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CONFIRMATORY SAMPLING INVESTIGATION REPORT AREA OF CONCERN 720 (AOC
720) ZONE G FOR OIL/WATER SEPARATOR CNC CHARLESTON SC
4/1/2003
CH2M HILL

CONFIRMATORY SAMPLING INVESTIGATION REPORT

AOC 720, Zone G Oil/Water Separator



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

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

CH2M-Jones

April 2003

Contract N62467-99-C-0960



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April 30, 2003

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

Re: Confirmatory Sampling Investigation Report (Revision 1) —AOC 720 (Zone G)

Dear Mr. Scaturo:

Enclosed please find four copies of the Confirmatory Sampling Investigation Report (Revision 1) for AOC 720 in Zone G of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

The principal author of this document is Louise Palmer. Please contact her at (704) 329-0072, extension 296, if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

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

CONFIRMATORY SAMPLING INVESTIGATION REPORT

AOC 720, Zone G Oil/Water Separator



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

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

PREPARED BY
CH2M-Jones

April 2003

*Revision No.1
Contract N62467-99-C-0960
158814.ZG.PR.16*

**Certification Page for Confirmatory Sampling Investigation
Report (Revision 1) – AOC 720, Zone G**

Oil/Water Separator

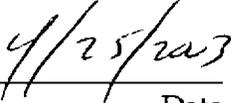
I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina

P. E. No. 21428



Dean Williamson, P.E.



Date

1 Contents

2 Section	Page
3 Acronyms and Abbreviations	vi
4 1.0 Introduction.....	1-1
5 1.1 Zone G Physical Setting	1-1
6 1.2 Potential Receptors	1-2
7 1.3 AOC 720 Site Background and Setting	1-2
8 1.4 Report Organization.....	1-3
9 Figure 1-1 Location of AOC 720 within Zone G.....	1-5
10 Figure 1-2 Shallow Groundwater Potentiometric Surface Map (July 2002).....	1-6
11 Figure 1-3 Deep Groundwater Potentiometric Surface Map (June 2002).....	1-7
12 Figure 1-4 Aerial Photograph of AOC 720.....	1-8
13 2.0 Environmental Sampling at AOC 720	2-1
14 2.1 Soil Sampling and Analysis.....	2-1
15 2.1.1 Metals in Soil Samples	2-2
16 2.1.2 PCBs/Pesticides in Soil Samples	2-2
17 2.1.3 SVOCs in Soil Samples.....	2-2
18 2.1.4 VOCs in Soil Samples.....	2-3
19 2.2 Groundwater Sampling and Analysis	2-3
20 2.3 COPC Evaluation and Refinement.....	2-4
21 2.3.1 Subsurface Soil COPC Refinement.....	2-4
22 2.3.2 Groundwater COPC Refinement.....	2-5
23 2.4 Investigation Summary – AOC 720.....	2-6
24 Table 2-1 Analytes Detected in Subsurface Soil at AOC 720	2-7
25 Table 2-2 Analytes Detected in Groundwater at AOC 720.....	2-13
26 Table 2-3 COPC Refinement, Lead in Subsurface Soil at AOC 720	2-14
27 Table 2-4 COPC Refinement, Pentachlorophenol at AOC 720.....	2-15
28 Figure 2-1 CSI Sample Locations at AOC 720	2-16
29 3.0 AOC 720 CSI Conclusions and Recommendations	3-1
30 4.0 References.....	4-1

1 **Contents, Continued**

2 **Appendices**

- 3 **A** Photographs of AOC 720 Site
- 4 **B** Data Summary Tables for AOC 720 samples
- 5 **C** Data Validation Report for AOC 720 samples
- 6 **D** DPT Groundwater Sample Logs for AOC 720
- 7 **E** Excerpts from the *Zone G RFI Report, Revision 0* (EnSafe, 1998)
- 8 **F** Excerpts from the *Evaluation of Drainage System Serving Charleston Naval Complex*
9 (Davis & Floyd, September 1998)
- 10 **G** CH2M-Jones' Responses to SCDHEC Comments on the *CSI Report, AOC 720, Zone G,*
11 *Revision 0*

1 **Acronyms and Abbreviations**

2	AOC	Area of concern
3	BEQ	Benzo[a]pyrene equivalent
4	BRAC	Base Realignment and Closure Act
5	BRC	Background reference concentration
6	CA	Corrective action
7	CNC	Charleston Naval Complex
8	COPC	Chemical of potential concern
9	COC	Chemical of concern
10	CSC	Coastal Service Center
11	CSI	Confirmatory sampling investigation
12	DAF	Dilution attenuation factor
13	DPT	Direct-push technology
14	EPA	U.S. Environmental Protection Agency
15	EnSafe	EnSafe Inc.
16	ft bls	Feet below land surface
17	HI	Hazard index
18	$\mu\text{g/L}$	Microgram per liter
19	mg/kg	Milligram per kilogram
20	MCL	Maximum contaminant level
21	NAVBASE	Naval base
22	NFA	No further action
23	NFI	No further investigation
24	NOAA	National Oceanographic Atmospheric Administration
25	OP	Organophosphorous
26	OWS	Oil/water separator
27	PAH	Polycyclic aromatic hydrocarbon
28	PCB	Polychlorinated biphenyl

1 **Acronyms and Abbreviations, Continued**

2	RBC	Risk-based concentration
3	RCRA	Resource Conservation and Recovery Act
4	RFA	RCRA Facility Assessment
5	RFI	RCRA Facility Investigation
6	SCDHEC	South Carolina Department of Health and Environmental Control
7	SSL	Soil screening level
8	SWMU	Solid waste management unit
9	SVOC	Semivolatile organic compound
10	UST	Underground storage tank
11	VOC	Volatile organic compound

1.0 Introduction

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

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

11 In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation
12 and remediation services at the CNC. This submittal has been prepared by CH2M-Jones to
13 report the Confirmatory Sampling Investigation (CSI) for Oil/Water Separator (OWS) Area
14 of Concern (AOC) 720 in Zone G of the CNC. This AOC was not included in the RFI report
15 submitted for Zone G because at the time the report was written, it had not been identified
16 as an AOC. A CSI for this unit was recommended in the *RCRA Facility Assessment (RFA),
17 Revision 1, Charleston Naval Complex* (Department of the Navy, Southern Division, February
18 2001). There is no reason to believe that hazardous materials have been released from this
19 OWS unit. Figure 1-1 illustrates the location of AOC 720 within Zone G at CNC.

20 OWS AOC 720 was added to the RCRA Part B permit in 2001. This site was designated for a
21 CSI because no operational history or visual evidence existed for the site to determine
22 whether it is free of contamination. CSI activities were conducted to evaluate the nature and
23 extent of potential contamination from the OWS historical operation. No Further Action
24 (NFA) is proposed for this OWS AOC, as the results of the recent CSI conclude that there is
25 no contamination present at the site.

26 1.1 Zone G Physical Setting

27 The physical setting of Zone G is discussed in detail in Section 2 – NAVBASE Physical
28 Setting of the *Zone G RFI Report, Revision 0* (EnSafe Inc. [EnSafe], 1998). The RFI report
29 includes discussions of the regional setting, the geologic and hydrogeologic conditions, and
30 climate of the CNC. Excerpts of this discussion are presented in Appendix E of this Revision

1 1 CSI Report. The area around AOC 720 is zoned for future light marine industrial usage
2 (M-1), similar to its historical usage.

3 Potentiometric surface maps of the "shallow" and "deep" groundwater aquifers are
4 presented in Figures 1-2 and 1-3. These maps were prepared from measurements taken in
5 June (Figure 1-3) and July (Figure 1-2) of 2002. The groundwater maps in Figures 1-2 and 1-3
6 indicate that the flow direction in both water-bearing units at AOC 720 is northward toward
7 the Cooper River. The groundwater at AOC 720, and in most of Zone G, is also expected to
8 have some tidal influence, as the site is within 700 feet of the river.

9 **1.2 Potential Receptors**

10 The potential receptors for Zone G sites are discussed in detail in Section 6 – Fate and
11 Transport, Section 7 – Human Health Risk Assessment, and Section 8 – Ecological Risk
12 Summary of the *Zone G RFI Report, Revision 0*. Because the investigated unit is below land
13 surface, potential releases from the OWS would likely impact only subsurface soil and
14 groundwater. Therefore, direct exposure concerns from potential releases from the OWS are
15 minimal, due the absence of surface exposure media.

16 **1.3 AOC 720 Site Background and Setting**

17 In the RFA, AOC 720 was defined as an OWS at Building X12. The OWS is associated with
18 an equipment wash pad located approximately 150 feet south of Building X12, and
19 approximately 110 feet southeast of Building 1431. Building X12 was previously used by the
20 Navy as a Carpenter/Maintenance Shop and has been removed. Building 1431, a covered
21 open-air concrete slab, was previously used by the Navy for small equipment storage and is
22 currently used as a staging and field fabricating area by construction contractors for the
23 State of South Carolina Department of Transportation (DOT). The OWS at AOC 720 and the
24 equipment wash pad were not directly associated with operations at either Building X12 or
25 Building 1431; no drains or piping are known to have connect the buildings to the OWS. The
26 wash pad and the OWS are not in use, and at times, most of the wash pad has been covered
27 with a soil stockpile or debris not associated with the OWS. Figure 1-4 presents an aerial
28 photograph of AOC 720, taken in 1997 before the surrounding buildings were removed.

29 The OWS at AOC 720 is located south of the 16 x 30-ft concrete wash pad and
30 approximately 5-ft square equipment pad. The equipment pad has been recently removed.
31 The OWS is not evident from the surface and is not accessible (there is no manhole).

32 Photographs of AOC 720 are presented in Appendix A of this report. Information regarding

1 the configuration of the OWS is not available. It has been assumed that recently removed
2 PVC piping extending above grade south of the equipment pad may have been used as part
3 of the OWS operation. A report of the wastewater lines prepared by Davis and Floyd (1998)
4 indicates that the OWS drained northward to the sanitary sewer at Hobson Avenue. A
5 drawing from *Evaluation of Drainage System Serving Charleston Naval Complex* (Davis and
6 Floyd, September 1998) showing the drain line to the sanitary sewer is included in
7 Appendix F.

8 The surface topography surrounding AOC 720 is level, unpaved land. It is currently used as
9 a construction staging area. Surface runoff from the AOC 720 area is likely to flow towards
10 the Cooper River.

11 **1.4 Report Organization**

12 This Revision 1 CSI Report consists of the following sections, including this introductory
13 section:

14 **1.0 Introduction** — Presents the purpose of the report and general information regarding
15 the facility setting and potential receptors at AOC 720. Also presents a description of the
16 site.

17 **2.0 Environmental Sampling at AOC 720** —Summarizes the results for samples collected at
18 AOC 720.

19 **3.0 AOC 720 CSI Conclusions and Recommendations** —Provides conclusions and
20 recommendations regarding potential contamination at the site.

21 **4.0 References** — Lists the references used in this document.

22 **Appendix A** contains photographs of the AOC 720 area.

23 **Appendix B** contains data summary tables for AOC 720 samples.

24 **Appendix C** contains the data validation report for AOC 720 samples.

25 **Appendix D** contains DPT Groundwater Sample Logs for AOC 720.

26 **Appendix E** contains excerpts from the *Zone G RFI Report, Revision 0* (EnSafe, 1998).

27 **Appendix F** contains excerpts from *Evaluation of Drainage System Serving Charleston Naval*
28 *Complex* (Davis & Floyd, September 1998).

- 1 **Appendix G** contains responses to SCDHEC comments made regarding the *CSI Report*,
- 2 *AOC 720, Zone G, Revision 0* (CH2M-Jones, 2002).
- 3 All tables and figures appear at the end of their respective sections.

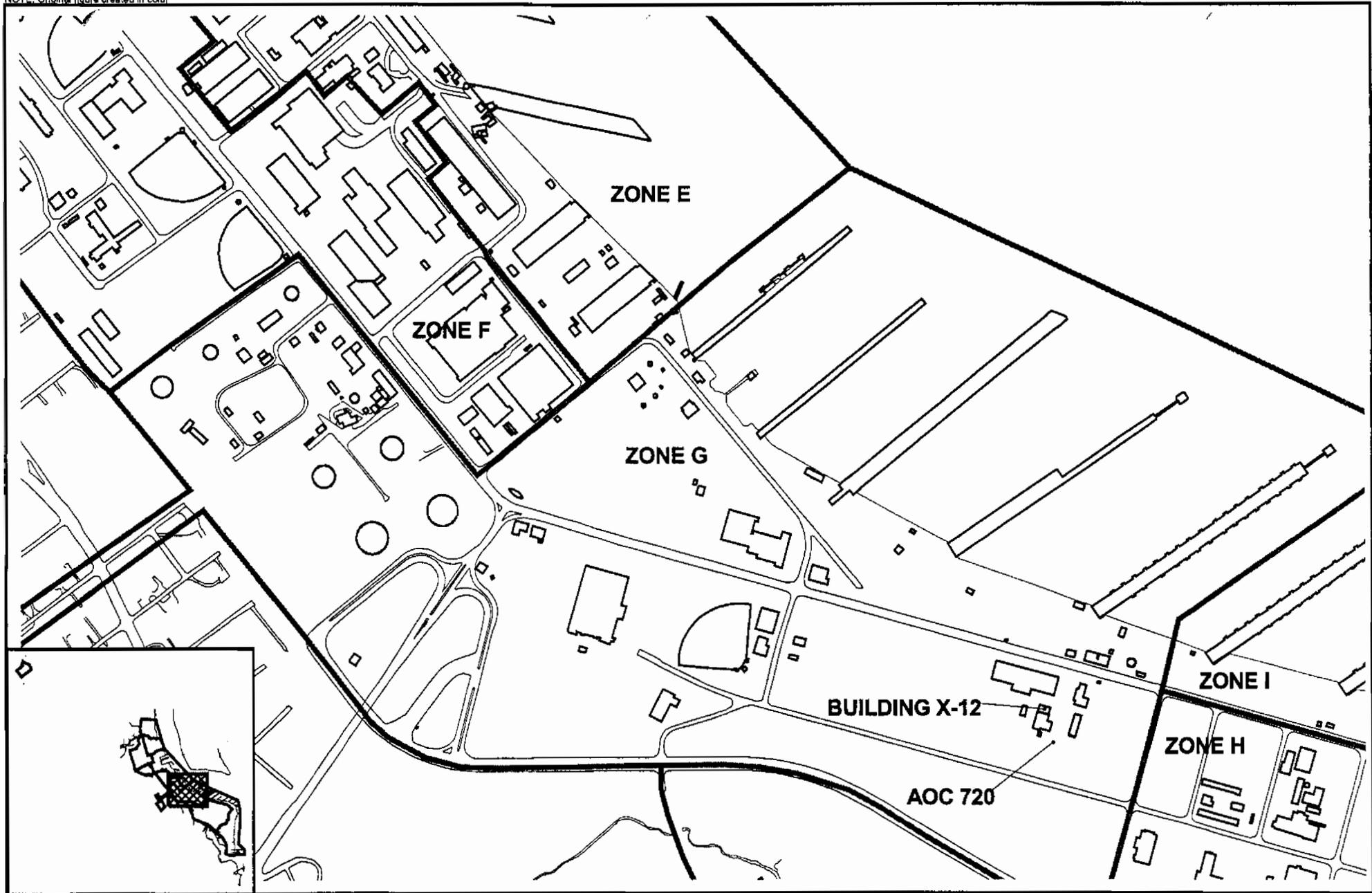


Figure 1-1
Location of AOC 720
Zones G
Confirmatory Sampling Investigation
Charleston Naval Complex

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NOTE: Original figure created in color



Figure 1-2
July 2002 Shallow Groundwater Contours
AOC 720
Confirmatory Sampling Investigation
Charleston Naval Complex

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NOTE: Original figure created in color

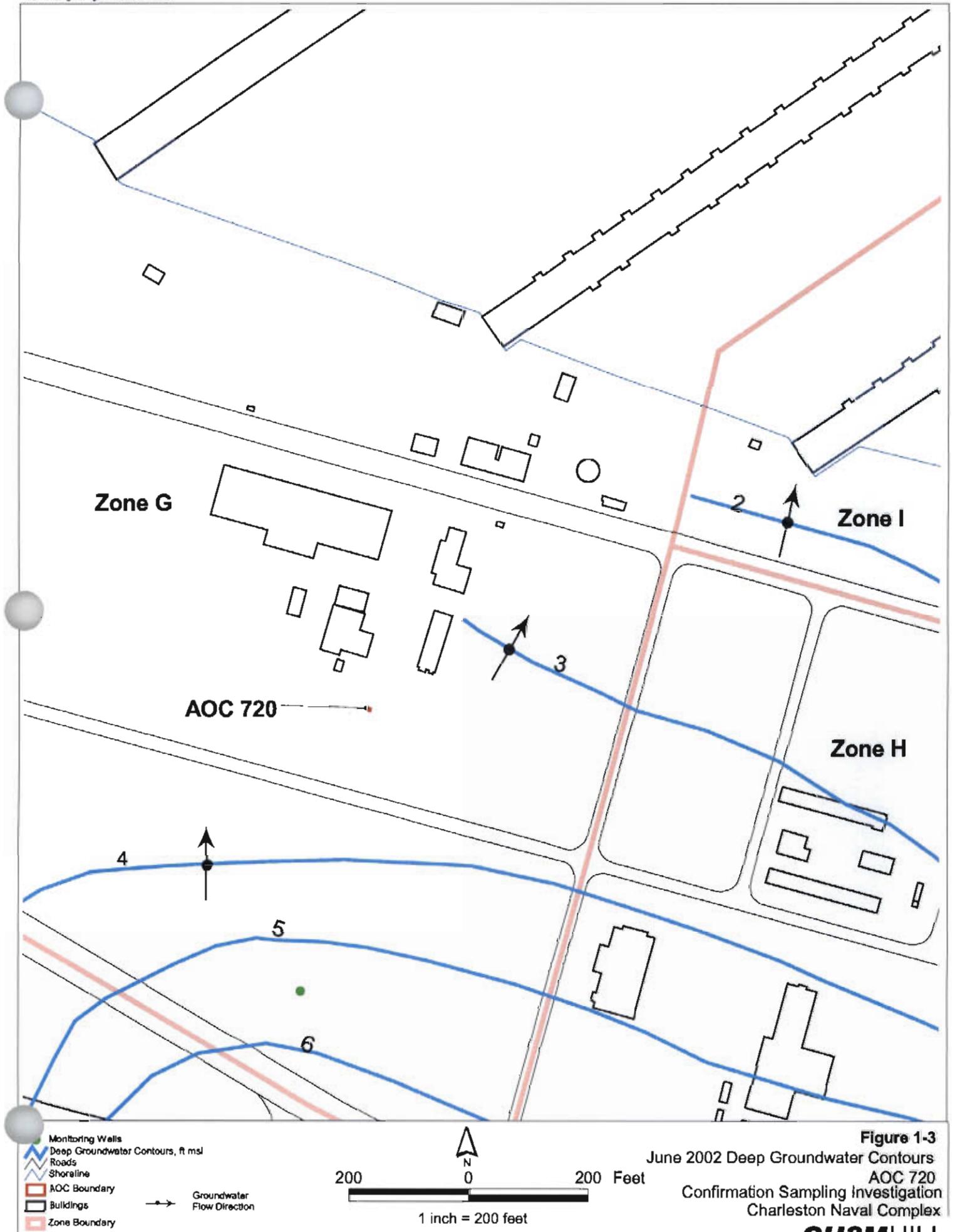
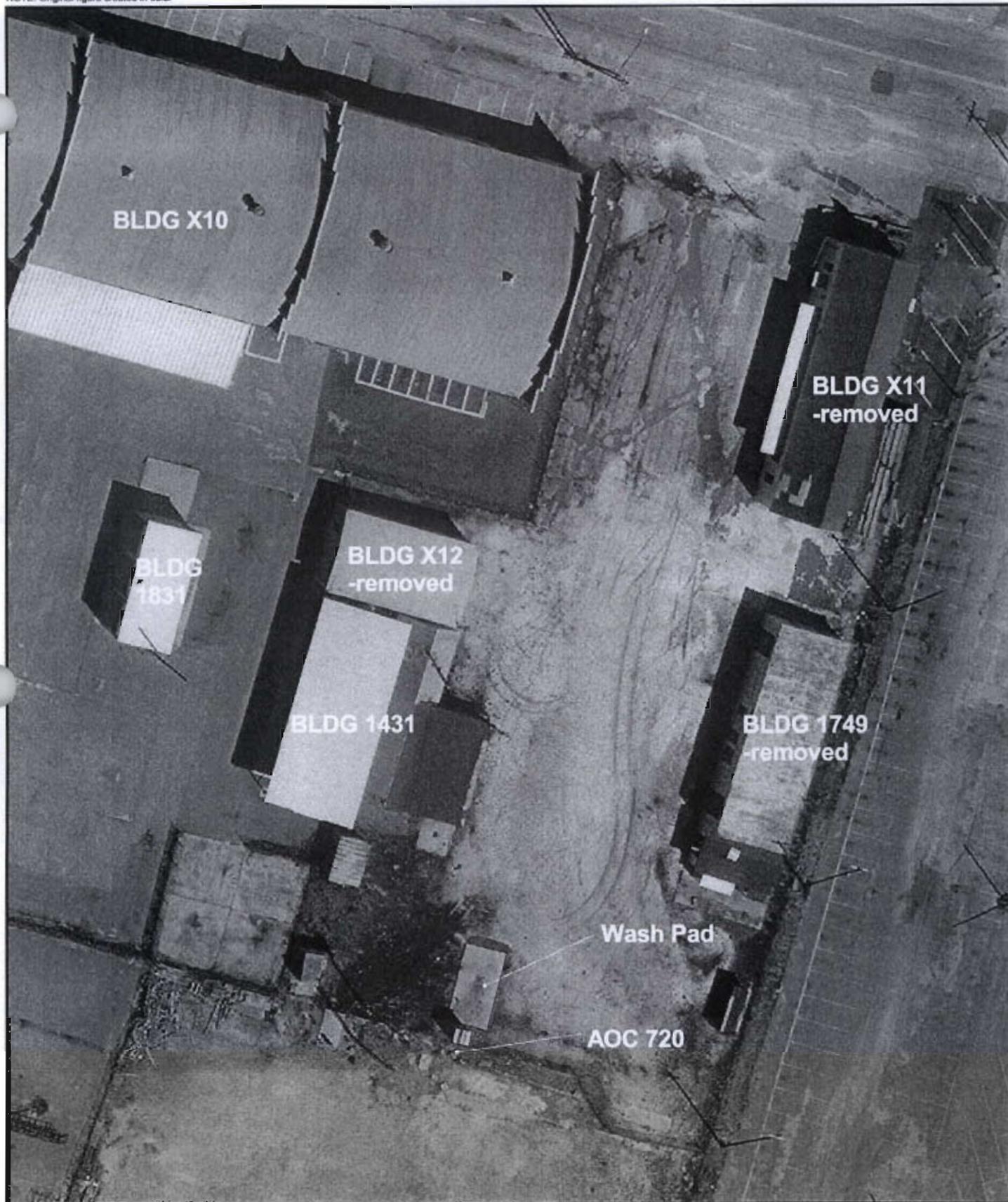


Figure 1-3

June 2002 Deep Groundwater Contours
AOC 720
Confirmation Sampling Investigation
Charleston Naval Complex



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



0 50 100 Feet



1 inch = 50 feet

Figure 1-4
Aerial Photo of AOC 720

Confirmatory Sampling Investigation
Charleston Naval Complex

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Section 2.0

2.0 Environmental Sampling at AOC 720

For the AOC 720 CSI, six subsurface soil samples and four groundwater samples from direct-push technology (DPT) geoprobes were collected surrounding the OWS. These samples were collected as described in the *Sampling and Analysis Plan; AOC 720, Zone F; AOC 720, Zone F; Oil/Water Separators; Charleston Naval Complex; (CH2M-Jones, March 2002)* and *Sampling and Analysis Plan Addendum; Area of Concern 720, Zone G; (CH2M-Jones, January 2003)*. The originally planned groundwater sample location east of the OWS (G720GP003) did not produce sufficient water for a sample, and was abandoned. The locations of the originally planned soil and groundwater samples were shifted to surround the visible PVC piping, at the assumed location of the OWS. During the initial sampling effort, the DOT contractor had stockpiled debris and soil on the northern side of the planned sample locations. These stockpiles were later removed and allowed access to the samples on the north side of the OWS. The CSI sample locations are presented in Figure 2-1. The data set for the AOC 720 samples is presented in Appendix B of this report. The data validation summary report for the site data is presented in Appendix C. The AOC 720 sample results are described below.

