum will address the need to characterize chlorinated solvents detected in the
11 groundwater upgradient of the existing monitoring well 162GW002. On the basis of the
12 results from the groundwater samples proposed in this area, an additional well to
13 monitor the chlorinated solvent plume may be recommended.

14 **SWMU 163**

15 **Comment 8:**

16 **Figure 2.3**

17 *This figure does not show SWMU boundaries. Please revise in the report.*

18 **Response 8:**

19 The figure will be revised for the Final Zone K RFI report.

20 **Comment 9:**

21 **Page 2.3.4, Section 2.3.1 Previous Field Work, Groundwater, lines 6-10**

22 *This states that additional samples were taken in September of 1999. The figure does not*
23 *illustrate these sampling locations. Please revise this information in the report.*

24 **Response 9:**

25 The vertical profile sample collection locations in the immediate vicinity of the concrete
26 pit source area are depicted on Figure 2-4 in this Zone K RFI Work Plan Addendum.
27 This investigation at SWMU 163 completed by EnSafe will be discussed in the Final
28 Zone K RFI report.

29 **Comment 10:**

30 **Page 2.3.5, Section 2.3.2 Data Gaps, Shallow Groundwater, lines 14-16.**

31 *States that shallow groundwater has been defined, this is not correct. There are no shallow or*
32 *deep groundwater monitoring wells down gradient of the SWMU. Shallow and deep wells must*
33 *be added to properly characterize the groundwater at this SWMU.*

1 **Response 10:**

2 The groundwater investigation as described in Section 2.8 of the November 1999 Zone K
3 RFI Work Plan Addendum was characterized by vertical profiling in the shallow and
4 deep portions of the surficial aquifer downgradient of the site. In addition, the deep
5 portion of the surficial aquifer near the southern property boundary will be further
6 investigated as outlined in Section 2.2 of this Zone K RFI Work Plan Addendum. The
7 analytical data from the groundwater profiling investigations will clearly define the
8 extent of chlorinated solvent contamination in the surficial aquifer. The Navy
9 understands that additional monitoring wells to monitor the dissolved chlorinated
10 solvents in both the shallow and deep portions of the aquifer down gradient of SWMU
11 163 may be required.

12 **Comment 11:**

13 *The Department suggests that additional monitoring wells be added to the proposed sampling*
14 *effort to fill in data gaps and complete the nature and extent investigation for groundwater at*
15 *this site.*

16 **Response 11:**

17 See Response 10.

18 SWMU 164

19 **Comment 12:**

20 **Figure 2.4**

21 *This figure does not indicate the groundwater flow direction. Please revise the figure for the*
22 *report.*

23 **Response 12:**

24 The arrow was inadvertently left off of the figure. Figures depicting groundwater
25 elevation contours, the nature and extent of contaminants in groundwater, and
26 groundwater flow direction will be provided in the final RFI report.

27 **Comment 13:**

28 **Page 2.4.4, Section 2.4.2 Data Gaps, Groundwater, lines 22-23.**

29 *The text states that the decision to install monitoring wells will be made on the results of the*
30 *pending soil investigation. Please explain the rationale to justify this line of thought. Monitoring*
31 *wells will be needed before soil analytical results are received to characterize the groundwater at*
32 *this site. The Navy must also determine site-specific groundwater flow directions to properly*
33 *characterize the site.*

1 **Response 13:**

2 There were no contaminants detected above screening levels in the groundwater
3 samples collected from grid well GDKGW002, which is located approximately 130 feet
4 downgradient of SWMU 164. In addition, there were no VOCs detected in the
5 groundwater samples collected from the shallow portion of the surficial aquifer at the
6 direct push technology (DPT) points 166GP018 and 166GP072, which are located
7 approximately 100 feet sidegradient and 40 feet downgradient, respectively, of SWMU
8 164. Finally, metals were not detected above their respective MCL in the filtered sample
9 from 166GP018. Chlorinated solvents were not detected above the method detection
10 limit in the groundwater sample collected from the deep monitoring well, 16622D,
11 located immediately northwest of the site, or 60 feet sidegradient of SWMU 164. It was
12 agreed in the September 6, 2000 meeting that additional monitoring wells to investigate
13 potential groundwater contaminants associated with SWMU 164 were not required.

14 **SWMU 696**

15 **Comment 17:**

16 **Page 2.6.1, Section 2.6, lines 13-15**

17 *These lines state that the Navy is not sure if the 1000 gallon UST is still in place or not. The*
18 *Navy must determine if the UST is still in place. If the tank is still in place and not in use, then*
19 *the Navy must properly abandon the UST and associated piping. Please address this in the*
20 *report.*

21 **Response 17:**

22 According to EnSafe, the UST Assessment Report for UST 2509 was reviewed to verify
23 that the tank was removed. This information, along with confirmation sampling results
24 and location of former tank, piping, etc., will be presented in the final Zone K RFI
25 report.