2.1 Soil Sampling and Analysis

Six subsurface soil samples were collected from 3 to 5 ft below land surface (ft bls), corresponding to the anticipated OWS inlet and outlet pipe depths. This depth was selected to include soil most likely to have been impacted by a potential release from the OWS piping and base. Samples from soil boring locations G720SB001, G720SB002, G720SB003, and G720SB006 were analyzed for a full analytical suite, including polychlorinated biphenyls (PCBs)/pesticides, volatile organic compounds (VOCs), semivolatile organic compounds (SVOC)s, and metals. Samples from G720SB004 and G720SB005 were analyzed for lead only, to evaluate a lead anomaly in the vicinity of G720SB003, as described below. Analytes detected in the soil samples are listed in Table 2-1.

Subsurface soil concentrations were compared to soil screening levels (SSLs) from the U.S. Environmental Protection Agency (EPA) *Soil Screening Guidance Appendix A* (1996). SSLs were adjusted for dilution attenuation factors (DAFs) of 1.0 for VOCs and 10 for other analytes. Soil metals concentrations were also compared to background concentrations for subsurface soil from combined Zones G and H grid (background) samples. The background

1 sample data sets for the two zones were combined because of the small grid sample
2 population for Zone G, and because AOC 720 is located near Zone H in a similar industrial
3 use area. The polycyclic aromatic hydrocarbons (PAHs) detected in soils were compared
4 against background levels established for CNC. The following text presents the details of
5 the analytical results compared to the screening criteria discussed above.

6 **2.1.1 Metals in Soil Samples**

7 With one exception, metals in the soil samples were detected at concentrations below
8 screening criteria (i.e., below SSLs [DAF=10] or within their background ranges for Zones G
9 and H). As presented in Table 2-1, lead was detected at G720SB003 at a concentration of 890
10 milligrams per kilogram (mg/kg), which is higher than the background range of 2.1 mg/kg
11 to 76 mg/kg and the RBC/SSL of 400 mg/kg. However, a duplicate analysis of this same
12 soil sample reported a lead concentration of 13 mg/kg. Subsurface samples G720SB004 and
13 G720SB005 were collected 5 ft on either side of G720SB003, and had lead concentrations of
14 8.7 and 9.27 mg/kg. On the basis of the normal sample result from location G720SB003, lead
15 may be considered a chemical of potential concern (COPC) in soil at AOC 720, and is
16 discussed further in Section 2.3 of this report.

17 **2.1.2 PCBs/Pesticides in Soil Samples**

18 Aroclor-1260 was detected in one soil sample, G720SB006, at an estimated concentration of
19 0.002 mg/kg. No SSL is listed for the PCB Aroclor-1260, although the SSL for Aroclor-1254
20 is 0.54 mg/kg, greater than the detected concentration of Aroclor-1260. Therefore, Aroclor-
21 1260 is not considered a COPC at this site.

22 As shown in Table 2-1, trace levels of pesticides were detected in the subsurface soil from
23 sample locations G720SB001, G720SB003, and G720SB006. These pesticides may be related to
24 historical routine maintenance spraying of facilities, and construction/maintenance
25 excavation activities which mixed surface and subsurface soils around AOC 720. All
26 concentrations of detected pesticides were found to be less than their SSLs. No PCB or
27 pesticide COPCs were identified in soil at AOC 720.

28 **2.1.3 SVOCs in Soil Samples**

29 As shown in Table 2-1, trace amounts of PAHs were detected in the subsurface soil samples.
30 All SVOC concentrations were less than SSLs, and benzo[a]pyrene equivalents (BEQs) were
31 less than the sitewide reference concentrations for the CNC. Therefore, no SVOC COPCs in
32 subsurface soil were identified at AOC 720.

2.1.4 VOCs in Soil Samples

As shown in Table 2-1, trace amounts of cis-1,2-dichloroethene (cis-1,2-DCE) and carbon disulfide were detected in one of the three soil samples collected in the AOC 720 area. In addition, trace amounts of acetone and/or methyl ethyl ketone were detected in all the soil samples that were analyzed for VOCs. No VOC concentrations exceeded the conservative SSLs at a DAF=1.0. Therefore, VOCs in soil are not a concern at AOC 720.

2.2 Groundwater Sampling and Analysis

Data from three DPT locations were used to evaluate groundwater quality at AOC 720.

Although a total of four locations were designated for sampling in the *Sampling and Analysis Plan* (CH2M-Jones, 2002) and *Sampling and Analysis Plan Addendum* (CH2M-Jones, 2003), no groundwater could be obtained from the third location G720GP003 (adjacent to G720SB002). It should be noted that no contamination (e.g., COPCs) was identified in the subsurface soil at that location.

The DPT samples were collected from the first water-producing stratum encountered at the site, at 8 to 12-ft bls. Samples from locations G720GP001 and G720GP002 were analyzed for VOCs, SVOCs, and PCBs/pesticides. The first DPT sample from G720GP006 was analyzed for VOCs, PCBs/pesticides, and metals. Metals data from unscreened DPT groundwater samples are not considered representative of area groundwater due to the particulates inherent in the DPT collection process; therefore metals results are not evaluated for this investigation, although they are presented in the data summary tables in Appendix B. For the first sample from G720GP006, SVOCs were left out of the analytical suite due to laboratory error, and the location was subsequently resampled. The second DPT sample from G720GP006 was analyzed for SVOCs. Logs of the DPT groundwater samples are presented in Appendix D.

The organic compounds detected from the groundwater analyses are presented in Table 2-2. Concentrations were compared to the maximum contaminant level (MCL); where no MCL existed they were compared to the EPA Region III risk-based concentration (RBC), with the noncarcinogenic chemical RBC adjusted for a hazard index (HI) of 0.1.

No PCBs, pesticides, or VOCs were detected in groundwater at AOC 720. SVOCs detected include trace concentrations of PAHs such as acenaphthene and pyrene, as well as pentachlorophenol (PCP) and 2-chlorophenol. Concentrations of the SVOCs were all estimated, and were typically less than an order of magnitude below their reporting limits.

1 No SVOCs were detected at G720GP002; acenaphthene was detected at location G720GP001;
2 the other SVOCs were detected at location G720GP006.

3 As presented in Table 2-2, with the exception of PCP, SVOCs detected in groundwater had
4 estimated concentrations less than screening criteria. PCP was detected at an estimated
5 value 5.9 J $\mu\text{g}/\text{L}$ at G720GP006, compared to its MCL of 1 $\mu\text{g}/\text{L}$. Therefore, PCP was
6 identified as a COPC in groundwater at AOC 720, and is discussed further in Section 2.3 of
7 this report.

8 **2.3 COPC Evaluation and Refinement**

9 This section discusses chemicals that were identified as COPCs because their concentrations
10 exceeded background values and either SSLs (for subsurface soil), or MCLs or RBCs (for
11 groundwater). The factors that determine whether a COPC meets the criteria for being
12 considered a chemical of concern (COC) are discussed for each parameter.

13 **2.3.1 Subsurface Soil COPC Refinement**

14 As presented in Table 2-1, lead was detected at G720SB003 at a concentration of 890 mg/kg,
15 which is higher than the background range of 2.1 mg/kg to 76 mg/kg and the assumed SSL
16 of 400 mg/kg. However, this sample also had a duplicate sample collected in the field as
17 part of the sampling quality control (QC) process, and the lead concentration in the field
18 duplicate sample was 13 mg/kg, which is similar to the background concentrations. The
19 duplicate sample concentration at G720SB003 is also similar to the lead concentrations
20 detected in G720SB001 and G720SB002 (7.9 and 4.2 mg/kg). Samples G720SB004 and
21 G720SB005 were collected within approximately 4 feet of G720SB003 to further evaluate lead
22 in the vicinity. Lead was detected in those two samples at 8.7 and 9.27 mg/kg, also similar
23 to the site lead concentrations. Concentrations of all chemicals analyzed within the duplicate
24 field samples are presented in the data summary tables in Appendix B.

25 Table 2-3 presents lead data for all soil samples collected at AOC 720. As can be noted, only
26 the normal sample at G720SB003 had an elevated concentration of lead. This could have
27 been caused by a metal fragment in the soil sample and does not indicate the widespread
28 lead presence at this location, as the duplicate sample and surrounding samples did not
29 have elevated lead concentrations. The lead concentration at sample location G720SB003
30 (452 mg/kg) in Table 2-3 is an average of the normal and duplicate sample results. The site
31 average, including concentrations from the other five boring locations, is 83 mg/kg. This

1 average value is less than the screening value for lead of 400 mg/kg, indicating that it does
2 not pose a threat to groundwater.

3 The elevated lead concentration is limited to one sample at G720SB003, was not reproduced
4 in the duplicate field sample at the same location. The duplicate sample from G720SB003
5 contained lead at concentrations similar to the background and other five borings at the site.
6 Therefore, the one elevated detection is an anomaly and is not indicative of site-wide soil
7 contamination at AOC 720. The average lead concentration in subsurface soil is less than the
8 screening criteria which is protective of direct exposure, as well as leachability. It should be
9 noted that the lead concentration detected in the unscreened (turbid) groundwater sample
10 from G720GP006 was reported at 5.49 $\mu\text{g}/\text{L}$ (see Appendix B), lower than the 15 $\mu\text{g}/\text{L}$ MCL.
11 Therefore, the lead anomaly at G720SB003 does not appear to be impacting site
12 groundwater. Therefore, lead is not considered a COC at this site.

13 **2.3.2 Groundwater COPC Refinement**

14 Pentachlorophenol was identified as a COPC in groundwater at location G720GP006. Table
15 2-4 presents PCP results from soil and groundwater samples collected at AOC 720.

16 Including field duplicate samples, this compound was analyzed in three groundwater
17 samples and six soil samples. PCP was not detected in any soil samples at AOC 720, and
18 was not detected in groundwater DPT samples from the site other than at G720GP006. The
19 reported estimated concentration, 5.9 J $\mu\text{g}/\text{L}$, is an order of magnitude below the reporting
20 limit (approximately 50 $\mu\text{g}/\text{L}$).

21 PCP is typically found at wood-treating sites, as it is a fungicide and may also be used in
22 herbicides. There is no indication of its use at the wash pad at AOC 720.

23 None of the other groundwater or soil samples collected indicated the presence of PCP.
24 However, in reviewing the data for groundwater at the CNC (using the CNC GIS), it was
25 noted that PCP was occasionally detected in sporadic (non-reproducible detections) in a
26 number of wells, including grid or background wells, at the CNC. Of the 692 wells that have
27 had groundwater samples analyzed for PCP, there have been 14 low level (J-flagged)
28 reported detections of PCP and no PCP detections with a "=" flag. Where such isolated and
29 low level (i.e., J-flagged) detections have occurred at AOCs or SWMUs, PCP has not been
30 previously considered a COC.

31 Because it wasn't detected in any other samples at AOC 720, it does not appear
32 representative of groundwater or soil conditions at AOC 720, and therefore PCP is not
33 considered a COC at this site.

1 **2.4 Investigation Summary – AOC 720**

2 Soil and groundwater samples collected around AOC 720 indicate the lack of contamination
3 from historical operation of the OWS system. An elevated lead concentration detected at one
4 location was not reproduced in the duplicate sample collected at the same time and location,
5 and the lead concentrations in surrounding samples were within the normal background
6 range. The site-average lead concentration is below the most conservative screening criteria.
7 No organic COPCs were identified in the site soils. The trace levels of pesticides and PAHs
8 detected in the soil samples were reflective of the general industrial setting at CNC, and are
9 below the screening criteria.

10 The only COPC detected in the groundwater at AOC 720 was pentachlorophenol, at a
11 concentration below the reporting limit but greater than the MCL. This chemical was not
12 detected in any other sample at AOC 720, and is not considered a COC. No COCs were
13 identified in soil or groundwater media surrounding the OWS at AOC 720.

TABLE 2-1
 Analytes Detected in Subsurface Soil at AOC 720
 CSI Report, AOC 720, Zone G, Charleston Naval Complex

Parameter	Sample Location	Date Sampled	Concentration (mg/kg)	Qualifier	SSL ^a	Zone G Subsurface Soil Background Range ^b
Metals						
Aluminum	G720SB001	06/11/2002	4,900	J	NL	798 - 45,300
	G720SB002	06/11/2002	5,300	J		
	G720SB003	06/11/2002	8,300	J		
	G720SB006	02/20/2003	13,800	=		
Antimony	G720SB003	06/11/2002	0.86	J	2.5	1.5 - 19
	G720SB006	02/20/2003	0.876	J		
Arsenic	G720SB001	06/11/2002	5.4	=	15	0.78 - 136
	G720SB002	06/11/2002	6.6	=		
	G720SB003	06/11/2002	7.9	=		
	G720SB006	02/20/2003	10.9	=		
Barium	G720SB001	06/11/2002	13	J	800	2.4 - 63
	G720SB002	06/11/2002	32	J		
	G720SB003	06/11/2002	28	J		
	G720SB006	02/20/2003	51.5	J		
Beryllium	G720SB001	06/11/2002	0.36	J	32	0.06 - 2.4
	G720SB002	06/11/2002	0.85	J		
	G720SB003	06/11/2002	0.56	J		
	G720SB006	02/20/2003	0.745	J		
Cadmium	G720SB001	06/11/2002	0.39	J	4	0.08 - 1.2
	G720SB002	06/11/2002	0.41	J		
	G720SB003	06/11/2002	0.45	J		
	G720SB006	02/20/2003	0.293	J		
Calcium	G720SB001	06/11/2002	160000	=	NL	346 - 320,000
	G720SB002	06/11/2002	200000	=		
	G720SB003	06/11/2002	150000	=		
	G720SB006	02/20/2003	52900	J		

TABLE 2-1
 Analytes Detected in Subsurface Soil at AOC 720
 CSI Report, AOC 720, Zone G, Charleston Naval Complex

Parameter	Sample Location	Date Sampled	Concentration (mg/kg)	Qualifier	SSL ^a	Zone G Subsurface Soil Background Range ^b
Chromium, Total	G720SB001	06/11/2002	32	J	19	2.9 - 95
	G720SB002	06/11/2002	43	J		
	G720SB003	06/11/2002	38	J		
	G720SB006	02/20/2003	35.6	J		
Cobalt	G720SB001	06/11/2002	0.91	J	1,000	0.27 - 15
	G720SB002	06/11/2002	0.97	J		
	G720SB003	06/11/2002	3.3	J		
	G720SB006	02/20/2003	3.71	J		
Copper	G720SB001	06/11/2002	8.5	=	5,300	0.53 - 46
	G720SB002	06/11/2002	8.9	=		
	G720SB003	06/11/2002	29	=		
	G720SB006	02/20/2003	25.2	J		
Iron	G720SB001	06/11/2002	4,500	J	NL	1,210 - 58,100
	G720SB002	06/11/2002	4,700	J		
	G720SB003	06/11/2002	8,100	J		
	G720SB006	02/20/2003	12,600	=		
Lead	G720SB001	06/11/2002	7.9	=	400	2.1 - 76
	G720SB002	06/11/2002	4.2	=		
	G720SB003	06/11/2002	890 ^c	=		
	G720SB004	02/20/2003	8.7	J		
	G720SB005	02/20/2003	9.27	J		
	G720SB006	02/20/2003	23.6	J		
Magnesium	G720SB001	06/11/2002	3,600	J	NL	80 - 12,700
	G720SB002	06/11/2002	6,100	J		
	G720SB003	06/11/2002	4,300	J		
	G720SB006	02/20/2003	3,090	=		
Manganese	G720SB001	06/11/2002	45	J	480	5.6 - 966
	G720SB002	06/11/2002	35	J		

TABLE 2-1
 Analytes Detected in Subsurface Soil at AOC 720
 CSI Report, AOC 720, Zone G, Charleston Naval Complex

Parameter	Sample Location	Date Sampled	Concentration (mg/kg)	Qualifier	SSL ^a	Zone G Subsurface Soil Background Range ^b
Manganese	G720SB003	06/11/2002	61	J	480	5.6 - 966
	G720SB006	02/20/2003	61.8	=		
Mercury	G720SB001	06/11/2002	0.025	J	1	0.02 - 1.3
	G720SB002	06/11/2002	0.019	J		
	G720SB003	06/11/2002	0.088	J		
	G720SB006	02/20/2003	0.0296	J		
Nickel	G720SB001	06/11/2002	14	=	65	0.74 - 78
	G720SB002	06/11/2002	17	=		
	G720SB003	06/11/2002	21	=		
	G720SB006	02/20/2003	14.2	J		
Potassium	G720SB001	06/11/2002	880	J	NL	60 - 3,790
	G720SB002	06/11/2002	1,000	J		
	G720SB003	06/11/2002	1,100	J		
	G720SB006	02/20/2003	1,130	J		
Selenium	G720SB001	06/11/2002	1.1	J	2.5	0.36 - 3.9
	G720SB002	06/11/2002	1.6	=		
	G720SB003	06/11/2002	0.95	J		
	G720SB006	02/20/2003	0.866	J		
Sodium	G720SB001	06/11/2002	850	J	NL	11 - 3,890
	G720SB002	06/11/2002	1,100	J		
	G720SB003	06/11/2002	930	J		
	G720SB006	02/20/2003	1,200	J		
Vanadium	G720SB001	06/11/2002	19	J	3,000	2.7 - 112
	G720SB002	06/11/2002	25	J		
	G720SB003	06/11/2002	25	J		
	G720SB006	02/20/2003	30.4	=		
Zinc	G720SB001	06/11/2002	36	=	6,000	1.8 - 233
	G720SB002	06/11/2002	37	=		

TABLE 2-1
 Analytes Detected in Subsurface Soil at AOC 720
 CSI Report, AOC 720, Zone G, Charleston Naval Complex

Parameter	Sample Location	Date Sampled	Concentration (mg/kg)	Qualifier	SSL ^a	Zone G Subsurface Soil Background Range ^b
Zinc	G720SB003	06/11/2002	120	=	6,000	1.8 - 233
	G720SB006	02/20/2003	66.6	J		
Semivolatile Organic Compounds						
BEQs	G720SB001	06/11/2002	0.298	=	NA	1.4
	G720SB003	06/11/2002	0.461	=		
	G720SB006	02/20/2003	0.181	=		
Benzo(a)Anthracene	G720SB001	06/11/2002	0.056	J	1	0.627
	G720SB003	06/11/2002	0.033	J		
	G720SB006	02/20/2003	0.0817	J		
Benzo(a)Pyrene	G720SB001	06/11/2002	0.055	J	4	0.623
	G720SB006	02/20/2003	0.125	J		
Benzo(b)Fluoranthene	G720SB001	06/11/2002	0.10	J	2.5	0.631
	G720SB003	06/11/2002	0.041	J		
	G720SB006	02/20/2003	0.226	J		
Benzo(g,h,i)Perylene	G720SB001	06/11/2002	0.054	J	NL	NA
	G720SB003	06/11/2002	0.037	J		
	G720SB006	02/20/2003	0.128	J		
Benzo(k)Fluoranthene	G720SB006	02/20/2003	0.106	J	25	0.596
Chrysene	G720SB001	06/11/2002	0.077	J	80	0.616
	G720SB003	06/11/2002	0.051	J		
	G720SB006	02/20/2003	0.141	J		
Fluoranthene	G720SB001	06/11/2002	0.12	J	2,100	NA
	G720SB003	06/11/2002	0.072	J		
	G720SB006	02/20/2003	0.0948	J		
Indeno(1,2,3-cd)pyrene	G720SB006	02/20/2003	0.13	J	7	0.525
Phenanthrene	G720SB001	06/11/2002	0.059	J	NA	NA
	G720SB003	06/11/2002	0.041	J		

TABLE 2-1
 Analytes Detected in Subsurface Soil at AOC 720
 CSI Report, AOC 720, Zone G, Charleston Naval Complex

Parameter	Sample Location	Date Sampled	Concentration (mg/kg)	Qualifier	SSL ^a	Zone G Subsurface Soil Background Range ^b
Phenanthrene	G720SB006	02/20/2003	0.0396	J	NA	NA
Pyrene	G720SB001	06/11/2002	0.1	J	2,100	NA
	G720SB006	02/20/2003	0.0937	J		
Volatile Organic Compounds						
1,2-DCE (total)	G720SB003	06/11/2002	0.0041	J	0.02	NA
Acetone	G720SB001	06/11/2002	0.065	J	0.80	NA
	G720SB002	06/11/2002	0.067	J		
	G720SB003	06/11/2002	0.092	J		
	G720SB006	02/20/2003	0.0312	J		
Carbon Disulfide	G720SB002	06/11/2002	0.0045	J	2.00	NA
	G720SB003	06/11/2002	0.0053	J		
cis-1,2-DCE	G720SB003	06/11/2002	0.0041	J	0.02	NA
Methyl ethyl ketone (2-Butanone)	G720SB001	06/11/2002	0.0088	J	0.40	NA
	G720SB002	06/11/2002	0.0077	J		
	G720SB003	06/11/2002	0.0079	J		
Pesticides and PCBs						
Aroclor-1260	G720SB006	02/20/2003	0.002	J	NA	NA
Alpha-chlordane	G720SB003	06/11/2002	0.00064	J	5	NA
Beta-BHC	G720SB006	02/20/2003	0.0015	J	0.0015	NA
Delta-BHC	G720SB006	02/20/2003	0.0014	J	0.0045	NA
Endosulfan Sulfate	G720SB006	02/20/2003	0.00224	J	9	NA
Endrin Aldehyde	G720SB003	06/11/2002	0.00053	J	2.7	NA
Gamma-chlordane	G720SB003	06/11/2002	0.0019	J	5	NA
Heptachlor	G720SB006	02/20/2003	0.0015	J	12	NA
Lindane	G720SB006	02/20/2003	0.001	J	0.0045	NA

TABLE 2-1
 Analytes Detected in Subsurface Soil at AOC 720
 CSI Report, AOC 720, Zone G, Charleston Naval Complex

Parameter	Sample Location	Date Sampled	Concentration (mg/kg)	Qualifier	SSL ^a	Zone G Subsurface Soil Background Range ^b
p,p'-DDD	G720SB001	06/11/2002	0.012	J	8	NA
	G720SB003	06/11/2002	0.024	J		
	G720SB006	02/20/2003	0.0192	=		
p,p'-DDE	G720SB001	06/11/2002	0.0092	J	27	NA
	G720SB003	06/11/2002	0.021	=		
	G720SB006	02/20/2003	0.0177	=		
p,p'-DDT	G720SB003	06/11/2002	0.0042	=	16	NA

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

Concentrations in bold type and outlined exceed the SSL and Background Range.

^a SSLs from EPA Soil Screening Guidance: User's Guide; DAF = 1.0 for VOCs, DAF = 10 for others

^b Background Range values for metals are the minimum and maximum concentrations detected in Zones G and H grid samples.

^c Lead concentration in field duplicate sample at F720SB003 is 13 mg/kg.

NA = Not available

NL = Not listed

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

J indicates that the concentration reported is an estimated concentration.

TABLE 2-2
 Organic Analytes Detected in Groundwater at AOC 720^a
 CSI Report, AOC 720, Zone G, Charleston Naval Complex

Parameter	Sample Location	Date Sampled	Concentration (µg/L)	Qualifier	MCL/RBC ^b
Semivolatile Organic Compounds					
Acenaphthene	G720GP001	06/18/2002	0.49	J	<i>37</i>
2,4,6-Trichlorophenol	G720GP006	03/12/2003	0.494	J	<i>6.1</i>
2,4-Dichlorophenol	G720GP006	03/12/2003	0.53	J	<i>11</i>
2-Chlorophenol	G720GP006	03/12/2003	0.625	J	<i>3</i>
Hexachlorobutadiene	G720GP006	03/12/2003	0.37	J	<i>0.86</i>
Naphthalene	G720GP006	03/12/2003	0.444	J	<i>0.65</i>
Pentachlorophenol	G720GP006	03/12/2003	5.9	J	<i>1</i>
Pyrene	G720GP006	03/12/2003	0.526	J	<i>18</i>
2-Methylphenol (o-Cresol)	G720GP006	03/12/2003	0.525	J	<i>180</i>

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

Values that are bold and outlined within the table indicate an exceedance of the appropriate screening criteria.

^aThe results of inorganic analyses of the unfiltered, unscreened groundwater sample from G720GP006 are presented in the Data Summary Tables in Appendix B of this CSI Report.

^bRisk-based concentrations (RBCs) are listed in italics where no primary MCL exists. RBCs are 1/10 of tap water RBC listed in EPA Region III RBC (October 2000) table for non-carcinogenic compounds (HI=0.1).

J = Estimated concentration

TABLE 2-3
 COPC Refinement; Lead in Subsurface Soil at AOC 720
 CSI Report, AOC 720, Zone G, Charleston Naval Complex

Sample Location	Date Sampled	Lead Concentration (mg/kg)	Qualifier	Average Lead Concentration at Sample Location
G720SB001	06/11/2002	7.9	=	7.9
G720SB002	06/11/2002	4.2	=	4.2
G720SB003	06/11/2002	890	=	452
G720SB003 (duplicate)	06/11/2002	13	=	
G720SB004	02/20/2003	8.7	J	8.7
G720SB005	02/20/2003	9.27	J	9.27
G720SB006	02/20/2003	23.6	J	18.8
G720SB006 (duplicate)	02/20/2003	14	J	
Average AOC 720 Lead Concentration				83

SSL= 400 mg/kg, from EPA Soil Soil Screening Guidance: User's Guide 1996 Background Range = 2.1 to 76 mg/kg; values are the minimum and maximum concentrations detected in Zones G and H subsurface soil grid samples.

TABLE 2-4
 COPC Refinement; Pentachlorophenol at AOC 720
 CSI Report, AOC 720, Zone G, Charleston Naval Complex

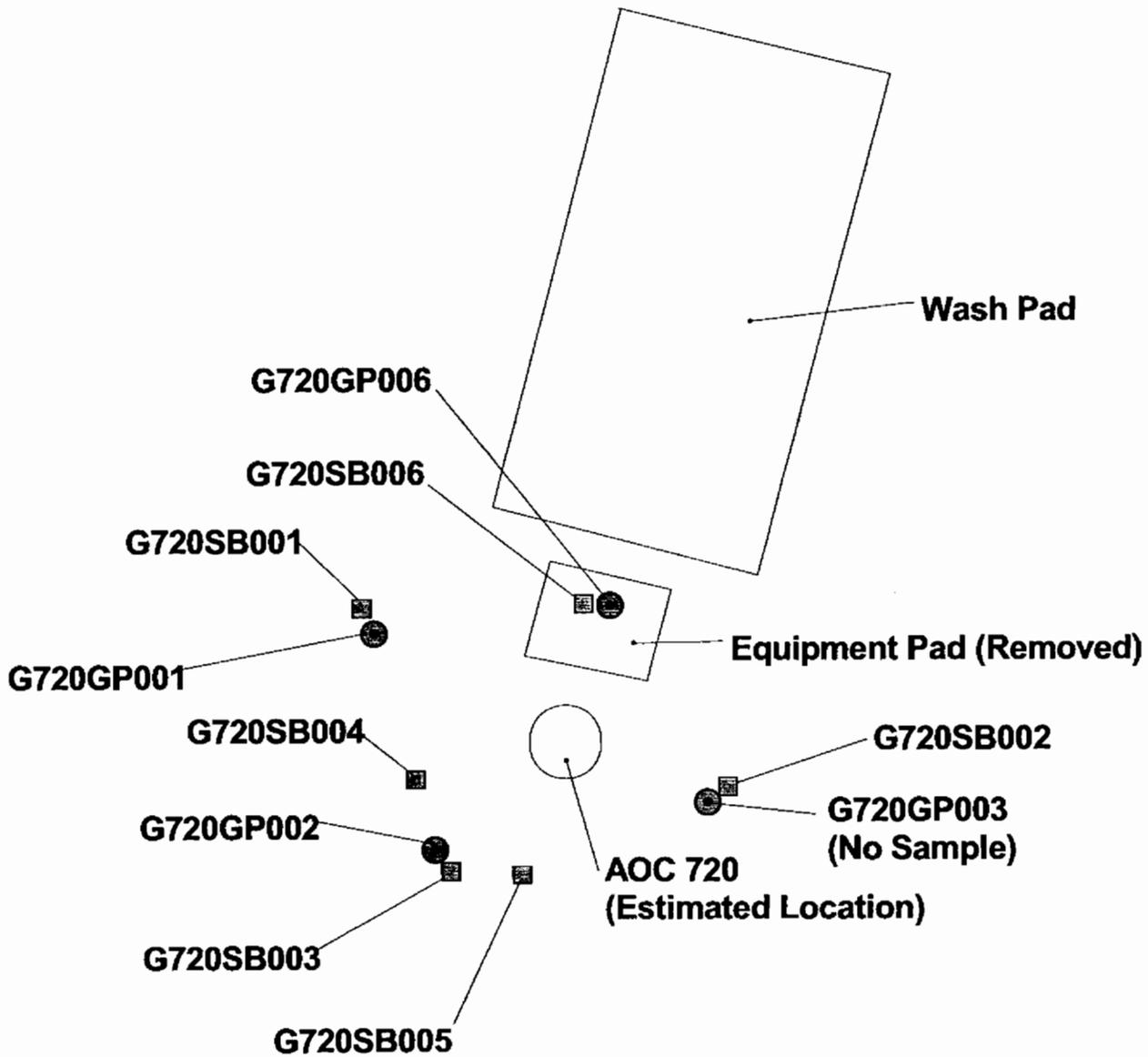
Sample Location	Date Sampled	Units	Pentachlorophenol Concentration	Qualifier
Groundwater				
G720GP001	06/18/2002	µg/L	48.8	U
G720GP006	03/12/2003	µg/L	5.9	J
Subsurface Soil				
G720SB001	06/11/2002	mg/kg	2.0	U
G720SB002	06/11/2002	mg/kg	2.3	U
G720SB003	06/11/2002	mg/kg	2.1	U
G720SB003 (duplicate)	06/11/2002	mg/kg	2.0	U
G720SB006	02/20/2003	mg/kg	1.6	U
G720SB006 (duplicate)	02/20/2003	mg/kg	1.6	U

Maximum contaminant level (MCL) is 1 microgram per liter (µg/L).

U = Analyte not detected

J = Estimated concentration

Result (51 U) from sample location G720GP002 rejected as unusable, due to associated laboratory QC parameters out of criteria.



- Subsurface Soil
- Groundwater Probe Sample

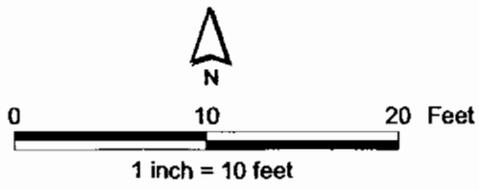


Figure 2-1
CSI Samples AOC 720
Confirmation Sampling Investigation
Charleston Naval Complex



3.0 AOC 720 CSI Conclusions and Recommendations

This section summarizes the conclusions and recommendations resulting from the data evaluation for the CSI at AOC 720.

- The OWS was associated with an equipment wash pad approximately 150 feet from the former Building X12, and reportedly not associated with the building operations. Its installation, operation history, and configuration are unknown. It drains to the sanitary sewer system.
- Soil and groundwater samples were collected surrounding the OWS specifically to investigate the OWS site, as provided in the approved *Sampling and Analysis Plan; AOC 713, Zone F; AOC 720, Zone F; Oil/Water Separators; Charleston Naval Complex* (CH2M-Jones, 2002) and *Sampling and Analysis Plan Addendum; Area of Concern 720, Zone G* (CH2M-Jones, 2003). One groundwater sample could not be collected because the aquifer did not yield sufficient groundwater.
- Soil and groundwater samples were analyzed for VOCs, SVOCs, PCBs, pesticides, and metals.
- None of the soil chemicals were identified as COCs. Only one sample had a lead detection above conservative COPC screening criteria; however its field duplicate sample and two other samples collected within 5 feet of it contained lead at background levels. Therefore, lead is not considered a COC at this site.
- Pentachlorophenol was detected in one groundwater sample, at an estimated concentration an order of magnitude below the reporting limit but above the MCL. This compound was not detected in any other site sample, and does not appear representative of site conditions. Therefore, it is not considered a COC at AOC 720.

Thus, site soil and groundwater at AOC 720 do not appear to have been adversely impacted by the OWS, and do not present a human health or ecological exposure concern under current or unrestricted (i.e., residential) land use conditions.

Therefore, based on the analytical data which indicate a lack of contamination, AOC 720 is recommended for NFA status.

1 **4.0 References**

- 2 CH2M-Jones. *Sampling and Analysis Plan; AOC 720, Zone F; AOC 720, Zone F; Oil/Water*
- 3 *Separators*. Charleston Naval Complex. March 2002.
- 4 Davis and Floyd. *Evaluation of Drainage System Serving Charleston Naval Complex*. September
- 5 1998.
- 6 Department of the Navy, Southern Division. *RCRA Facility Assessment (RFA) Revision 1*.
- 7 Charleston Naval Complex. February 2001.
- 8 EnSafe Inc. *Zone G RCRA Facility Investigation Report, NAVBASE Charleston*. Revision 0.
- 9 February 20, 1998.

Appendix A



Wash pad and equipment pad at AOC 720, looking south. OWS is located beneath weeds south of equipment pad.



AOC 720, looking north toward Hobson Avenue. Aboveground PVC piping may be associated with the OWS.

Metals, Subsurface Soils		StationID	G720SB001		G720SB002		G720SB002		
AOC 720		SampleID	720SB00102 (3-5ft)		720SB00202 (3-5ft)		720SB00202 (3-5ft)		
		DateCollected	6/11/2002		6/11/2002		6/11/2002		
		DateExtracted	6/17/2002		6/17/2002		6/18/2002		
		DateAnalyzed	6/18/2002		6/25/2002		6/25/2002		
		SDGNumber	CNC114		CNC114		CNC114		
Parameter	Units								
Aluminum	mg/kg		4900	J			5300	J	
Antimony	mg/kg		0.62	U			0.66	U	
Arsenic	mg/kg		5.4	=			6.6	=	
Barium	mg/kg		13	J			32	J	
Beryllium	mg/kg		0.36	J			0.85	J	
Cadmium	mg/kg		0.39	J			0.41	J	
Calcium	mg/kg		160000	=			200000	=	
Chromium, Total	mg/kg		32	J			43	J	
Cobalt	mg/kg		0.91	J			0.97	J	
Copper	mg/kg		8.5	=			8.9	=	
Iron	mg/kg		4500	J			4700	J	
Lead	mg/kg		7.9	=			4.2	=	
Magnesium	mg/kg		3600	J			6100	J	
Manganese	mg/kg		45	J			35	J	
Nickel	mg/kg		14	=			17	=	
Potassium	mg/kg		880	J			1000	J	
Selenium	mg/kg		1.1	J			1.6	=	
Silver	mg/kg		0.23	U			0.25	U	
Sodium	mg/kg		850	J			1100	J	
Thallium	mg/kg		0.7	U			0.75	U	
Vanadium	mg/kg		19	J			25	J	
Zinc	mg/kg		36	=			37	=	
Mercury	mg/kg	0.025	J			0.019	J		

Analytical Data Summary

09/24/2002 3:42 PM

Metals, Subsurface Soils AOC 720	StationID	G720SB003		G720SB003		G720SB003		G720SB003	
	SampleID	720CB00302 (3-5ft)		720CB00302 (3-5ft)		720SB00302 (3-5ft)		720SB00302 (3-5ft)	
	DateCollected	6/11/2002		6/11/2002		6/11/2002		6/11/2002	
	DateExtracted	6/17/2002		6/18/2002		6/17/2002		6/18/2002	
	DateAnalyzed	6/18/2002		6/25/2002		6/18/2002		6/25/2002	
	SDGNumber	CNC114		CNC114		CNC114		CNC114	
Parameter	Units								
Aluminum	mg/kg		7200	J			8300	J	
Antimony	mg/kg		0.76	J			0.86	J	
Arsenic	mg/kg		8	=			7.9	=	
Barium	mg/kg		32	J			28	J	
Beryllium	mg/kg		0.52	J			0.56	J	
Cadmium	mg/kg		0.48	J			0.45	J	
Calcium	mg/kg		170000	=			150000	=	
Chromium, Total	mg/kg		43	J			38	J	
Cobalt	mg/kg		2	J			3.3	J	
Copper	mg/kg		22	=			29	=	
Iron	mg/kg		7300	J			8100	J	
Lead	mg/kg		13	=			890	=	
Magnesium	mg/kg		4500	J			4300	J	
Manganese	mg/kg		56	J			61	J	
Nickel	mg/kg		23	=			21	=	
Potassium	mg/kg		1100	J			1100	J	
Selenium	mg/kg		1.1	J			0.95	J	
Silver	mg/kg		0.24	U			0.25	U	
Sodium	mg/kg		1000	J			930	J	
Thallium	mg/kg		0.73	U			0.74	U	
Vanadium	mg/kg		24	J			25	J	
Zinc	mg/kg		61	=			120	=	
Mercury	mg/kg	0.07	J			0.088	J		

PCBs, Subsurface Soils AOC 720		StationID	G720SB001		G720SB002		G720SB003		G720SB003		G720SB003		
		SampleID	720SB00102 (3-5ft)		720SB00202 (3-5ft)		720CB00302 (3-5ft)		720CB00302DL (3-5ft)		720SB00302 (3-5ft)		
		DateCollected	6/11/2002		6/11/2002		6/11/2002		6/11/2002		6/11/2002		
		DateExtracted	6/14/2002		6/14/2002		6/14/2002		6/14/2002		6/14/2002		
		DateAnalyzed	6/18/2002		6/18/2002		6/18/2002		6/18/2002		6/18/2002		
		SDGNumber	CNC114		CNC114		CNC114		CNC114		CNC114		
Parameter	Units												
PCB-1016 (Arochlor 1016)	ug/kg	41	U	48	U	42	U	170	R	43	U		
PCB-1221 (Arochlor 1221)	ug/kg	41	U	48	U	42	U	170	R	43	U		
PCB-1232 (Arochlor 1232)	ug/kg	41	U	48	U	42	U	170	R	43	U		
PCB-1242 (Arochlor 1242)	ug/kg	41	U	48	U	42	U	170	R	43	U		
PCB-1248 (Arochlor 1248)	ug/kg	41	U	48	U	42	U	170	R	43	U		
PCB-1254 (Arochlor 1254)	ug/kg	83	U	97	U	86	U	340	R	87	U		
PCB-1260 (Arochlor 1260)	ug/kg	83	UJ	97	UJ	86	UJ	340	R	87	UJ		

Analytical Data Summary

09/24/2002 3:42 PM

Pesticides, Subsurface Soils
AOC 720

	StationID	G720SB001		G720SB002		G720SB003	
	SampleID	720SB00102 (3-5ft)		720SB00202 (3-5ft)		720CB00302 (3-5ft)	
	DateCollected	6/11/2002		6/11/2002		6/11/2002	
	DateExtracted	6/14/2002		6/14/2002		6/14/2002	
	DateAnalyzed	6/18/2002		6/18/2002		6/18/2002	
	SDGNumber	CNC114		CNC114		CNC114	
Parameter	Units						
Aldrin	ug/kg	1.6	U	1.9	U	1.7	U
Alpha BHC (Alpha Hexachlorocyclohexane)	ug/kg	1.6	U	1.9	U	1.7	U
Alpha-chlordane	ug/kg	1.6	U	1.9	U	1	J
Beta BHC (Beta Hexachlorocyclohexane)	ug/kg	1.6	U	1.9	U	1.7	U
Chlordane	ug/kg	16	U	19	U	17	U
Delta BHC (Delta Hexachlorocyclohexane)	ug/kg	1.6	U	1.9	U	1.7	U
Dieldrin	ug/kg	3.1	U	3.6	U	3.2	U
Endosulfan I	ug/kg	1.6	U	1.9	U	1.7	U
Endosulfan II	ug/kg	3.1	U	3.6	U	0.72	J
Endosulfan Sulfate	ug/kg	3.1	U	3.6	U	3.2	U
Endrin Aldehyde	ug/kg	3.1	UJ	3.6	UJ	0.52	J
Endrin Ketone	ug/kg	3.1	U	3.6	U	3.2	U
Endrin	ug/kg	3.1	U	3.6	U	3.2	U
Gamma BHC (Lindane)	ug/kg	1.6	U	1.9	U	1.7	U
Gamma-chlordane	ug/kg	1.6	U	1.9	U	5.3	J
Heptachlor Epoxide	ug/kg	1.6	U	1.9	U	1.7	U
Heptachlor	ug/kg	1.6	U	1.9	U	0.42	J
Methoxychlor	ug/kg	16	UJ	19	UJ	17	UJ
p,p'-DDD	ug/kg	12	J	3.6	U	30	J
p,p'-DDE	ug/kg	9.2	J	3.6	U	21	J
p,p'-DDT	ug/kg	3.1	U	3.6	U	190	R
Toxaphene	ug/kg	100	U	120	U	110	U