26 **Comment 18:**

27 **Page 2.6.3, Data Gaps, Surface Soil, lines 9-12**

28 *These lines state that PCB contaminated soil was removed during the IM. It is also stated that*
29 *no further delineation of PCBs is required because the area is surrounded by data points. This*
30 *rational would explain the horizontal extent, but it is not clear if vertical extent confirmation*
31 *samples taken after the IM was completed. Please provide an explanation as to whether or not*
32 *vertical confirmation samples were Response to SCDHEC Comments on the Zone K RFI Work*
33 *Plan Addendum Dated December 22, 1999 taken. y no samples were taken to confirm the*
34 *vertical extent the Navy must take additional samples to delineate the vertical extent.*

1 **Response 18:**

2 The Interim Measure Completion report indicates that confirmation samples were
3 collected during the removal and that no further vertical delineation is required. CH2M-
4 Jones will review the Interim Measure Completion report to verify that the horizontal
5 and vertical boundaries of the PCB soil excavation were defined by the confirmation soil
6 samples. The results from the Interim Measures, along with the analytical results from
7 the confirmation soil samples, will be presented in the final Zone K RFI report.

8 **Comment 19:**

9 **Figure 2.6**

10 *This figure does not show the piping runs associated with the 1000 gallon UST. Please revise the*
11 *figure to indicate the piping runs in the report.*

12 **Response 19:**

13 See Response 17.

14 **SWMU 698**

15 **Comment 20:**

16 **Figure 2.7**

17 *This figure does not indicate groundwater flow direction for this site. This Department cannot be*
18 *sure proposed wells are up or down gradient unless the groundwater direction is shown. Please*
19 *revise the figure for the report.*

20 **Response 20:**

21 The flow direction arrow was inadvertently left off of the figure. Groundwater flow is to
22 the northeast. Figures depicting groundwater elevation contours, the nature and extent
23 of contaminants in groundwater, and groundwater flow direction will be provided in
24 the Final RFI report.

25 **Comment 21:**

26 **Page 2.7.1, AOC 698, Building 2508, Boiler House, Naval Annex, lines 5-10.**

27 *This text explains that this area was designated as an AOC because of the lead based paint*
28 *peeling from the building. The previous sample locations are too far from the building to get a*
29 *more accurate reading of the lead content in the soil. The Navy should propose additional*
30 *samples to better characterize the lead content in the soil adjacent to the building.*

31 **Response 21:**

32 According to EnSafe, soil samples 698SB003, 698SB006, and 698SB008 were collected
33 within one to three feet of the building in areas where there was visible paint peeling

1 from the buildings' exterior. The highest lead concentration in these samples was 113
2 mg/kg, which is below the 400 mg/kg screening criteria established for lead on the
3 basis of the Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA
4 Corrective Action Facilities (USEPA, 1994). Lead was not detected above the screening
5 criteria value in any of the soil samples collected from the site and analyzed for metals.
6 As a result, additional samples are not warranted.

7 **Comment 22:**

8 **Page 2.7.5, Section 2.7.2 Data Gaps, Shallow Groundwater, lines 7-12.**

9 *These lines state that analytes exceeded their respective screening values and will be listed under*
10 *the sample locations of which they were found. However, figure 2.7 does not list any analytes for*
11 *any sample location. Please revise the figure in the report.*

12 **Response 22:**

13 The information was inadvertently left off of the figure. Figures presenting the nature
14 and extent of known COCs will be provided in the Final Zone K RFI report.

15 **Comment 23:**

16 **Page 2.7.5, Sampling and Analysis Plan, lines 20-22**

17 *These lines propose the location of a well down gradient of well 698001. However, the figure 2.7*
18 *does not indicate which direction groundwater flows. See comment 20.*

19 **Response 23:**

20 See Response 20.

21 **Groundwater Strategy**

22 **Comment 24:**

23 **Page 2.8.1, Section 2.8, line 14-16**

24 *Stratigraphic control is only considered useful for vertical control not horizontal control. Please*
25 *explain the rationale where by stratigraphic control is considered.*

26 **Response 24:**

27 By definition, stratigraphic control is the degree and understanding of the stratigraphy
28 of an area; the body of knowledge that can be used to interpret its stratigraphy or
29 geologic history. The vertical profile locations installed by EnSafe and the vertical
30 profile locations proposed in this Zone K RFI Work Plan Addendum will be used to
31 interpret the structural nature of top the Ashley formation in the western and
32 southwestern part of the Annex. Cross sections derived from the data will be used to
33 evaluate the vertical relationships of strata in the upper 50 to 60 feet in addition to their
34 horizontal/lateral extent.