**Pesticides, Subsurface Soils
AOC 720**

Parameter	Units	StationID G720SB003		StationID G720SB003	
		SampleID	720CB00302DL (3-5ft)	SampleID	720SB00302 (3-5ft)
		DateCollected	6/11/2002	DateCollected	6/11/2002
		DateExtracted	6/14/2002	DateExtracted	6/14/2002
		DateAnalyzed	6/18/2002	DateAnalyzed	6/18/2002
		SDGNumber	CNC114	SDGNumber	CNC114
Aldrin	ug/kg	6.7	R	1.7	U
Alpha BHC (Alpha Hexachlorocyclohexane)	ug/kg	6.7	R	1.7	U
Alpha-chlordane	ug/kg	1.7	R	0.64	J
Beta BHC (Beta Hexachlorocyclohexane)	ug/kg	6.7	R	1.7	U
Chlordane	ug/kg	67	R	17	U
Delta BHC (Delta Hexachlorocyclohexane)	ug/kg	6.7	R	1.7	U
Dieldrin	ug/kg	13	R	3.2	U
Endosulfan I	ug/kg	6.7	R	1.7	U
Endosulfan II	ug/kg	13	R	3.2	U
Endosulfan Sulfate	ug/kg	13	R	3.2	U
Endrin Aldehyde	ug/kg	13	R	0.53	J
Endrin Ketone	ug/kg	13	R	3.2	U
Endrin	ug/kg	13	R	3.2	U
Gamma BHC (Lindane)	ug/kg	6.7	R	1.7	U
Gamma-chlordane	ug/kg	6.7	R	1.9	J
Heptachlor Epoxide	ug/kg	6.7	R	1.7	U
Heptachlor	ug/kg	6.7	R	1.7	U
Methoxychlor	ug/kg	67	R	17	UJ
p,p'-DDD	ug/kg	43	R	24	J
p,p'-DDE	ug/kg	28	R	21	=
p,p'-DDT	ug/kg	240	J	4.2	=
Toxaphene	ug/kg	420	R	110	U

Analytical Data Summary

09/24/2002 3:42 PM

SVOCs, Subsurface Soils
AOC 720

Parameter	Units	G720SB001		G720SB002		G720SB003		G720SB003	
		StationID	SampleID	StationID	SampleID	StationID	SampleID	StationID	SampleID
		720SB00102 (3-5ft)	720SB00202 (3-5ft)	720CB00302 (3-5ft)	720SB00302 (3-5ft)				
		DateCollected	6/11/2002	6/11/2002	6/11/2002	6/11/2002	6/11/2002	6/11/2002	6/11/2002
		DateExtracted	6/17/2002	6/17/2002	6/17/2002	6/17/2002	6/17/2002	6/17/2002	6/17/2002
		DateAnalyzed	6/18/2002	6/18/2002	6/18/2002	6/18/2002	6/18/2002	6/18/2002	6/18/2002
		SDGNumber	CNC114	CNC114	CNC114	CNC114	CNC114	CNC114	CNC114
N-Nitrosodiphenylamine	ug/kg	410	U	480	U	420	U	430	U
Phenol	ug/kg	410	U	480	U	420	U	430	U
bis(2-Chloroethyl) ether (2-Chloroethyl Ether)	ug/kg	410	U	480	U	420	U	430	U
Bis(2-Chloroisopropyl)Ether	ug/kg	410	U	480	U	420	U	430	U
2-Chlorophenol	ug/kg	410	U	480	U	420	U	430	U
1,4-Dichlorobenzene	ug/kg	410	U	480	U	420	U	430	U
Benzyl alcohol	ug/kg	410	U	480	U	420	U	430	U
1,2-Dichlorobenzene	ug/kg	410	U	480	U	420	U	430	U
1,3-Dichlorobenzene	ug/kg	410	U	480	U	420	U	430	U
2-Methylphenol (o-Cresol)	ug/kg	410	U	480	U	420	U	430	U
N-Nitrosodi-n-propylamine	ug/kg	410	U	480	U	420	UJ	430	U
3-Methylphenol/4-Methylphenol (mp-Cresol)	ug/kg	410	U	480	U	420	U	430	U
Hexachloroethane	ug/kg	410	U	480	U	420	U	430	U
Nitrobenzene	ug/kg	410	U	480	U	420	U	430	U
Isophorone	ug/kg	410	U	480	U	420	U	430	U
2-Nitrophenol	ug/kg	410	U	480	U	420	U	430	U
2,4-Dimethylphenol	ug/kg	410	U	480	U	420	U	430	U
bis(2-Chloroethoxy) Methane	ug/kg	410	U	480	U	420	U	430	U
2,4-Dichlorophenol	ug/kg	410	U	480	U	420	U	430	U
Benzoic acid	ug/kg	2000	U	2300	U	2000	U	2100	U
1,2,4-Trichlorobenzene	ug/kg	410	U	480	U	420	UJ	430	U
Naphthalene	ug/kg	410	U	480	U	420	U	430	U
4-Chloroaniline	ug/kg	410	U	480	U	420	U	430	U
Hexachlorobutadiene	ug/kg	410	U	480	U	420	U	430	U
4-Chloro-3-methylphenol	ug/kg	410	U	480	U	420	U	430	U
2-Methylnaphthalene	ug/kg	410	U	480	U	420	U	430	U
Hexachlorocyclopentadiene	ug/kg	410	U	480	U	420	U	430	U
2,4,6-Trichlorophenol	ug/kg	410	U	480	U	420	U	430	U
2,4,5-Trichlorophenol	ug/kg	2000	U	2300	U	2000	U	2100	U
2-Chloronaphthalene	ug/kg	410	U	480	U	420	U	430	U

**SVOCs, Subsurface Soils
AOC 720**

StationID	G720SB001		G720SB002		G720SB003		G720SB003		
SampleID	720SB00102 (3-5ft)		720SB00202 (3-5ft)		720CB00302 (3-5ft)		720SB00302 (3-5ft)		
DateCollected	6/11/2002		6/11/2002		6/11/2002		6/11/2002		
DateExtracted	6/17/2002		6/17/2002		6/17/2002		6/17/2002		
DateAnalyzed	6/18/2002		6/18/2002		6/18/2002		6/18/2002		
SDGNumber	CNC114		CNC114		CNC114		CNC114		
Parameter	Units								
2-Nitroaniline	ug/kg	2000	U	2300	U	2000	U	2100	U
3-Nitroaniline	ug/kg	2000	U	2300	U	2000	U	2100	U
Dimethyl Phthalate	ug/kg	410	U	480	U	420	UJ	430	U
2,6-Dinitrotoluene	ug/kg	410	U	480	U	420	U	430	U
Acenaphthylene	ug/kg	410	U	480	U	420	U	430	U
Acenaphthene	ug/kg	410	U	480	U	76	J	430	U
2,4-Dinitrophenol	ug/kg	2000	U	2300	U	2000	U	2100	U
Dibenzofuran	ug/kg	410	U	480	U	420	U	430	U
2,4-Dinitrotoluene	ug/kg	410	U	480	U	420	U	430	U
Diethyl Phthalate	ug/kg	410	U	480	U	420	U	430	U
4-Nitrophenol	ug/kg	2000	U	2300	U	2000	U	2100	U
Fluorene	ug/kg	410	U	480	U	78	J	430	U
4-Chlorophenyl Phenyl Ether	ug/kg	410	U	480	U	420	U	430	U
4,6-Dinitro-2-methylphenol	ug/kg	2000	U	2300	U	2000	U	2100	U
4-Nitroaniline	ug/kg	2000	U	2300	U	2000	U	2100	U
4-Bromophenyl Phenyl Ether	ug/kg	410	U	480	U	420	U	430	U
Hexachlorobenzene	ug/kg	410	U	480	U	420	U	430	U
Pentachlorophenol	ug/kg	2000	U	2300	U	2000	U	2100	U
Phenanthrene	ug/kg	59	J	480	U	590	J	41	J
Anthracene	ug/kg	410	U	480	U	420	U	430	U
Di-n-butyl Phthalate	ug/kg	410	U	480	U	420	U	430	U
Fluoranthene	ug/kg	120	J	480	U	440	=	72	J
Pyrene	ug/kg	100	J	480	U	610	=	430	U
Benzyl Butyl Phthalate	ug/kg	410	U	480	U	420	UJ	430	U
Benzo(a)Anthracene	ug/kg	56	J	480	U	210	J	33	J
3,3'-Dichlorobenzidine	ug/kg	810	U	960	U	850	U	860	U
Chrysene	ug/kg	77	J	480	U	260	J	51	J
bis(2-Ethylhexyl) Phthalate	ug/kg	410	U	480	U	420	U	430	U
Di-n-octylphthalate	ug/kg	410	U	480	U	420	U	430	U
Benzo(b)Fluoranthene	ug/kg	100	J	480	U	120	J	41	J

Analytical Data Summary

09/24/2002 3:42 PM

SVOCs, Subsurface Soils
AOC 720

	StationID	G720SB001	G720SB002	G720SB003	G720SB003
	SampleID	720SB00102 (3-5ft)	720SB00202 (3-5ft)	720CB00302 (3-5ft)	720SB00302 (3-5ft)
	DateCollected	6/11/2002	6/11/2002	6/11/2002	6/11/2002
	DateExtracted	6/17/2002	6/17/2002	6/17/2002	6/17/2002
	DateAnalyzed	6/18/2002	6/18/2002	6/18/2002	6/18/2002
	SDGNumber	CNC114	CNC114	CNC114	CNC114
Parameter	Units				
Benzo(k)Fluoranthene	ug/kg	410 U	480 U	140 J	430 U
Benzo(a)Pyrene	ug/kg	55 J	480 U	180 J	430 U
Indeno(1,2,3-c,d)pyrene	ug/kg	410 U	480 U	420 UJ	430 U
Dibenz(a,h)anthracene	ug/kg	410 U	480 U	420 U	430 U
Benzo(g,h,i)Perylene	ug/kg	54 J	480 U	130 J	37 J
Carbazole	ug/kg	410 U	480 U	420 U	430 U

VOCs, Subsurface Soils
AOC 720

StationID	G720SB001		G720SB002		G720SB003		G720SB003		
SampleID	720SB00102 (3-5ft)		720SB00202 (3-5ft)		720CB00302 (3-5ft)		720SB00302 (3-5ft)		
DateCollected	6/11/2002		6/11/2002		6/11/2002		6/11/2002		
DateExtracted	6/17/2002		6/17/2002		6/17/2002		6/17/2002		
DateAnalyzed	6/17/2002		6/17/2002		6/17/2002		6/17/2002		
SDGNumber	CNC114		CNC114		CNC114		CNC114		
Parameter	Units								
Chloromethane	ug/kg	13	U	14	U	13	U	14	U
Vinyl chloride	ug/kg	13	U	14	U	13	U	14	U
Bromomethane	ug/kg	13	UJ	14	UJ	13	UJ	14	UJ
Chloroethane	ug/kg	13	U	14	U	13	U	14	U
1,1-Dichloroethene	ug/kg	6.4	UJ	7.1	UJ	6.5	UJ	6.8	UJ
Acetone	ug/kg	65	J	67	J	150	J	92	J
Carbon Disulfide	ug/kg	6.4	UJ	4.5	J	12	J	5.3	J
Methylene Chloride	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
trans-1,2-Dichloroethene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
1,1-Dichloroethane	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
Vinyl acetate	ug/kg	13	U	14	U	13	U	14	U
Methyl ethyl ketone (2-Butanone)	ug/kg	8.8	J	7.7	J	20	J	7.9	J
cis-1,2-Dichloroethylene	ug/kg	6.4	U	7.1	U	6.5	U	4.1	J
1,2-Dichloroethene (total)	ug/kg	6.4	U	7.1	U	6.5	U	4.1	J
Chloroform	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
1,1,1-Trichloroethane	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
Carbon Tetrachloride	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
1,2-Dichloroethane	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
Benzene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
Trichloroethylene (TCE)	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
1,2-Dichloropropane	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
Bromodichloromethane	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
2-Chloroethyl vinyl ether	ug/kg	13	UJ	14	UJ	13	UJ	14	UJ
cis-1,3-Dichloropropene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/kg	13	UJ	14	UJ	13	UJ	14	UJ
Toluene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
trans-1,3-Dichloropropene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
1,1,2-Trichloroethane	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
2-Hexanone	ug/kg	13	UJ	14	UJ	13	UJ	14	UJ
Tetrachloroethylene (PCE)	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U

Analytical Data Summary

09/24/2002 3:42 PM

VOCs, Subsurface Soils
AOC 720

	StationID	G720SB001		G720SB002		G720SB003		G720SB003	
	SampleID	720SB00102 (3-5ft)		720SB00202 (3-5ft)		720CB00302 (3-5ft)		720SB00302 (3-5ft)	
	DateCollected	6/11/2002		6/11/2002		6/11/2002		6/11/2002	
	DateExtracted	6/17/2002		6/17/2002		6/17/2002		6/17/2002	
	DateAnalyzed	6/17/2002		6/17/2002		6/17/2002		6/17/2002	
	SDGNumber	CNC114		CNC114		CNC114		CNC114	
Parameter	Units								
Dibromochloromethane	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
Chlorobenzene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
Ethylbenzene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
m+p Xylene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
o-Xylene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
Xylenes, Total	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
Styrene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
Bromoform	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
1,1,2,2-Tetrachloroethane	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
1,3-Dichlorobenzene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
1,4-Dichlorobenzene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
1,2-Dichlorobenzene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
1,2,4-Trichlorobenzene	ug/kg	6.4	U	7.1	U	6.5	U	6.8	U
1,2,3-Trichlorobenzene	ug/kg	6.4	UJ	7.1	UJ	6.5	UJ	6.8	UJ

**PCBs, Groundwater
AOC 720**

StationID	G720GP001	G720GP002
SampleID	720GP001M2	720GP002M2
DateCollected	6/18/2002	6/18/2002
DateExtracted	6/22/2002	6/22/2002
DateAnalyzed	7/4/2002	7/4/2002
SDGNumber	62384	62384

Parameter	Units				
PCB-1016 (Arochlor 1016)	ug/L	4.9	U	0.98	U
PCB-1221 (Arochlor 1221)	ug/L	4.9	U	0.98	U
PCB-1232 (Arochlor 1232)	ug/L	4.9	U	0.98	U
PCB-1242 (Arochlor 1242)	ug/L	4.9	U	0.98	U
PCB-1248 (Arochlor 1248)	ug/L	4.9	U	0.98	U
PCB-1254 (Arochlor 1254)	ug/L	9.8	U	2	U
PCB-1260 (Arochlor 1260)	ug/L	9.8	U	2	U

Analytical Data Summary

09/24/2002 3:42 PM

Pesticides, Groundwater
AOC 720

Parameter	Units	StationID		G720GP002	
		G720GP001			
		G720GP001		G720GP002	
		720GP001M2		720GP002M2	
		6/18/2002		6/18/2002	
		6/25/2002		6/25/2002	
		6/28/2002		6/28/2002	
		62384		62384	
Aldrin	ug/L	0.04	U	0.041	U
Alpha BHC (Alpha Hexachlorocyclohexane)	ug/L	0.04	U	0.041	U
Alpha-chlordane	ug/L	0.04	U	0.041	U
Beta BHC (Beta Hexachlorocyclohexane)	ug/L	0.04	U	0.041	U
Chlordane	ug/L	0.4	U	0.41	U
Delta BHC (Delta Hexachlorocyclohexane)	ug/L	0.04	U	0.041	U
Dieldrin	ug/L	0.08	U	0.082	U
Endosulfan I	ug/L	0.04	U	0.041	U
Endosulfan II	ug/L	0.08	U	0.082	U
Endosulfan Sulfate	ug/L	0.08	U	0.082	U
Endrin Aldehyde	ug/L	0.08	U	0.082	U
Endrin Ketone	ug/L	0.08	U	0.082	U
Endrin	ug/L	0.08	U	0.082	U
Gamma BHC (Lindane)	ug/L	0.04	U	0.041	U
Gamma-chlordane	ug/L	0.04	U	0.041	U
Heptachlor Epoxide	ug/L	0.04	U	0.041	U
Heptachlor	ug/L	0.04	U	0.041	U
Methoxychlor	ug/L	0.38	U	0.39	U
p,p'-DDD	ug/L	0.08	U	0.082	U
p,p'-DDE	ug/L	0.08	U	0.082	U
p,p'-DDT	ug/L	0.08	U	0.082	U
Toxaphene	ug/L	2.5	U	2.6	U

**SVOCs, Groundwater
AOC 720**

Parameter	Units	StationID	G720GP001		G720GP002	
		SampleID	Value	Unit	Value	Unit
		720GP001M2	720GP002M2			
		DateCollected	6/18/2002		6/18/2002	
		DateExtracted	6/24/2002		6/24/2002	
		DateAnalyzed	6/29/2002		6/29/2002	
		SDGNumber	62384		62384	
Phenol	ug/L		9.8	U	10.2	R
bis(2-Chloroethyl) ether (2-Chloroethyl Ether)	ug/L		9.8	U	10.2	U
2-Chlorophenol	ug/L		9.8	U	10.2	R
1,3-Dichlorobenzene	ug/L		9.8	U	10.2	U
1,4-Dichlorobenzene	ug/L		9.8	U	10.2	U
Benzyl alcohol	ug/L		9.8	U	10.2	U
1,2-Dichlorobenzene	ug/L		9.8	U	10.2	U
Bis(2-Chloroisopropyl)Ether	ug/L		9.8	U	10.2	U
2-Methylphenol (o-Cresol)	ug/L		9.8	U	10.2	R
N-Nitrosodi-n-propylamine	ug/L		9.8	U	10.2	U
3-Methylphenol/4-Methylphenol (mp-Cresol)	ug/L		9.8	U	10.2	R
Hexachloroethane	ug/L		9.8	U	10.2	U
Nitrobenzene	ug/L		9.8	U	10.2	U
Isophorone	ug/L		9.8	U	10.2	U
2-Nitrophenol	ug/L		9.8	U	10.2	R
2,4-Dimethylphenol	ug/L		9.8	U	10.2	R
bis(2-Chloroethoxy) Methane	ug/L		9.8	U	10.2	U
2,4-Dichlorophenol	ug/L		9.8	U	10.2	R
Benzoic acid	ug/L		48.8	R	51	R
1,2,4-Trichlorobenzene	ug/L		9.8	U	10.2	U
Naphthalene	ug/L		9.8	U	10.2	U
4-Chloroaniline	ug/L		9.8	U	10.2	U
Hexachlorobutadiene	ug/L		9.8	U	10.2	U
4-Chloro-3-methylphenol	ug/L		9.8	U	10.2	R
2-Methylnaphthalene	ug/L		9.8	U	10.2	U
Hexachlorocyclopentadiene	ug/L		9.8	U	10.2	U
2,4,6-Trichlorophenol	ug/L		9.8	U	10.2	R
2,4,5-Trichlorophenol	ug/L		48.8	U	51	R
2-Chloronaphthalene	ug/L		9.8	U	10.2	U
2-Nitroaniline	ug/L		48.8	U	51	U

SVOCs, Groundwater
AOC 720

Parameter	Units	StationID		SampleID	
		G720GP001	G720GP002	720GP001M2	720GP002M2
		DateCollected		DateCollected	
		DateExtracted		DateExtracted	
		DateAnalyzed		DateAnalyzed	
		SDGNumber		SDGNumber	
		62384		62384	
3-Nitroaniline	ug/L	48.8	U	51	U
Dimethyl Phthalate	ug/L	9.8	U	10.2	U
2,6-Dinitrotoluene	ug/L	9.8	U	10.2	U
Acenaphthylene	ug/L	9.8	U	10.2	U
Acenaphthene	ug/L	0.49	J	10.2	U
2,4-Dinitrophenol	ug/L	48.8	UJ	51	R
Dibenzofuran	ug/L	9.8	U	10.2	U
2,4-Dinitrotoluene	ug/L	9.8	U	10.2	U
Diethyl Phthalate	ug/L	9.8	U	10.2	U
4-Nitrophenol	ug/L	48.8	U	51	R
Fluorene	ug/L	9.8	U	10.2	U
4-Chlorophenyl Phenyl Ether	ug/L	9.8	U	10.2	U
4,6-Dinitro-2-methylphenol	ug/L	48.8	U	51	R
4-Nitroaniline	ug/L	48.8	U	51	U
Diphenylamine	ug/L	9.8	U	10.2	U
4-Bromophenyl Phenyl Ether	ug/L	9.8	U	10.2	U
Hexachlorobenzene	ug/L	9.8	U	10.2	U
Pentachlorophenol	ug/L	48.8	U	51	R
Phenanthrene	ug/L	9.8	U	10.2	U
Anthracene	ug/L	9.8	U	10.2	U
Di-n-butyl Phthalate	ug/L	9.8	U	10.2	U
Fluoranthene	ug/L	9.8	U	10.2	U
Pyrene	ug/L	9.8	U	10.2	U
Benzyl Butyl Phthalate	ug/L	9.8	U	10.2	U
Benzo(a)Anthracene	ug/L	9.8	U	10.2	U
3,3'-Dichlorobenzidine	ug/L	19.5	U	20.4	U
Chrysene	ug/L	9.8	U	10.2	U
bis(2-Ethylhexyl) Phthalate	ug/L	9.8	U	10.2	U
Di-n-octylphthalate	ug/L	9.8	U	10.2	U
Benzo(b)Fluoranthene	ug/L	9.8	U	10.2	U

**SVOCs, Groundwater
AOC 720**

	StationID	G720GP001		G720GP002	
	SampleID	720GP001M2		720GP002M2	
	DateCollected	6/18/2002		6/18/2002	
	DateExtracted	6/24/2002		6/24/2002	
	DateAnalyzed	6/29/2002		6/29/2002	
	SDGNumber	62384		62384	
Parameter	Units				
Benzo(k)Fluoranthene	ug/L	9.8	U	10.2	U
Benzo(a)Pyrene	ug/L	0.98	U	1	U
Indeno(1,2,3-c,d)pyrene	ug/L	9.8	U	10.2	U
Dibenz(a,h)anthracene	ug/L	9.8	U	10.2	U
Benzo(g,h,i)Perylene	ug/L	9.8	U	10.2	U
Carbazole	ug/L	9.8	U	10.2	U

Analytical Data Summary

09/24/2002 3:42 PM

VOCs, Groundwater
AOC 720

	StationID	G720GP001		G720GP002	
	SampleID	720GP001M2		720GP002M2	
	DateCollected	6/18/2002		6/18/2002	
	DateExtracted	6/24/2002		6/24/2002	
	DateAnalyzed	6/24/2002		6/24/2002	
	SDGNumber	62384		62384	
Parameter	Units				
Chloromethane	ug/L	10	U	10	U
Vinyl chloride	ug/L	10	U	10	U
Bromomethane	ug/L	10	U	10	U
Chloroethane	ug/L	10	U	10	U
1,1-Dichloroethene	ug/L	5	U	5	U
Acetone	ug/L	10	U	10	U
Carbon Disulfide	ug/L	5	U	5	U
Methylene Chloride	ug/L	5	U	5	U
trans-1,2-Dichloroethene	ug/L	5	U	5	U
1,1-Dichloroethane	ug/L	5	U	5	U
Vinyl acetate	ug/L	10	UJ	10	UJ
Methyl ethyl ketone (2-Butanone)	ug/L	10	U	10	U
cis-1,2-Dichloroethylene	ug/L	5	U	5	U
1,2-Dichloroethene (total)	ug/L	5	U	5	U
Chloroform	ug/L	5	U	5	U
1,1,1-Trichloroethane	ug/L	5	U	5	U
Carbon Tetrachloride	ug/L	5	U	5	U
1,2-Dichloroethane	ug/L	5	U	5	U
Benzene	ug/L	5	U	5	U
Trichloroethylene (TCE)	ug/L	5	U	5	U
1,2-Dichloropropane	ug/L	5	U	5	U
Bromodichloromethane	ug/L	5	U	5	U
2-Chloroethyl vinyl ether	ug/L	5	R	5	U
cis-1,3-Dichloropropene	ug/L	5	U	5	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/L	10	U	10	U
Toluene	ug/L	5	U	5	U
trans-1,3-Dichloropropene	ug/L	5	U	5	U
1,1,2-Trichloroethane	ug/L	5	U	5	U
2-Hexanone	ug/L	10	U	10	U
Tetrachloroethylene (PCE)	ug/L	5	U	5	U

VOCs, Groundwater
AOC 720

	StationID	G720GP001		G720GP002	
	SampleID	720GP001M2		720GP002M2	
	DateCollected	6/18/2002		6/18/2002	
	DateExtracted	6/24/2002		6/24/2002	
	DateAnalyzed	6/24/2002		6/24/2002	
	SDGNumber	62384		62384	
Parameter	Units				
Dibromochloromethane	ug/L	5	U	5	U
Chlorobenzene	ug/L	5	U	5	U
Ethylbenzene	ug/L	5	U	5	U
m+p Xylene	ug/L	5	U	5	U
o-Xylene	ug/L	5	U	5	U
Xylenes, Total	ug/L	5	U	5	U
Styrene	ug/L	5	U	5	U
Bromoform	ug/L	5	U	5	U
1,1,2,2-Tetrachloroethane	ug/L	5	U	5	U
1,3-Dichlorobenzene	ug/L	5	U	5	U
1,4-Dichlorobenzene	ug/L	5	U	5	U
1,2-Dichlorobenzene	ug/L	5	U	5	U
1,2,4-Trichlorobenzene	ug/L	5	U	5	U
1,2,3-Trichlorobenzene	ug/L	5	U	5	U

Analytical Data Summary

04/25/2003 11:10 AM

VOCs, Subsurface Soils
AOC 720

	StationID	G720SB006		G720SB006	
	SampleID	720CB00602 (3-5ft)		720SB00602 (3-5ft)	
	DateCollected	02/20/2003		02/20/2003	
	DateExtracted	02/21/2003		02/21/2003	
	DateAnalyzed	02/25/2003		02/25/2003	
	SDGNumber	75312		75312	
Parameter	Units				
Chloromethane	ug/kg	11.5	U	11.8	U
Vinyl chloride	ug/kg	11.5	U	11.8	U
Bromomethane	ug/kg	11.5	U	11.8	U
Chloroethane	ug/kg	11.5	U	11.8	U
1,1-Dichloroethene	ug/kg	5.8	U	5.9	U
Acetone	ug/kg	21.3	J	31.2	J
Carbon Disulfide	ug/kg	5.8	U	5.9	U
Methylene Chloride	ug/kg	5.8	U	5.9	U
trans-1,2-Dichloroethene	ug/kg	5.8	U	5.9	U
1,1-Dichloroethane	ug/kg	5.8	U	5.9	U
Vinyl acetate	ug/kg	11.5	U	11.8	U
Methyl ethyl ketone (2-Butanone)	ug/kg	11.5	U	11.8	U
cis-1,2-Dichloroethylene	ug/kg	5.8	U	5.9	U
1,2-Dichloroethene (total)	ug/kg	5.8	U	5.9	U
Chloroform	ug/kg	5.8	U	5.9	U
1,1,1-Trichloroethane	ug/kg	5.8	U	5.9	U
Carbon Tetrachloride	ug/kg	5.8	U	5.9	U
1,2-Dichloroethane	ug/kg	5.8	U	5.9	U
Benzene	ug/kg	5.8	U	5.9	U
Trichloroethylene (TCE)	ug/kg	5.8	U	5.9	U
1,2-Dichloropropane	ug/kg	5.8	U	5.9	U
Bromodichloromethane	ug/kg	5.8	U	5.9	U
2-Chloroethyl vinyl ether	ug/kg	11.5	U	11.8	U
cis-1,3-Dichloropropene	ug/kg	5.8	U	5.9	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/kg	11.5	U	11.8	U
Toluene	ug/kg	5.8	U	5.9	U
trans-1,3-Dichloropropene	ug/kg	5.8	U	5.9	U
1,1,2-Trichloroethane	ug/kg	5.8	U	5.9	U
2-Hexanone	ug/kg	11.5	U	11.8	U
Tetrachloroethylene (PCE)	ug/kg	5.8	U	5.9	U

VOCs, Subsurface Soils
AOC 720

	StationID	G720SB006		G720SB006	
	SampleID	720CB00602 (3-5ft)		720SB00602 (3-5ft)	
	DateCollected	02/20/2003		02/20/2003	
	DateExtracted	02/21/2003		02/21/2003	
	DateAnalyzed	02/25/2003		02/25/2003	
	SDGNumber	75312		75312	
Parameter	Units				
Dibromochloromethane	ug/kg	5.8	U	5.9	U
Chlorobenzene	ug/kg	5.8	U	5.9	U
Ethylbenzene	ug/kg	5.8	U	5.9	U
m+p Xylene	ug/kg	5.8	U	5.9	U
o-Xylene	ug/kg	5.8	U	5.9	U
Xylenes, Total	ug/kg	5.8	U	5.9	U
Styrene	ug/kg	5.8	U	5.9	U
Bromoform	ug/kg	5.8	UJ	5.9	U
1,1,2,2-Tetrachloroethane	ug/kg	5.8	UJ	5.9	U
1,3-Dichlorobenzene	ug/kg	5.8	UJ	5.9	U
1,4-Dichlorobenzene	ug/kg	5.8	UJ	5.9	U
1,2-Dichlorobenzene	ug/kg	5.8	UJ	5.9	U
1,2,4-Trichlorobenzene	ug/kg	5.8	UJ	5.9	U
1,2,3-Trichlorobenzene	ug/kg	5.8	UJ	5.9	U

Analytical Data Summary

04/25/2003 11:10 AM

SVOCs, Subsurface Soils
AOC 720

	StationID	G720SB006		G720SB006	
	SampleID	720CB00602 (3-5ft)		720SB00602 (3-5ft)	
	DateCollected	02/20/2003		02/20/2003	
	DateExtracted	02/21/2003		02/21/2003	
	DateAnalyzed	02/24/2003		02/24/2003	
	SDGNumber	75312		75312	
Parameter	Units				
Benzo(g,h,i)Perylene	ug/kg	435	UJ	128	J
Phenol	ug/kg	435	U	422	U
bis(2-Chloroethyl) ether (2-Chloroethyl Ether)	ug/kg	435	U	422	U
Bis(2-Chloroisopropyl)Ether	ug/kg	435	U	422	U
2-Chlorophenol	ug/kg	435	U	422	U
Benzyl alcohol	ug/kg	435	U	422	U
2-Methylphenol (o-Cresol)	ug/kg	435	U	422	U
N-Nitrosodi-n-propylamine	ug/kg	435	U	422	U
3-Methylphenol/4-Methylphenol (mp-Cresol)	ug/kg	435	U	422	U
Hexachloroethane	ug/kg	435	U	422	U
Nitrobenzene	ug/kg	435	U	422	U
Isophorone	ug/kg	435	U	422	U
2-Nitrophenol	ug/kg	435	U	422	U
2,4-Dimethylphenol	ug/kg	435	U	422	U
bis(2-Chloroethoxy) Methane	ug/kg	435	U	422	U
2,4-Dichlorophenol	ug/kg	435	U	422	U
Benzoic acid	ug/kg	2110	UJ	2040	UJ
Naphthalene	ug/kg	435	U	422	U
4-Chloroaniline	ug/kg	435	U	422	U
Hexachlorobutadiene	ug/kg	435	U	422	U
4-Chloro-3-methylphenol	ug/kg	395	U	383	U
2-Methylnaphthalene	ug/kg	435	U	422	U
Hexachlorocyclopentadiene	ug/kg	435	U	422	U
2,4,6-Trichlorophenol	ug/kg	435	U	422	U
2,4,5-Trichlorophenol	ug/kg	2110	U	2040	U
2-Chloronaphthalene	ug/kg	435	U	422	U
2-Nitroaniline	ug/kg	2110	U	2040	U
3-Nitroaniline	ug/kg	2110	U	2040	U
Dimethyl Phthalate	ug/kg	435	U	422	U
2,6-Dinitrotoluene	ug/kg	435	U	422	U

SVOCs, Subsurface Soils
AOC 720

Parameter	Units	G720SB006		G720SB006	
		435	U	422	U
Acenaphthylene	ug/kg	435	U	422	U
Acenaphthene	ug/kg	395	U	383	U
2,4-Dinitrophenol	ug/kg	2110	UJ	2040	UJ
Dibenzofuran	ug/kg	435	U	422	U
2,4-Dinitrotoluene	ug/kg	395	U	383	U
Diethyl Phthalate	ug/kg	435	U	422	U
4-Nitrophenol	ug/kg	2110	U	2040	U
Fluorene	ug/kg	435	U	422	U
4-Chlorophenyl Phenyl Ether	ug/kg	435	U	422	U
4,6-Dinitro-2-methylphenol	ug/kg	2110	U	2040	U
4-Nitroaniline	ug/kg	2110	U	2040	U
Diphenylamine	ug/kg	435	U	422	U
4-Bromophenyl Phenyl Ether	ug/kg	435	U	422	U
Hexachlorobenzene	ug/kg	435	U	422	U
Pentachlorophenol	ug/kg	2110	U	2040	U
Phenanthrene	ug/kg	435	U	39.6	J
Anthracene	ug/kg	435	U	422	U
Di-n-butyl Phthalate	ug/kg	435	UJ	422	UJ
Fluoranthene	ug/kg	41.4	J	94.8	J
Pyrene	ug/kg	40.7	J	93.7	J
Benzyl Butyl Phthalate	ug/kg	435	U	422	U
Benzo(a)Anthracene	ug/kg	30.3	J	81.7	J
3,3'-Dichlorobenzidine	ug/kg	869	U	843	U
Chrysene	ug/kg	27	J	141	J
bis(2-Ethylhexyl) Phthalate	ug/kg	435	U	422	U
Di-n-octylphthalate	ug/kg	435	U	422	U
Benzo(b)Fluoranthene	ug/kg	435	U	226	J
Benzo(k)Fluoranthene	ug/kg	50.1	J	106	J
Benzo(a)Pyrene	ug/kg	28.3	J	125	J
Indeno(1,2,3-c,d)pyrene	ug/kg	435	U	130	J

Analytical Data Summary

04/25/2003 11:10 AM

SVOCs, Subsurface Soils
AOC 720

	StationID	G720SB006		G720SB006	
	SampleID	720CB00602 (3-5ft)		720SB00602 (3-5ft)	
	DateCollected	02/20/2003		02/20/2003	
	DateExtracted	02/21/2003		02/21/2003	
	DateAnalyzed	02/24/2003		02/24/2003	
	SDGNumber	75312		75312	
Parameter	Units				
Dibenz(a,h)anthracene	ug/kg	435	U	422	U
Carbazole	ug/kg	435	U	422	U

**Pesticides, Subsurface Soils
AOC 720**

Parameter	Units	G720SB006		G720SB006	
		720CB00602 (3-5ft)		720SB00602 (3-5ft)	
StationID		G720SB006		G720SB006	
SampleID		720CB00602 (3-5ft)		720SB00602 (3-5ft)	
DateCollected		02/20/2003		02/20/2003	
DateExtracted		02/25/2003		02/25/2003	
DateAnalyzed		02/27/2003		02/27/2003	
SDGNumber		75312		75312	
Aldrin	ug/kg	8.5	U	8.3	U
Alpha BHC (Alpha Hexachlorocyclohexane)	ug/kg	8.5	U	8.3	U
Alpha-chlordane	ug/kg	8.5	U	8.3	U
Beta BHC (Beta Hexachlorocyclohexane)	ug/kg	8.5	U	1.5	J
Chlordane	ug/kg	85.4	U	82.8	U
Delta BHC (Delta Hexachlorocyclohexane)	ug/kg	8.5	U	1.4	J
Dieldrin	ug/kg	16.4	U	16	U
Endosulfan I	ug/kg	8.5	U	8.3	U
Endosulfan II	ug/kg	16.4	U	16	U
Endosulfan Sulfate	ug/kg	16.4	U	2.2	J
Endrin Aldehyde	ug/kg	16.4	U	16	U
Endrin Ketone	ug/kg	16.4	U	16	U
Endrin	ug/kg	16.4	U	16	U
Gamma BHC (Lindane)	ug/kg	8.5	U	1	J
Gamma-chlordane	ug/kg	8.5	U	8.3	U
Heptachlor Epoxide	ug/kg	8.5	U	8.3	U
Heptachlor	ug/kg	8.5	U	1.5	J
Methoxychlor	ug/kg	85.4	U	82.8	U
p,p'-DDD	ug/kg	24.8	=	19.2	=
p,p'-DDE	ug/kg	25	=	17.7	=
p,p'-DDT	ug/kg	16.4	U	16	U
Toxaphene	ug/kg	545	U	529	U

Analytical Data Summary

04/25/2003 11:10 AM

PCBs, Subsurface Soils
AOC 720

	StationID	G720SB006		G720SB006	
	SampleID	720CB00602 (3-5ft)		720SB00602 (3-5ft)	
	DateCollected	02/20/2003		02/20/2003	
	DateExtracted	02/21/2003		02/21/2003	
	DateAnalyzed	02/24/2003		02/24/2003	
	SDGNumber	75312		75312	
Parameter	Units				
PCB-1016 (Arochlor 1016)	ug/kg	43.4	U	42.1	U
PCB-1221 (Arochlor 1221)	ug/kg	43.4	U	42.1	U
PCB-1232 (Arochlor 1232)	ug/kg	43.4	U	42.1	U
PCB-1242 (Arochlor 1242)	ug/kg	43.4	U	42.1	U
PCB-1248 (Arochlor 1248)	ug/kg	43.4	U	42.1	U
PCB-1254 (Arochlor 1254)	ug/kg	88.2	U	85.5	U
PCB-1260 (Arochlor 1260)	ug/kg	2.4	J	2	J

**Metals, Subsurface Soils
AOC 720**

StationID	G720SB004	G720SB005	G720SB006	G720SB006
SampleID	720SB00402 (3-5ft)	720SB00502 (3-5ft)	720CB00602 (3-5ft)	720CB00602 (3-5ft)
DateCollected	02/20/2003	02/20/2003	02/20/2003	02/20/2003
DateExtracted	02/26/2003	02/26/2003	02/24/2003	02/26/2003
DateAnalyzed	03/03/2003	03/03/2003	02/25/2003	03/03/2003
SDGNumber	75312	75312	75312	75312

Parameter	Units						
Aluminum	mg/kg					23600	=
Antimony	mg/kg					1.71	J
Arsenic	mg/kg					8.65	=
Barium	mg/kg					63.1	J
Beryllium	mg/kg					1.23	=
Cadmium	mg/kg					0.444	J
Calcium	mg/kg					97000	J
Chromium, Total	mg/kg					69.8	J
Cobalt	mg/kg					3.66	J
Copper	mg/kg					12.2	J
Iron	mg/kg					15500	=
Lead	mg/kg	8.7	J	9.27	J	14	J
Magnesium	mg/kg					4980	=
Manganese	mg/kg					64.8	=
Nickel	mg/kg					20.5	J
Potassium	mg/kg					1570	J
Selenium	mg/kg					1.05	J
Silver	mg/kg					0.301	U
Sodium	mg/kg					1670	J
Thallium	mg/kg					0.757	U
Vanadium	mg/kg					49.1	=
Zinc	mg/kg					72.6	J
Mercury	mg/kg					0.045	J

Analytical Data Summary

04/25/2003 11:10 AM

Metals, Subsurface Soils
AOC 720

StationID	G720SB006	G720SB006
SampleID	720SB00602 (3-5ft)	720SB00602 (3-5ft)
DateCollected	02/20/2003	02/20/2003
DateExtracted	02/24/2003	02/26/2003
DateAnalyzed	02/25/2003	03/03/2003
SDGNumber	75312	75312
Parameter	Units	
Aluminum	mg/kg	13800 =
Antimony	mg/kg	0.876 J
Arsenic	mg/kg	10.9 =
Barium	mg/kg	51.5 J
Beryllium	mg/kg	0.745 J
Cadmium	mg/kg	0.293 J
Calcium	mg/kg	52900 J
Chromium, Total	mg/kg	35.6 J
Cobalt	mg/kg	3.71 J
Copper	mg/kg	25.2 J
Iron	mg/kg	12600 =
Lead	mg/kg	23.6 J
Magnesium	mg/kg	3090 =
Manganese	mg/kg	61.8 =
Nickel	mg/kg	14.2 J
Potassium	mg/kg	1130 J
Selenium	mg/kg	0.866 J
Silver	mg/kg	0.319 U
Sodium	mg/kg	1200 J
Thallium	mg/kg	0.801 U
Vanadium	mg/kg	30.4 =
Zinc	mg/kg	66.7 J
Mercury	mg/kg	0.03 J

VOCs, Groundwater
AOC 720

Parameter	Units	StationID	SampleID	DateCollected	DateExtracted	DateAnalyzed	SDGNumber
		G720GP006	720GP006N1	02/20/2003	02/24/2003	02/24/2003	75313
Chloromethane	ug/L	10	U				
Vinyl chloride	ug/L	10	U				
Bromomethane	ug/L	10	U				
Chloroethane	ug/L	10	U				
1,1-Dichloroethene	ug/L	5	U				
Acetone	ug/L	10	U				
Carbon Disulfide	ug/L	5	U				
Methylene Chloride	ug/L	5	U				
trans-1,2-Dichloroethene	ug/L	5	U				
1,1-Dichloroethane	ug/L	5	U				
Vinyl acetate	ug/L	10	U				
Methyl ethyl ketone (2-Butanone)	ug/L	10	U				
cis-1,2-Dichloroethylene	ug/L	5	U				
1,2-Dichloroethene (total)	ug/L	5	U				
Chloroform	ug/L	5	U				
1,1,1-Trichloroethane	ug/L	5	U				
Carbon Tetrachloride	ug/L	5	U				
1,2-Dichloroethane	ug/L	5	U				
Benzene	ug/L	5	U				
Trichloroethylene (TCE)	ug/L	5	U				
1,2-Dichloropropane	ug/L	5	U				
Bromodichloromethane	ug/L	5	U				
2-Chloroethyl vinyl ether	ug/L	10	U				
cis-1,3-Dichloropropene	ug/L	5	U				
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/L	10	U				
Toluene	ug/L	5	U				
trans-1,3-Dichloropropene	ug/L	5	U				
1,1,2-Trichloroethane	ug/L	5	U				
2-Hexanone	ug/L	10	U				
Tetrachloroethylene (PCE)	ug/L	5	U				

Analytical Data Summary

04/25/2003 11:10 AM

VOCs, Groundwater
AOC 720

StationID	G720GP006	
SampleID	720GP006N1	
DateCollected	02/20/2003	
DateExtracted	02/24/2003	
DateAnalyzed	02/24/2003	
SDGNumber	75313	
Parameter	Units	
Dibromochloromethane	ug/L	5 U
Chlorobenzene	ug/L	5 U
Ethylbenzene	ug/L	5 U
m+p Xylene	ug/L	5 U
o-Xylene	ug/L	5 U
Xylenes, Total	ug/L	5 U
Styrene	ug/L	5 U
Bromoform	ug/L	5 U
1,1,2,2-Tetrachloroethane	ug/L	5 U
1,3-Dichlorobenzene	ug/L	5 U
1,4-Dichlorobenzene	ug/L	5 U
1,2-Dichlorobenzene	ug/L	5 U
1,2,4-Trichlorobenzene	ug/L	5 U
1,2,3-Trichlorobenzene	ug/L	5 U

SVOCs, Groundwater
AOC 720

	StationID	G720GP006	
	SampleID	720GP006	
	DateCollected	03/12/2003	
	DateExtracted	03/13/2003	
	DateAnalyzed	03/14/2003	
	SDGNumber	76284	
Parameter	Units		
Phenol	ug/L	10	U
bis(2-Chloroethyl) ether (2-Chloroethyl Ether)	ug/L	10	U
2-Chlorophenol	ug/L	0.62	J
1,3-Dichlorobenzene	ug/L	10	U
1,4-Dichlorobenzene	ug/L	10	U
Benzyl alcohol	ug/L	10	U
1,2-Dichlorobenzene	ug/L	10	U
Bis(2-Chloroisopropyl)Ether	ug/L	10	U
2-Methylphenol (o-Cresol)	ug/L	0.52	J
N-Nitrosodi-n-propylamine	ug/L	10	U
3-Methylphenol/4-Methylphenol (mp-Cresol)	ug/L	10	U
Hexachloroethane	ug/L	10	U
Nitrobenzene	ug/L	10	U
Isophorone	ug/L	10	U
2-Nitrophenol	ug/L	10	U
2,4-Dimethylphenol	ug/L	10	U
bis(2-Chloroethoxy) Methane	ug/L	10	U
2,4-Dichlorophenol	ug/L	0.53	J
Benzoic acid	ug/L	50	UJ
1,2,4-Trichlorobenzene	ug/L	10	U
Naphthalene	ug/L	0.44	J
4-Chloroaniline	ug/L	10	U
Hexachlorobutadiene	ug/L	0.37	J
4-Chloro-3-methylphenol	ug/L	10	U
2-Methylnaphthalene	ug/L	10	U
Hexachlorocyclopentadiene	ug/L	10	UJ
2,4,6-Trichlorophenol	ug/L	0.49	J
2,4,5-Trichlorophenol	ug/L	50	U
2-Chloronaphthalene	ug/L	10	U
2-Nitroaniline	ug/L	50	U

Analytical Data Summary

04/25/2003 11:10 AM

**SVOCs, Groundwater
AOC 720**

	StationID	G720GP006	
	SampleID	720GP006	
	DateCollected	03/12/2003	
	DateExtracted	03/13/2003	
	DateAnalyzed	03/14/2003	
	SDGNumber	76284	
Parameter	Units		
3-Nitroaniline	ug/L	50	U
Dimethyl Phthalate	ug/L	10	U
2,6-Dinitrotoluene	ug/L	10	U
Acenaphthylene	ug/L	10	U
Acenaphthene	ug/L	10	U
2,4-Dinitrophenol	ug/L	50	UJ
Dibenzofuran	ug/L	10	U
2,4-Dinitrotoluene	ug/L	10	U
Diethyl Phthalate	ug/L	10	U
4-Nitrophenol	ug/L	50	U
Fluorene	ug/L	10	U
4-Chlorophenyl Phenyl Ether	ug/L	10	U
4,6-Dinitro-2-methylphenol	ug/L	50	U
4-Nitroaniline	ug/L	50	U
Diphenylamine	ug/L	10	U
4-Bromophenyl Phenyl Ether	ug/L	10	U
Hexachlorobenzene	ug/L	10	U
Pentachlorophenol	ug/L	5.9	J
Phenanthrene	ug/L	10	U
Anthracene	ug/L	10	U
Di-n-butyl Phthalate	ug/L	10	U
Fluoranthene	ug/L	10	U
Pyrene	ug/L	0.52	J
Benzyl Butyl Phthalate	ug/L	10	U
Benzo(a)Anthracene	ug/L	10	U
3,3'-Dichlorobenzidine	ug/L	20	U
Chrysene	ug/L	10	U
bis(2-Ethylhexyl) Phthalate	ug/L	10	UJ
Di-n-octylphthalate	ug/L	10	U
Benzo(b)Fluoranthene	ug/L	10	U

**SVOCs, Groundwater
AOC 720**

StationID	G720GP006	
SampleID	720GP006	
DateCollected	03/12/2003	
DateExtracted	03/13/2003	
DateAnalyzed	03/14/2003	
SDGNumber	76284	
Parameter	Units	
Benzo(k)Fluoranthene	ug/L	10 U
Benzo(a)Pyrene	ug/L	1 U
Indeno(1,2,3-c,d)pyrene	ug/L	10 U
Dibenz(a,h)anthracene	ug/L	10 U
Benzo(g,h,i)Perylene	ug/L	10 U
Carbazole	ug/L	10 U

Analytical Data Summary

04/25/2003 11:10 AM

Pesticides, Groundwater
AOC 720

StationID	G720GP006	
SampleID	720GP006N1	
DateCollected	02/20/2003	
DateExtracted	02/21/2003	
DateAnalyzed	02/26/2003	
SDGNumber	75313	
Parameter	Units	
Aldrin	ug/L	0.04 UJ
Alpha BHC (Alpha Hexachlorocyclohexane)	ug/L	0.04 UJ
Alpha-chlordane	ug/L	0.04 UJ
Beta BHC (Beta Hexachlorocyclohexane)	ug/L	0.04 UJ
Chlordane	ug/L	0.4 UJ
Delta BHC (Delta Hexachlorocyclohexane)	ug/L	0.04 UJ
Dieldrin	ug/L	0.08 UJ
Endosulfan I	ug/L	0.04 UJ
Endosulfan II	ug/L	0.08 UJ
Endosulfan Sulfate	ug/L	0.08 UJ
Endrin Aldehyde	ug/L	0.08 UJ
Endrin Ketone	ug/L	0.08 UJ
Endrin	ug/L	0.08 UJ
Gamma BHC (Lindane)	ug/L	0.04 UJ
Gamma-chlordane	ug/L	0.04 UJ
Heptachlor Epoxide	ug/L	0.04 UJ
Heptachlor	ug/L	0.04 UJ
Methoxychlor	ug/L	0.38 UJ
p,p'-DDD	ug/L	0.08 UJ
p,p'-DDE	ug/L	0.08 UJ
p,p'-DDT	ug/L	0.08 UJ
Toxaphene	ug/L	2.5 UJ

**PCBs, Groundwater
AOC 720**

StationID	G720GP006
SampleID	720GP006N1
DateCollected	02/20/2003
DateExtracted	02/21/2003
DateAnalyzed	02/25/2003
SDGNumber	75313

Parameter	Units		
PCB-1016 (Arochlor 1016)	ug/L	0.96	UJ
PCB-1221 (Arochlor 1221)	ug/L	0.96	UJ
PCB-1232 (Arochlor 1232)	ug/L	0.96	UJ
PCB-1242 (Arochlor 1242)	ug/L	0.96	UJ
PCB-1248 (Arochlor 1248)	ug/L	0.96	UJ
PCB-1254 (Arochlor 1254)	ug/L	1.9	UJ
PCB-1260 (Arochlor 1260)	ug/L	1.9	UJ

Analytical Data Summary

04/25/2003 11:10 AM

Metals, Groundwater AOC 720		StationID	G720GP006	G720GP006
		SampleID	720GP006N1	720GP006N1
		DateCollected	02/20/2003	02/20/2003
		DateExtracted	02/24/2003	02/25/2003
		DateAnalyzed	02/25/2003	02/26/2003
		SDGNumber	75313	75313
Parameter	Units			
Aluminum	ug/L		12900	=
Antimony	ug/L		6.81	U
Arsenic	ug/L		31.4	=
Barium	ug/L		82.6	J
Beryllium	ug/L		0.421	U
Cadmium	ug/L		0.807	U
Calcium	ug/L		252000	=
Chromium, Total	ug/L		202	=
Cobalt	ug/L		4.73	J
Copper	ug/L		142	=
Iron	ug/L		39900	=
Lead	ug/L		5.49	=
Magnesium	ug/L		893000	=
Manganese	ug/L		636	J
Nickel	ug/L		137	=
Potassium	ug/L		244000	J
Selenium	ug/L		6.79	U
Silver	ug/L		2.5	U
Sodium	ug/L		7480000	J
Thallium	ug/L		6.27	U
Vanadium	ug/L		36.5	J
Zinc	ug/L		179	J
Mercury	ug/L	0.052	U	

Appendix C

Data Validation Summary - Charleston Naval Complex - Zone G, AOC 720

TO: Louise Palmer/CH2M HILL/CLT

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

DATE: August 26, 2002

The purpose of this memorandum is to present the results of the data validation process for the samples collected in Zone G, AOC 720. The samples were collected between the dates of May 2, 2002 and June 18, 2002.

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

The Quality Control areas that were reviewed and the resulting findings are documented within each subsection that follows. This data was validated for compliance with the analytical method requirements. This process also included a review of the data to assess the accuracy, precision, and completeness based upon procedures described in the guidance documents such as the Environmental Protection Agency (EPA) *National Functional Guidelines for Inorganic Data Review* (EPA 1994) and *National Functional Guidelines for Organic Data Review* (EPA 1999). Quality assurance/quality control (QA/QC) summary forms and data reports were reviewed.

Samples were submitted to Severn Trent Services, STL Savannah Laboratories, Inc., in Savannah, Georgia, for the following analyses: SW-846 8260 Volatile Organic Compounds (VOC), SW-846 8270 Semivolatile Organic Compounds (SVOC), SW-846 8081 Organochlorine Pesticides, SW-846 8082 Polychlorinated Biphenyls, and Metals following SW-846 6010/7000 Series methodology.

Samples were submitted to General Engineering Laboratories, Inc., in Charleston, South Carolina, for the following analyses: SW-846 8260 Volatile Organic Compounds (VOC), SW-846 8270 Semivolatile Organic Compounds (SVOC), SW-846 8081 Organochlorine Pesticides, and SW-846 8082 Polychlorinated Biphenyls.

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

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

The following primary flags were used to qualify the data:

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

Secondary Data Validation Qualifiers

<u>Code</u>	<u>Definition</u>
2S	Second Source
BL	Blank
BD	Blank Spike/Blank Spike Duplicate or (LCS/LCSD) Precision
BS	Blank Spike/LCS
CC	Continuing Calibration Verification
DL	Dilution
FD	Field Duplicate
HT	Holding Time
IB	In-Between (metals - B's → J's)
IC	Initial Calibration
IS	Internal Standard
LD	Lab Duplicate
LR	Concentration exceeded Linear Range
MD	MS/MSD or LCS/LCSD Precision
MS	Matrix Spike/Matrix Spike Duplicate
OT	Other (see DV worksheet)
PD	Pesticide Degradation
PS	Post Spike
RE	Re-extraction/Re-analysis
SD	Serial Dilution
SS	Spiked Surrogate
TN	Tune

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

Sample ID	Method	Sample ID	Lab Sample ID	Matrix	Control Type	Frequency	Priority	Start Date	Lab Method	QA/QC	QA/QC	QA/QC	QA/QC	QA/QC	QA/QC
62384	FIELDQC	720TP001M2	62384001	WQ	TB			05/02/02		X					
62384	G720GP001	720GP001M2	62384002	WG	N			06/18/02		X	X	X	X		
62384	G720GP002	720GP002M2	62384003	WG	N			06/18/02		X	X	X	X		
62384	FIELDQC	720EP001M2	62384004	WQ	EB			06/18/02		X	X		X		
62384	LABQC	1200241350	1200241350	WQ	LB								X		
62384	LABQC	1200241351	1200241351	WQ	BS								X		
62384	LABQC	1200243012	1200243012	WQ	LB						X				
62384	LABQC	1200243013	1200243013	WQ	BS						X				
62384	LABQC	1200243360	1200243360	WQ	LB							X			
62384	LABQC	1200243361	1200243361	WQ	BS							X			
62384	LABQC	1200244296	1200244296	WQ	LB					X					
62384	LABQC	1200244297	1200244297	WQ	BS					X					
62384	G720GP001	720GP001M2MS	1200244322	WG	MS			06/18/02		X					
62384	G720GP001	720GP001M2SD	1200244323	WG	SD			06/18/02		X					
62384	LABQC	1200252219	1200252219	WQ	LB					X					
62384	LABQC	1200252220	1200252220	WQ	BS					X					
CNC114	G720SB001	720SB00102	S244070*1	SO	N	3	5	06/11/02		X	X	X	X	X	X
CNC114	G720SB002	720SB00202	S244070*2	SO	N	3	5	06/11/02		X	X	X	X	X	X
CNC114	G720SB003	720SB00302	S244070*3	SO	N	3	5	06/11/02		X	X	X	X	X	X
CNC114	G720SB003	720CB00302	S244070*4	SO	FD	3	5	06/11/02		X	X	X	X	X	X

ID	Location	Sample ID	Sample Description	Matrix	LR Type	Dilution	Duplicates	Trips	Date	VOC	SVOC	PCBs	Other	Other	Other
CNC114	G720SB003	720CB00302DL	S244070*4*DL	SO	LR	DL	3	5	06/11/02				X	X	
CNC114	FIELDQC	720EB001M1	S244070*5	WQ	EB				06/11/02	X	X	X	X	X	X
CNC114	FIELDQC	720TB001M1	S244070*6	WQ	TB				06/11/02	X					
CNC114	LABQC	440707LB	S244070*7	WQ	LB					X	X	X	X	X	X
CNC114	LABQC	440708BS	S244070*8	WQ	BS					X	X	X	X	X	X
CNC114	LABQC	4407014LB	S244070*14	SQ	LB					X	X	X	X	X	X
CNC114	LABQC	4407015BS	S244070*15	SQ	BS					X	X	X	X	X	X

MATRIX CODE

WG - Groundwater
WQ - Water QC Sample
SO - Soil
SQ - Soil QC Sample

SAMPLE TYPE CODE

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

LR TYPE CODE

DL - Dilution

ANALYSIS CODE

VOC - Volatile Organic Compounds
SVOC - Semivolatile Organic Compounds
PCBs - Polychlorinated Biphenyls

Organic Parameters

Quality Control Review

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

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Method blanks, equipment blanks, and trip blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Surrogate Recoveries** – Surrogate Compounds are added to each sample and the recoveries are used to monitor lab performance and possible matrix interference.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", either laboratory reagent water or Ottawa sand, in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **Field Duplicate Samples** – These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **GC/MS Tuning** – The mass spectrum of the tuning compound is evaluated for method compliance. The criteria are established to verify the proper mass assignment and mass resolution.
- **Initial Calibration** – The initial calibration ensures that the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest.
- **Continuing Calibration** – The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds.
- **Internal Standards** – The internal standards (retention time and response) are evaluated for method compliance. The internal standards are used in quantitation of the target parameters and monitor the instrument sensitivity and response for stability during each analysis.
- **Confirmation** – If GCMS methodology is not initially used for analysis, SW-846 method 8000 requires confirmation when the composition of samples is not well characterized. Therefore, even when the identification has been confirmed on a dissimilar column or detector, the agreement of the quantitative results on both columns is evaluated. For

Pesticide and PCB analyses covered in this report, confirmation was performed using a dissimilar analytical column. The laboratory analyzed samples with a gas chromatograph (GC) utilizing simultaneous primary and confirmation data acquisition. Per SW-86 method 8000, 40% RPD criteria was used as the acceptance limit.

Volatile Organic Compounds (VOC) Analyses

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

Blanks

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

TABLE 2

Blank Contamination: VOCs

Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

SRF	Sample ID	Field Sample ID	Sample Type	Parameter	Lab Result (µg/L)	Reporting Limit (µg/L)	Acceptance Limit (µg/L)
62384	1200244296	1200244296	LB	Acetone	3.2	µg/L	32.0 µg/L
62384	720EP001M2	62384004	EB	Acetone	2.4	µg/L	24.0 µg/L
62384	720TP001M1	62384001	TB	Acetone	2.7	µg/L	27.0 µg/L
CNC114	720TB001M1	S244070*6	TB	Methylene chloride	4.2	µg/L	42.0 µg/L

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

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

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

Recoveries - Surrogate, MS/MSD and LCS/LCSD

All Surrogate, Matrix Spike (MS), Matrix Spike Duplicate (MSD), Laboratory Control Sample (LCS) and Laboratory Control Duplicate Sample (LCSD) recoveries were within acceptable quality control limits, except as noted in Table 3 below.

TABLE 3

Surrogate, MS/MSD, and LCS/LCSD Recoveries and RPDs Out of QC Limits: VOC
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

ID#	Sample	Parameter	Recovery	Recovery Limit	RPD	RPD Limit	Associated Sample	Findings
62384	720GP001M2 MS/MSD	2-Chloroethyl vinyl ether	0* / 0*	70-130			62384002	Detects-J, non-detects-R
		Vinyl acetate	41.2* / 40.8*	70-130				Detects-J, non-detects-UJ
62384	120024297 LCS	Vinyl chloride	134*	70-130			62384001, 62384004	Detects only - J
		2-Chloroethyl vinyl ether	157.2*	70-130				
		Vinyl acetate	55.2*	70-130				Detects-J, non-detects-UJ
384	1200252220 LCS	Vinyl acetate	53.2*	70-130			62384002, 62384003	Detects-J, non-detects-UJ
		2-Chloroethyl vinyl ether	164.4*	70-130				Detects only - J
		2-Hexanone	133.2*	70-130				
CNC114	4407015BS LCS/LCSD	Bromomethane	240* / 112	70-130	73*	30	S244070*1-6	Detects-J, non-detects-UJ
		Carbon disulfide	144* / 154*	70-130				
		1,1-Dichloroethene	65* / 96	70-130	30*	22		
		Acetone	110 / 190*	70-130	53*	30		
		2-Chloroethyl vinyl ether	68* / 100	70-130	38*	30		
		2-Hexanone	51* / 73	70-130	35*	30		
		1,2,3-Trichlorobenzene	72 / 106	70-130	38*	30		
* - out of control limits								

Field Duplicate Samples

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

- The field duplicate pair in SDG CNC114, samples 720SB00302 and 720CB00302, had a Relative Percent Deviation (RPD) outside of acceptance criteria for acetone. The RPD for acetone for these samples was 47.9 percent with a limit of 35 percent.

Initial and Continuing Calibration Criteria

All initial calibration criteria and continuing calibration criteria were met, except as listed in Table 4.

TABLE 4

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: VOC
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Initial/Continuing Calibration Criteria	Chemical	Deviation (RPD)	Sample ID
VOA8-CCAL-06/24/02, 0718	Chloromethane	20.2% low	62384001, 62384004
	Dibromofluoromethane	27.8% high	
	2-Chloroethyl vinyl ether	33.6% high	
VOA8-CCAL-06/24/02, 1911	2-Chloroethyl vinyl ether	63.7% high	62384002, 62384003
	cis-1,3-Dichloropropylene	24.4% high	
	1,2,3-Trichlorobenzene	20.2% high	
MSL5972-ICAL-06/04/02, 1842	Acetone	R ² =0.988	S244070*1-6
	2-Butanone	R ² =0.988	
	2-Chloroethyl vinyl ether	52.3%RSD	
	1,2,3-Trichlorobenzene	30.7%RSD	
MSL5972-CCAL-06/17/02, 0636	Chloromethane	23.3% high	S244070*1-6
	Bromomethane	68.6% high	
	Acetone	36.6% high	
	Carbon disulfide	69.9% high	
	2-Chloroethyl vinyl ether	RRF=0.042	
	4-Methyl-2-pentanone	20.7% low	
	2-Hexanone	28.8% low	

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

- When the percent Relative Standard Deviation (%RSD) or correlation coefficient (R^2) was out in the initial calibration, all associated samples were qualified. Detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.
- When the percent difference (%D) was low in the continuing calibration standards, detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.
- When the percent difference (%D) was high in the continuing calibration standards, detected compounds were flagged "J", as estimated. Non-detected compounds were not flagged.
- When the Relative Response Factor (RRF) was low in the continuing calibration, detected compounds were flagged "J", and non-detected compounds were flagged "UJ", as estimated.

Semivolatile Organic Compounds (SVOC) Analyses

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

Blanks

The SVOC target parameters detected in blank samples are listed in Table 5.

TABLE 5

Blank Contamination: SVOCs

Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Site	Sample ID	Blank Sample ID	Sample Type	Contaminant	Concentration	Unit	Reporting Limit
62384	1200243012	1200243012	LB	bis(2-Ethylhexyl)phthalate	2.1	µg/L	21.0 µg/L
62384	720EP001M2	62384004	EB	bis(2-Ethylhexyl)phthalate	1.7	µg/L	17.0 µg/L

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

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

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

Recoveries - Surrogate, MS/MSD and LCS

All Surrogate, Matrix Spike (MS), Matrix Spike Duplicate (MSD), and Laboratory Control Sample (LCS) recoveries were within acceptable quality control limits, except as noted in Table 6 below.

TABLE 6
Surrogate, MS/MSD and LCS Recoveries and RPDs Out of QC Limits: SVOC
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Site	Sample	Compound	Recovery	RPD Limits	RPD Limits	Sample	RPD
62384	1200243013 LCS	Benzoic acid	0*	70-130		62384 - All	Detects-J, non-detects-R
62384	62384003	2-Fluorophenol	1*	21-110		62384003	Detects-J, non-detects-R
		Phenol-d5	3*	10-110			
		2,4,6-Tribromophenol	2*	10-123			
CNC114	720CB00302 MS/MSD	1,2,4-Trichlorobenzen	37* / 32*	38-107		S244070*4	Detects-J, non-detects-UJ
		Dimethylphthalate	46* / 42*	49-130			
		N-Nitrosodiphenylamine	49* / 44*	51-132			
		Phenanthrene	37* / 33*	39-152			
		Butylbenzylphthalate	53* / 49*	58-122			
		Benzo(a)anthracene	46* / 42*	54-137			
		Chrysene	45* / 40*	56-133			
		Indeno(1,2,3-cd)pyrene	51 / 37	24-136			
* - out of control limits							

Initial and Continuing Calibration Criteria

All initial calibration criteria and continuing calibration criteria were met, except as listed in Table 7.

TABLE 7

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: SVOC
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Instrument/Calibration Date	Analyte	Relative Standard Deviation of 4% (CAL) Standards (R ²)	AS 088101 Samples
MSD8-ICAL-06/25/02, 2211	2,4-Dinitrophenol	R ² =0.987	62384 – All
MSD8-CCAL-06/29/02, 0934	Benzyl alcohol	20.7% high	62384002, 62384003, 62384004
	bis(2-Chloroisopropyl)ether	20.4% high	
	2,4-Dinitrophenol	26.0% high	
	o-Nitroaniline	26.4% high	

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

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

Organochlorine Pesticide Analyses

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

Recoveries - Surrogate, MS/MSD and LCS

All Surrogate, Matrix Spike (MS), Matrix Spike Duplicate (MSD), and Laboratory Control Sample (LCS) recoveries were within acceptable quality control limits, except as noted in Table 8 below.

TABLE 8

Surrogate, MS/MSD and LCS Recoveries Out of QC Limits: Pesticides
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Site	Sample	Pesticide	Recovery	Control Limit	Sample	Flags
CNC114	4407015BS LCS	Endrin ketone	134*	29-112	S244070*1, 4, 4DL	Detects only - J
CNC114	S244070*1	Tetrachloro-m-xylene	50* / 42*	60-150	S244070*1	Detects-J, non-detects-UJ
		Decachlorobiphenyl	160*	60-150		
CNC114	S244070*4	Tetrachloro-m-xylene	57* / 52*	60-150	S244070*4	Detects-J, non-detects-UJ
		Decachlorobiphenyl	157*	60-150		
CNC114	S244070*4DL	Tetrachloro-m-xylene	57*	60-150	S244070*4DL	Detects-J, non-detects-UJ
		Decachlorobiphenyl	281*	60-150		

* - out of control limits

Field Duplicate Samples

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

- The percent Difference for 4,4'-DDT in the Native/Field Duplicate sample 720SB00302 / 720CB00302 was 191.3 percent with a 35 percent limit.

Initial and Continuing Calibration Criteria

All initial calibration criteria and continuing calibration criteria were met, except as listed in Table 9.

TABLE 9

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: Pesticides
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Sample	Pesticide	Exception	Sample
SGJECD1-CCAL-06/18/02, 1517	Endrin aldehyde	23.8% low	S244070*1-5
	Methoxychlor	17.5% low	
SGJECD2-CCAL-06/18/02, 1517	4,4'-DDT	21.1% low	S244070*1-5
	Endrin aldehyde	23.2% low	

TABLE 9

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: Pesticides
 Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Initial Calibration Criteria (ICC)	Analyte	Percent Difference (%D)	Associated Samples
	Methoxychlor	17.0% low	
SGJECD1-CCAL-06/18/02, 1907	gamma-Chlordane	15.2% high	S244070*1-5
	Endrin	16.6% high	
	4,4'-DDD	18.5% high	
	Endosulfan II	27.9% high	
SGJECD2-CCAL-06/18/02, 1907	Endrin ketone	23.7% high	S244070*1-5

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

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

Second Column Confirmation

The second column confirmation percent difference (%D) for some detected parameters, exceeded the 40 %D criteria. Those results were flagged "J", as estimated. The laboratory reported the lower of the two concentrations. The individual samples and specific compounds that were flagged are listed in Table 10 below.

TABLE 10
Second Column Confirmation out of Criteria: Pesticides
Charleston Naval Complex, Zone G, AOC 720 Charleston, SC

SITE	Sample ID	Lab Sample ID	Parameter
CNC114	720SB00302	S244070*3	gamma-Chlordane
CNC114	720SB00302	S244070*3	alpha-Chlordane
CNC114	720SB00302	S244070*3	Endrin aldehyde
CNC114	720CB00302	S244070*4	Heptachlor
CNC114	720CB00302	S244070*4	gamma-Chlordane
CNC114	720CB00302	S244070*4	Endosulfan II
CNC114	720CB00302	S244070*4	Endrin aldehyde
CNC114	720CB00302DL	S244070*4DL	gamma-Chlordane

Polychlorinated Biphenyls (PCBs) Analyses

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

Initial and Continuing Calibration Criteria

All initial calibration criteria and continuing calibration criteria were met, except as listed in Table 11.

TABLE 11

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: PCBs
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Instrument/Calibration Date	Analyte	Relative Standard Deviation and (%D) Difference	Associated Sample
SGJECD1-CCAL-06/18/02, 1542	Aroclor-1260	18.0% low	S244070*1-5
SGJECD2-CCAL-06/18/02, 1542	Aroclor-1016	16.2% low	S244070*1-5
SGJECD2-CCAL-06/18/02, 1932	Aroclor-1016	16.6% low	S244070*1-5

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

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

Inorganic Parameters

Quality Control Review

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

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

- **Pre/Post Digestion Spike (MS/MSD)** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **ICP Interference Check Sample** – This sample verifies the lab's interelement and background correction factors.
- **Initial Calibration Verification** – This parameter ensures that the instrument is capable of producing acceptable quantitative data for the target analyte list to be measured.
- **Continuing Calibration Verification** – This one-point, mid-range parameter establishes that the initial calibration is still valid by checking the performance of the instrument on a continual basis.
- **ICP Serial Dilution** – The serial dilution of samples quantitated by ICP determines whether or not significant physical or chemical interferences exist due to the sample matrix.
-

Metals Analyses

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

Field Duplicate Samples

All Field Duplicate Samples were within acceptable quality control limits, except as noted in Table 12 below. No flags are applied due to Field Duplicate precision.

TABLE 12
Field Duplicate RPDs Out of QC Limits: Metals
Charleston Naval Complex, , Zone G, AOC 720, Charleston, SC

Sample ID	Location	Parameter	Sample 1 (mg/Kg)	Sample 2 (mg/Kg)	RPD (%)	QC Limit
CNC114	720SB00302 / 720CB00302	Lead	890 mg /Kg	13 mg /Kg	194.2*	35
		Zinc	120 mg /Kg	61 mg /Kg	65.2*	35
* - out of control limits						

ICP Serial Dilution

All Serial Dilution recoveries were within acceptable quality control limits, except as noted in Table 13 below.

TABLE 13
Serial Dilution Recoveries Out of QC Limits: Metals
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

SDE	Parameter	Recovery	Recovery Limits	Associated Sample	Flag
CNC114	Aluminum	15.1*	10	S244070*1-5	Detects-J, non-detects-UJ
	Barium	13.8*	10		
	Chromium	18.4*	10		
	Iron	18.6*	10		
	Magnesium	17.7*	10		
	Manganese	17.5*	10		
	Vanadium	14.7*	10		
* - out of control limits					

Rejected Data

The majority of rejected data were associated with re-runs and dilutions (you can only have a single valid result per parameter per sample). However, there were selected results qualified as "R", rejected, due to associated QC parameters out of criteria. The rejected data are summarized in Table 13 below.

TABLE 13
Data Qualification Summary: Rejected Data
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

SDE	Sample ID	Parameter	Result	QC Flag	QC Value	QC Limit	Unit	Qualifier
62384	720GP001M2	SVOA	Benzoic acid	48.8	U	48.8	R	ug/L BS
62384	720GP002M2	SVOA	2,4,5-TRICHLOROPHENOL	51	U	51	R	ug/L SS
62384	720GP002M2	SVOA	2,4,6-TRICHLOROPHENOL	10.2	U	10.2	R	ug/L SS
62384	720GP002M2	SVOA	2,4-DICHLOROPHENOL	10.2	U	10.2	R	ug/L SS
62384	720GP002M2	SVOA	2,4-DIMETHYLPHENOL	10.2	U	10.2	R	ug/L SS

TABLE 13
 Data Qualification Summary: Rejected Data
 Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

SID	Sample ID	Parameter	Parameter	Lab Result	Quality	Final Result	Final Quality	Units	Validation
62384	720GP002M2	SVOA	2,4-DINITROPHENOL	51	U	51	R	ug/L	SS
62384	720GP002M2	SVOA	2-CHLOROPHENOL	10.2	U	10.2	R	ug/L	SS
62384	720GP002M2	SVOA	2-METHYLPHENOL (o-CRESOL)	10.2	U	10.2	R	ug/L	SS
62384	720GP002M2	SVOA	2-NITROPHENOL	10.2	U	10.2	R	ug/L	SS
62384	720GP002M2	SVOA	4,6-DINITRO-2-METHYLPHENOL	51	U	51	R	ug/L	SS
62384	720GP002M2	SVOA	4-CHLORO-3-METHYLPHENOL	10.2	U	10.2	R	ug/L	SS
62384	720GP002M2	SVOA	4-NITROPHENOL	51	U	51	R	ug/L	SS
62384	720GP002M2	SVOA	Benzoic acid	51	U	51	R	ug/L	SS,BS
62384	720GP002M2	SVOA	m,p-Cresols	10.2	U	10.2	R	ug/L	SS
62384	720GP002M2	SVOA	PENTACHLOROPHENOL	51	U	51	R	ug/L	SS
62384	720GP002M2	SVOA	PHENOL	10.2	U	10.2	R	ug/L	SS
62384	720GP001M2	VOA	2-Chloroethyl vinyl ether	5	U	5	R	ug/L	MS

Conclusion

A review of the analytical data submitted regarding the investigation of Zone G, AOC 720 at the Charleston Naval Complex, Charleston, South Carolina by CH2M HILL has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed, and that the analytical results should be considered usable as qualified.

As discussed above, there were specific results that were rejected, in which the data cannot be used. With the exception of these results, the validation review demonstrated that the analytical systems were generally in control and the data can be used in the decision making process.

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

Site	Sample ID	Lab Sample ID	Matrix	Parameter Group	Analytical Method	Parameter	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
62384	720GP002M2	62384003	WG	SVOA	SW8270C	2,4,5-TRICHLOROPHENOL	51	U	51	R	ug/L	SS
62384	720GP002M2	62384003	WG	SVOA	SW8270C	2,4,6-TRICHLOROPHENOL	10.2	U	10.2	R	ug/L	SS
62384	720GP002M2	62384003	WG	SVOA	SW8270C	2,4-DICHLOROPHENOL	10.2	U	10.2	R	ug/L	SS
62384	720GP002M2	62384003	WG	SVOA	SW8270C	2,4-DIMETHYLPHENOL	10.2	U	10.2	R	ug/L	SS
62384	720GP001M2	62384002	WG	SVOA	SW8270C	2,4-DINITROPHENOL	48.8	U	48.8	UJ	ug/L	IC
62384	720GP002M2	62384003	WG	SVOA	SW8270C	2,4-DINITROPHENOL	51	U	51	R	ug/L	SS
62384	720GP002M2	62384003	WG	SVOA	SW8270C	2-CHLOROPHENOL	10.2	U	10.2	R	ug/L	SS
62384	720GP002M2	62384003	WG	SVOA	SW8270C	2-METHYLPHENOL (o-CRESOL)	10.2	U	10.2	R	ug/L	SS
62384	720GP002M2	62384003	WG	SVOA	SW8270C	2-NITROPHENOL	10.2	U	10.2	R	ug/L	SS
62384	720GP002M2	62384003	WG	SVOA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	51	U	51	R	ug/L	SS
62384	720GP002M2	62384003	WG	SVOA	SW8270C	4-CHLORO-3-METHYLPHENOL	10.2	U	10.2	R	ug/L	SS
62384	720GP002M2	62384003	WG	SVOA	SW8270C	4-NITROPHENOL	51	U	51	R	ug/L	SS
62384	720GP001M2	62384002	WG	SVOA	SW8270C	Benzoic acid	48.8	U	48.8	R	ug/L	BS
62384	720GP002M2	62384003	WG	SVOA	SW8270C	Benzoic acid	51	U	51	R	ug/L	SS,BS
62384	720GP001M2	62384002	WG	SVOA	SW8270C	bis(2-ETHYLHEXYL) PHTHALATE	2.1	JB	9.8	U	ug/L	BL
62384	720GP002M2	62384003	WG	SVOA	SW8270C	bis(2-ETHYLHEXYL) PHTHALATE	1.8	JB	10.2	U	ug/L	BL
62384	720GP002M2	62384003	WG	SVOA	SW8270C	m,p-Cresols	10.2	U	10.2	R	ug/L	SS
62384	720GP002M2	62384003	WG	SVOA	SW8270C	PENTACHLOROPHENOL	51	U	51	R	ug/L	SS
62384	720GP002M2	62384003	WG	SVOA	SW8270C	PHENOL	10.2	U	10.2	R	ug/L	SS
62384	720GP001M2	62384002	WG	VOA	SW8260B	2-Chloroethyl vinyl ether	5	U	5	R	ug/L	MS
62384	720GP001M2	62384002	WG	VOA	SW8260B	ACETONE	3.1	J	10	U	ug/L	BL
62384	720GP002M2	62384003	WG	VOA	SW8260B	ACETONE	3.4	J	10	U	ug/L	BL
62384	720GP001M2	62384002	WG	VOA	SW8260B	Vinyl acetate	10	U	10	UJ	ug/L	MS,BS
62384	720GP002M2	62384003	WG	VOA	SW8260B	Vinyl acetate	10	U	10	UJ	ug/L	BS
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	ALUMINUM	7200	E	7200	J	mg/kg	SD
CNC114	720SB00102	S244070*1	SO	METAL	SW6010B	ALUMINUM	4900	E	4900	J	mg/kg	SD
CNC114	720SB00202	S244070*2	SO	METAL	SW6010B	ALUMINUM	5300	E	5300	J	mg/kg	SD
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	ALUMINUM	8300	E	8300	J	mg/kg	SD
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	ANTIMONY	0.76	B	0.76	J	mg/kg	IB
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	ANTIMONY	0.86	B	0.86	J	mg/kg	IB
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	BARIUM	32	BE	32	J	mg/kg	SD
CNC114	720SB00102	S244070*1	SO	METAL	SW6010B	BARIUM	13	BE	13	J	mg/kg	SD

Attachment 1 - Changed Qualifiers and Results
 Zone G, AOC 720 - Data Validation

Site	Sample ID	Lab Sample ID	Depth	Parameter Class	Analytical Method	Parameter	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
CNC114	720SB00202	S244070*2	SO	METAL	SW6010B	BARIUM	32	BE	32	J	mg/kg	SD
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	BARIUM	28	BE	28	J	mg/kg	SD
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	BERYLLIUM	0.52	B	0.52	J	mg/kg	IB
CNC114	720SB00102	S244070*1	SO	METAL	SW6010B	BERYLLIUM	0.36	B	0.36	J	mg/kg	IB
CNC114	720SB00202	S244070*2	SO	METAL	SW6010B	BERYLLIUM	0.85	B	0.85	J	mg/kg	IB
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	BERYLLIUM	0.56	B	0.56	J	mg/kg	IB
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	CADMIUM	0.48	B	0.48	J	mg/kg	IB
CNC114	720SB00102	S244070*1	SO	METAL	SW6010B	CADMIUM	0.39	B	0.39	J	mg/kg	IB
CNC114	720SB00202	S244070*2	SO	METAL	SW6010B	CADMIUM	0.41	B	0.41	J	mg/kg	IB
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	CADMIUM	0.45	B	0.45	J	mg/kg	IB
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	CHROMIUM, TOTAL	43	E	43	J	mg/kg	SD
CNC114	720SB00102	S244070*1	SO	METAL	SW6010B	CHROMIUM, TOTAL	32	E	32	J	mg/kg	SD
CNC114	720SB00202	S244070*2	SO	METAL	SW6010B	CHROMIUM, TOTAL	43	E	43	J	mg/kg	SD
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	CHROMIUM, TOTAL	38	E	38	J	mg/kg	SD
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	COBALT	2	B	2	J	mg/kg	IB
CNC114	720SB00102	S244070*1	SO	METAL	SW6010B	COBALT	0.91	B	0.91	J	mg/kg	IB
CNC114	720SB00202	S244070*2	SO	METAL	SW6010B	COBALT	0.97	B	0.97	J	mg/kg	IB
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	COBALT	3.3	B	3.3	J	mg/kg	IB
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	IRON	7300	E	7300	J	mg/kg	SD
CNC114	720SB00102	S244070*1	SO	METAL	SW6010B	IRON	4500	E	4500	J	mg/kg	SD
CNC114	720SB00202	S244070*2	SO	METAL	SW6010B	IRON	4700	E	4700	J	mg/kg	SD
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	IRON	8100	E	8100	J	mg/kg	SD
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	MAGNESIUM	4500	E	4500	J	mg/kg	SD
CNC114	720SB00102	S244070*1	SO	METAL	SW6010B	MAGNESIUM	3600	E	3600	J	mg/kg	SD
CNC114	720SB00202	S244070*2	SO	METAL	SW6010B	MAGNESIUM	6100	E	6100	J	mg/kg	SD
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	MAGNESIUM	4300	E	4300	J	mg/kg	SD
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	MANGANESE	56	E	56	J	mg/kg	SD
CNC114	720SB00102	S244070*1	SO	METAL	SW6010B	MANGANESE	45	E	45	J	mg/kg	SD
CNC114	720SB00202	S244070*2	SO	METAL	SW6010B	MANGANESE	35	E	35	J	mg/kg	SD
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	MANGANESE	61	E	61	J	mg/kg	SD
CNC114	720CB00302	S244070*4	SO	METAL	SW7471A	MERCURY	0.07	=	0.07	J	mg/kg	IB
CNC114	720SB00102	S244070*1	SO	METAL	SW7471A	MERCURY	0.025	=	0.025	J	mg/kg	IB

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

ID	Sample ID	TS Sample ID	Depth	Parameter	Method	Parameter	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
CNC114	720SB00202	S244070*2	SO	METAL	SW7471A	MERCURY	0.019	J	0.019	J	mg/kg	IB
CNC114	720SB00302	S244070*3	SO	METAL	SW7471A	MERCURY	0.088	=	0.088	J	mg/kg	IB
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	POTASSIUM	1100	B	1100	J	mg/kg	IB
CNC114	720SB00102	S244070*1	SO	METAL	SW6010B	POTASSIUM	880	B	880	J	mg/kg	IB
CNC114	720SB00202	S244070*2	SO	METAL	SW6010B	POTASSIUM	1000	B	1000	J	mg/kg	IB
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	POTASSIUM	1100	B	1100	J	mg/kg	IB
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	SELENIUM	1.1	B	1.1	J	mg/kg	IB
CNC114	720SB00102	S244070*1	SO	METAL	SW6010B	SELENIUM	1.1	B	1.1	J	mg/kg	IB
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	SELENIUM	0.95	B	0.95	J	mg/kg	IB
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	SODIUM	1000	B	1000	J	mg/kg	IB
CNC114	720SB00102	S244070*1	SO	METAL	SW6010B	SODIUM	850	B	850	J	mg/kg	IB
CNC114	720SB00202	S244070*2	SO	METAL	SW6010B	SODIUM	1100	B	1100	J	mg/kg	IB
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	SODIUM	930	B	930	J	mg/kg	IB
CNC114	720CB00302	S244070*4	SO	METAL	SW6010B	VANADIUM	24	E	24	J	mg/kg	SD
CNC114	720SB00102	S244070*1	SO	METAL	SW6010B	VANADIUM	19	E	19	J	mg/kg	SD
CNC114	720SB00202	S244070*2	SO	METAL	SW6010B	VANADIUM	25	E	25	J	mg/kg	SD
CNC114	720SB00302	S244070*3	SO	METAL	SW6010B	VANADIUM	25	E	25	J	mg/kg	SD
CNC114	720CB00302DL	S244070*4*DL	SO	PCB	SW8082	PCB-1016 (AROCHLOR 1016)	170	U	170	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PCB	SW8082	PCB-1221 (AROCHLOR 1221)	170	U	170	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PCB	SW8082	PCB-1232 (AROCHLOR 1232)	170	U	170	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PCB	SW8082	PCB-1242 (AROCHLOR 1242)	170	U	170	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PCB	SW8082	PCB-1248 (AROCHLOR 1248)	170	U	170	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PCB	SW8082	PCB-1254 (AROCHLOR 1254)	340	U	340	R	ug/kg	DL
CNC114	720CB00302	S244070*4	SO	PCB	SW8082	PCB-1260 (AROCHLOR 1260)	86	U	86	UJ	ug/kg	CC
CNC114	720CB00302DL	S244070*4*DL	SO	PCB	SW8082	PCB-1260 (AROCHLOR 1260)	340	U	340	R	ug/kg	DL
CNC114	720SB00102	S244070*1	SO	PCB	SW8082	PCB-1260 (AROCHLOR 1260)	83	U	83	UJ	ug/kg	CC
CNC114	720SB00202	S244070*2	SO	PCB	SW8082	PCB-1260 (AROCHLOR 1260)	97	U	97	UJ	ug/kg	CC
CNC114	720SB00302	S244070*3	SO	PCB	SW8082	PCB-1260 (AROCHLOR 1260)	87	U	87	UJ	ug/kg	CC
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	ALDRIN	6.7	U	6.7	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	ALPHA BHC	6.7	U	6.7	R	ug/kg	DL
CNC114	720CB00302	S244070*4	SO	PEST	SW8081A	ALPHA-CHLORDANE	1	J	1	J	ug/kg	SS
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	ALPHA-CHLORDANE	1.7	DJ	1.7	R	ug/kg	DL

Attachment 1 - Changed Qualifiers and Results
Zone G, AOC 720 - Data Validation

PT	Sample ID	Lot/Container	Matrix	Target Name	Analysis Method	Reference	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
CNC114	720SB00302	S244070*3	SO	PEST	SW8081A	ALPHA-CHLORDANE	0.64	JP	0.64	J	ug/kg	2C
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	BETA BHC	6.7	U	6.7	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	Chlordane	67	U	67	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	DELTA BHC	6.7	U	6.7	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	DIELDRIN	13	U	13	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	ENDOSULFAN I	6.7	U	6.7	R	ug/kg	DL
CNC114	720CB00302	S244070*4	SO	PEST	SW8081A	ENDOSULFAN II	0.72	JP	0.72	J	ug/kg	2C,SS
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	ENDOSULFAN II	13	U	13	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	ENDOSULFAN SULFATE	13	U	13	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	ENDRIN	13	U	13	R	ug/kg	DL
CNC114	720CB00302	S244070*4	SO	PEST	SW8081A	ENDRIN ALDEHYDE	0.52	JP	0.52	J	ug/kg	CC,2C,SS
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	ENDRIN ALDEHYDE	13	U	13	R	ug/kg	DL
CNC114	720SB00102	S244070*1	SO	PEST	SW8081A	ENDRIN ALDEHYDE	3.1	U	3.1	UJ	ug/kg	CC
CNC114	720SB00202	S244070*2	SO	PEST	SW8081A	ENDRIN ALDEHYDE	3.6	U	3.6	UJ	ug/kg	CC
CNC114	720SB00302	S244070*3	SO	PEST	SW8081A	ENDRIN ALDEHYDE	0.53	JP	0.53	J	ug/kg	CC,2C
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	ENDRIN KETONE	13	U	13	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	GAMMA BHC (LINDANE)	6.7	U	6.7	R	ug/kg	DL
CNC114	720CB00302	S244070*4	SO	PEST	SW8081A	GAMMA-CHLORDANE	5.3	P	5.3	J	ug/kg	CC,2C,SS
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	GAMMA-CHLORDANE	6.7	DP	6.7	R	ug/kg	DL
CNC114	720SB00302	S244070*3	SO	PEST	SW8081A	GAMMA-CHLORDANE	1.9	P	1.9	J	ug/kg	CC,2C
CNC114	720CB00302	S244070*4	SO	PEST	SW8081A	HEPTACHLOR	0.42	JP	0.42	J	ug/kg	2C,SS
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	HEPTACHLOR	6.7	U	6.7	R	ug/kg	DL
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	HEPTACHLOR EPOXIDE	6.7	U	6.7	R	ug/kg	DL
CNC114	720CB00302	S244070*4	SO	PEST	SW8081A	METHOXYCHLOR	17	U	17	UJ	ug/kg	CC
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	METHOXYCHLOR	67	U	67	R	ug/kg	DL
CNC114	720SB00102	S244070*1	SO	PEST	SW8081A	METHOXYCHLOR	16	U	16	UJ	ug/kg	CC
CNC114	720SB00202	S244070*2	SO	PEST	SW8081A	METHOXYCHLOR	19	U	19	UJ	ug/kg	CC
CNC114	720SB00302	S244070*3	SO	PEST	SW8081A	METHOXYCHLOR	17	U	17	UJ	ug/kg	CC
CNC114	720CB00302	S244070*4	SO	PEST	SW8081A	p,p'-DDD	30	=	30	J	ug/kg	CC,SS
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	p,p'-DDD	43	D	43	R	ug/kg	DL
CNC114	720SB00102	S244070*1	SO	PEST	SW8081A	p,p'-DDD	12	=	12	J	ug/kg	CC,SS
CNC114	720SB00302	S244070*3	SO	PEST	SW8081A	p,p'-DDD	24	=	24	J	ug/kg	CC

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

SPEC	Sample ID	Lab Sample ID	Matrix	Parameter Class	Analytical Method	Parameter	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
CNC114	720CB00302	S244070*4	SO	PEST	SW8081A	p,p'-DDE	21	=	21	J	ug/kg	SS
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	p,p'-DDE	28	D	28	R	ug/kg	DL
CNC114	720SB00102	S244070*1	SO	PEST	SW8081A	p,p'-DDE	9.2	=	9.2	J	ug/kg	SS
CNC114	720CB00302	S244070*4	SO	PEST	SW8081A	p,p'-DDT	190	E	190	R	ug/kg	LR
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	p,p'-DDT	240	D	240	J	ug/kg	CC,SS
CNC114	720CB00302DL	S244070*4*DL	SO	PEST	SW8081A	TOXAPHENE	420	U	420	R	ug/kg	DL
CNC114	720CB00302	S244070*4	SO	SVOA	SW8270C	1,2,4-TRICHLOROENZENE	420	U	420	UJ	ug/kg	MS
CNC114	720CB00302	S244070*4	SO	SVOA	SW8270C	BENZO(a)ANTHRACENE	210	J	210	J	ug/kg	MS
CNC114	720CB00302	S244070*4	SO	SVOA	SW8270C	BENZYL BUTYL PHTHALATE	420	U	420	UJ	ug/kg	MS
CNC114	720CB00302	S244070*4	SO	SVOA	SW8270C	CHRYSENE	260	J	260	J	ug/kg	MS
CNC114	720CB00302	S244070*4	SO	SVOA	SW8270C	DIMETHYL PHTHALATE	420	U	420	UJ	ug/kg	MS
CNC114	720CB00302	S244070*4	SO	SVOA	SW8270C	INDENO(1,2,3-c,d)PYRENE	420	U	420	UJ	ug/kg	MD
CNC114	720CB00302	S244070*4	SO	SVOA	SW8270C	N-NITROSODI-n-PROPYLAMINE	420	U	420	UJ	ug/kg	MS
CNC114	720CB00302	S244070*4	SO	SVOA	SW8270C	PHENANTHRENE	590	=	590	J	ug/kg	MS
CNC114	720CB00302	S244070*4	SO	VOA	SW8260B	1,1-DICHLOROETHENE	6.5	U	6.5	UJ	ug/kg	BD
CNC114	720SB00102	S244070*1	SO	VOA	SW8260B	1,1-DICHLOROETHENE	6.4	U	6.4	UJ	ug/kg	BD
CNC114	720SB00202	S244070*2	SO	VOA	SW8260B	1,1-DICHLOROETHENE	7.1	U	7.1	UJ	ug/kg	BD
CNC114	720SB00302	S244070*3	SO	VOA	SW8260B	1,1-DICHLOROETHENE	6.8	U	6.8	UJ	ug/kg	BD
CNC114	720CB00302	S244070*4	SO	VOA	SW8260B	1,2,3-Trichlorobenzene	6.5	U	6.5	UJ	ug/kg	IC,BD
CNC114	720SB00102	S244070*1	SO	VOA	SW8260B	1,2,3-Trichlorobenzene	6.4	U	6.4	UJ	ug/kg	IC,BD
CNC114	720SB00202	S244070*2	SO	VOA	SW8260B	1,2,3-Trichlorobenzene	7.1	U	7.1	UJ	ug/kg	IC,BD
CNC114	720SB00302	S244070*3	SO	VOA	SW8260B	1,2,3-Trichlorobenzene	6.8	U	6.8	UJ	ug/kg	IC,BD
CNC114	720CB00302	S244070*4	SO	VOA	SW8260B	2-BUTANONE (MEK)	20	=	20	J	ug/kg	IC
CNC114	720SB00102	S244070*1	SO	VOA	SW8260B	2-BUTANONE (MEK)	8.8	J	8.8	J	ug/kg	IC
CNC114	720SB00202	S244070*2	SO	VOA	SW8260B	2-BUTANONE (MEK)	7.7	J	7.7	J	ug/kg	IC
CNC114	720SB00302	S244070*3	SO	VOA	SW8260B	2-BUTANONE (MEK)	7.9	J	7.9	J	ug/kg	IC
CNC114	720CB00302	S244070*4	SO	VOA	SW8260B	2-Chloroethyl vinyl ether	13	UJ	13	UJ	ug/kg	IC,CC,BD
CNC114	720SB00102	S244070*1	SO	VOA	SW8260B	2-Chloroethyl vinyl ether	13	UJ	13	UJ	ug/kg	CC
CNC114	720SB00202	S244070*2	SO	VOA	SW8260B	2-Chloroethyl vinyl ether	14	UJ	14	UJ	ug/kg	IC,CC,BD
CNC114	720SB00302	S244070*3	SO	VOA	SW8260B	2-Chloroethyl vinyl ether	14	UJ	14	UJ	ug/kg	IC,CC,BD
CNC114	720CB00302	S244070*4	SO	VOA	SW8260B	2-HEXANONE	13	U	13	UJ	ug/kg	CC,BD
CNC114	720SB00102	S244070*1	SO	VOA	SW8260B	2-HEXANONE	13	U	13	UJ	ug/kg	CC,BD

Attachment 1 - Changed Qualifiers and Results
Zone G, AOC 720 - Data Validation

Sample ID	Location	Depth	Depth	Parameter	Method	Parameter	Lab Result	Lab Qual	Field Result	Field Qual	Unit	Reasons
CNC114	720SB00202	S244070*2	SO	VOA	SW8260B	2-HEXANONE	14	U	14	UJ	ug/kg	CC,BD
CNC114	720SB00302	S244070*3	SO	VOA	SW8260B	2-HEXANONE	14	U	14	UJ	ug/kg	CC,BD
CNC114	720CB00302	S244070*4	SO	VOA	SW8260B	4-METHYL-2-PENTANONE (MIBK)	13	U	13	UJ	ug/kg	CC
CNC114	720SB00102	S244070*1	SO	VOA	SW8260B	4-METHYL-2-PENTANONE (MIBK)	13	U	13	UJ	ug/kg	CC
CNC114	720SB00202	S244070*2	SO	VOA	SW8260B	4-METHYL-2-PENTANONE (MIBK)	14	U	14	UJ	ug/kg	CC
CNC114	720SB00302	S244070*3	SO	VOA	SW8260B	4-METHYL-2-PENTANONE (MIBK)	14	U	14	UJ	ug/kg	CC
CNC114	720CB00302	S244070*4	SO	VOA	SW8260B	ACETONE	150	=	150	J	ug/kg	IC,CC,BD
CNC114	720SB00102	S244070*1	SO	VOA	SW8260B	ACETONE	65	=	65	J	ug/kg	IC,CC,BD
CNC114	720SB00202	S244070*2	SO	VOA	SW8260B	ACETONE	67	=	67	J	ug/kg	IC,CC,BD
CNC114	720SB00302	S244070*3	SO	VOA	SW8260B	ACETONE	92	=	92	J	ug/kg	IC,CC,BD
CNC114	720CB00302	S244070*4	SO	VOA	SW8260B	BROMOMETHANE	13	U	13	UJ	ug/kg	BD
CNC114	720SB00102	S244070*1	SO	VOA	SW8260B	BROMOMETHANE	13	U	13	UJ	ug/kg	BD
CNC114	720SB00202	S244070*2	SO	VOA	SW8260B	BROMOMETHANE	14	U	14	UJ	ug/kg	BD
CNC114	720SB00302	S244070*3	SO	VOA	SW8260B	BROMOMETHANE	14	U	14	UJ	ug/kg	BD
CNC114	720CB00302	S244070*4	SO	VOA	SW8260B	CARBON DISULFIDE	12	=	12	J	ug/kg	CC,BS
CNC114	720SB00102	S244070*1	SO	VOA	SW8260B	CARBON DISULFIDE	6.4	U	6.4	UJ	ug/kg	BS
CNC114	720SB00202	S244070*2	SO	VOA	SW8260B	CARBON DISULFIDE	4.5	J	4.5	J	ug/kg	CC,BS
CNC114	720SB00302	S244070*3	SO	VOA	SW8260B	CARBON DISULFIDE	5.3	J	5.3	J	ug/kg	CC,BS

Laboratory: GEL		Project Name: Charleston Navy Complex		Site Name: Zone G, AOC 720		Lab Batch/SDG:												
Project Number: 158814.PM.04		TAT: standard		QA Level: level 3														
Project Manager: Tom Beisel		Address: GNV: 3011 SW Williston Rd., Gainesville, FL 32605		Address: ATL: 115 Perimeter Center Place NE, Suite 700, Atlanta, GA 30346-1278														
Send Report To: see last page of COC		EDD: CNC format																
Sample ID	Station ID	Sample Description	Depth		Date & Time Collected	Matrix	# of containers	VOCs (SW8260B)	SVOCs (SW8270C)	Pesticides/PCBs (SW8081A/8082)	Metals * (SW6010B/7000 series)	VOCs (SW8260B)	SVOCs (SW8270C)	Pesticides/PCBs (SW8081A/8082)	Metals * (SW6010B/7000 series)		Comments	
			Begin	End														
62384% 720GP001M2 ✓	F720GP001	GW from soil boring	8	12	6-14-02/1415	WG	6					X	X	X				
720GP002M2 ✓	F720GP002	GW from soil boring	8	12	6-14-02/1430	WG	6					X	X	X				
720GP003M2	F720GP003	GW from soil boring			NOT COLLECTED	WG						X	X	X				
720EP001M2 ✓	F720EP001	EB			6-14-02/1500	WQ	5					X	X	X				water EB
720TP001M2 ✓	F720TP001				LAB PROVIDED	WQ	3					X						TB

Sampled By: *[Signature]* Date/Time: 6/19/02 / 1720 Relinquished by: *[Signature]* Date/Time: 6/19/02

Additional Samplers: _____

Received By Lab: *[Signature]* Date/Time: 6/19/02 1720 Relinquished by: _____ Date/Time: _____

Received By: _____ Date/Time: _____ Shipped Via: UPS FedEx Hand Other Tracking#: _____

Remarks: TB at AOC 720 Note: 720GP003 not obtained due to NO WATER FROM 8-20' Temperature: _____

Rec: Exceptions: _____

Data Validation Summary - Charleston Naval Complex - Zone G, AOC 720

TO: Louise Palmer/CH2M HILL/CLT

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

DATE: April 7, 2003

The purpose of this memorandum is to present the results of the data validation process for the samples collected in Zone G, AOC 720. The samples were collected between the dates of February 20 and March 12, 2003.

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

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

Samples were submitted to General Engineering Laboratories, Inc., in Charleston, South Carolina, for the following analyses: SW-846 8260 Volatile Organic Compounds (VOC), SW-846 8270 Semivolatile Organic Compounds (SVOC), SW-846 8081 Organochlorine Pesticides, SW-846 8082 Polychlorinated Biphenyls and Metals following SW-846 6010/7000 Series methodology.

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

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

The following primary flags were used to qualify the data:

[=] Detected. The analyte was analyzed for and detected at the concentration shown.

[J] Estimated. The analyte was present but the reported value may not be accurate or precise.

[U] Undetected. The analyte was analyzed for but not detected above the method detection limit.

[UJ] Detection limit estimated. The analyte was analyzed for but qualified as not detected; the result is estimated.

[R] Rejected. The data is not useable.

Secondary Data Validation Qualifiers

<u>Code</u>	<u>Definition</u>
2S	Second Source
2C	Second Column Confirmation
BL	Blank
BD	Blank Spike/Blank Spike Duplicate or (LCS/LCSD) Precision
BS	Blank Spike/LCS
CC	Continuing Calibration Verification
DL	Dilution
FD	Field Duplicate
HT	Holding Time
IB	In-Between (metals - B's → J's)
IC	Initial Calibration
IS	Internal Standard
LD	Lab Duplicate
LR	Concentration exceeded Linear Range
MD	MS/MSD or LCS/LCSD Precision
MS	Matrix Spike/Matrix Spike Duplicate
OT	Other (see DV worksheet)
PD	Pesticide Degradation
PS	Post Spike
RE	Re-extraction/Re-analysis
SD	Serial Dilution
SS	Spiked Surrogate
TD	Total vs Dissolved
TN	Tune

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

Site	Station ID	Sample ID	Lab Sample ID	Matrix	Sample Type	Date Collected	VOC SW/260E	SVC SW/270E	PCB/PAH SW/031A	PCB SW/032	Metal SW/010E	Mercury SW/470A/ SW/471A
75312	G720SB004	720SB00402	75312001	SO	N	02/20/03					X	
75312	G720SB005	720SB00502	75312002	SO	N	02/20/03					X	
75312	G720SB006	720SB00602	75312003	SO	N	02/20/03	X	X	X	X	X	X
75312	G720SB006	720CB00602	75312004	SO	FD	02/20/03	X	X	X	X	X	X
75312	LABQC	1200383431	1200383431	SQ	LB			X				
75312	LABQC	1200383432	1200383432	SQ	BS			X				
75312	LABQC	1200384074	1200384074	SQ	LB					X		
75312	LABQC	1200384075	1200384075	SQ	BS					X		
75312	LABQC	720SB00602MS	1200384076	SO	MS	02/20/03				X		
75312	LABQC	720SB00602SD	1200384077	SO	SD	02/20/03				X		
75312	LABQC	1200384325	1200384325	SQ	LB							X
75312	LABQC	1200384326	1200384326	SQ	BS							X
75312	LABQC	720SB00602MS	1200384327	SO	MS	02/20/03						X
75312	LABQC	720SB00602SD	1200384328	SO	SD	02/20/03						X
75312	LABQC	1200384604	1200384604	SQ	LB				X			
75312	LABQC	1200384605	1200384605	SQ	BS				X			
75312	LABQC	1200384606	1200384606	SQ	BD				X			
75312	LABQC	1200385870	1200385870	SQ	LB						X	
75312	LABQC	1200385871	1200385871	SQ	BS						X	

SWQ	Referral ID	Sample ID	Lab Number	Issue	Sample Type	Lab Referral Date	VQC SW6240F	QCQC SW6240F	Primary SW6081A	ICE SW608F	Ward SW608E	Normal SW6270A/SW7741A
75312	LABQC	720SB00402MS	1200385872	SO	MS	02/20/03					X	
75312	LABQC	720SB00402SD	1200385873	SO	SD	02/20/03					X	
75312	LABQC	1200385947	1200385947	SQ	LB		X					
75312	LABQC	1200385948	1200385948	SQ	BS		X					
75312	LABQC	1200385953	1200385953	SQ	BD		X					
75313	FIELDQC	720EB004N1	75313001	WQ	EB	02/20/03	X	X	X	X	X	X
75313	FIELDQC	720EB006N1	75313002	WQ	EB	02/20/03	X	X	X	X	X	X
75313	FIELDQC	720TB004N1	75313003	WQ	TB	02/11/03	X					
75313	G720GB006	720GB006N1	75313004	WG	N	02/20/03	X		X	X	X	X
75313	LABQC	1200383960	1200383960	WQ	LB				X			
75313	LABQC	1200383961	1200383961	WQ	BS				X			
75313	LABQC	1200383962	1200383962	WQ	BD				X			
75313	LABQC	1200383975	1200383975	WQ	LB					X		
75313	LABQC	1200383976	1200383976	WQ	BS					X		
75313	LABQC	720GB006N1MS	1200384072	WG	MS	02/20/03				X		
75313	LABQC	720GB006N1SD	1200384073	WG	SD	02/20/03				X		
75313	LABQC	1200384317	1200384317	WQ	LB							X
75313	LABQC	1200384318	1200384318	WQ	BS							X
75313	LABQC	1200384747	1200384747	WQ	LB			X				
75313	LABQC	1200384748	1200384748	WQ	BS			X				
75313	LABQC	1200384952	1200384952	WQ	LB						X	

SPC	Station ID	Sample ID	Lab Sample ID	Matrix	Sample Type	Date Collected	VOC SW8260B	SVOC SW8270C	Pesticides SW8061A	PCBs SW8082	Metals SW8010B	Mercury SW7470A / SW7471A
75313	LABQC	1200384953	1200384953	WQ	BS						X	
75313	LABQC	1200385126	1200385126	WQ	LB		X					
75313	LABQC	1200385127	1200385127	WQ	BS		X					
76284	G720GP006	720GP006N1	76284001	WG	N	03/12/03		X				
76284	LABQC	1200393879	1200393879	WQ	LB			X				
76284	LABQC	1200393880	1200393880	WQ	BS			X				
76284	LABQC	1200393881	1200393881	WQ	BD			X				

MATRIX CODE

WG – Groundwater
WQ – Water QC Sample
SO – Soil
SQ – Soil QC Sample

SAMPLE TYPE CODE

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

ANALYSIS CODE

VOC – Volatile Organic Compounds
SVOC - Semivolatile Organic Compounds
PCBs – Polychlorinated Biphenyls

Organic Parameters

Quality Control Review

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

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Method blanks, equipment blanks, and trip blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Surrogate Recoveries** – Surrogate Compounds are added to each sample and the recoveries are used to monitor lab performance and possible matrix interference.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", either laboratory reagent water or Ottawa sand, in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **Field Duplicate Samples** – These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **GC/MS Tuning** – The mass spectrum of the tuning compound is evaluated for method compliance. The criteria are established to verify the proper mass assignment and mass resolution.
- **Initial Calibration** – The initial calibration ensures that the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest.
- **Continuing Calibration** – The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds.
- **Internal Standards** – The internal standards (retention time and response) are evaluated for method compliance. The internal standards are used in quantitation of the target parameters and monitor the instrument sensitivity and response for stability during each analysis.
- **Confirmation** – If GCMS methodology is not initially used for analysis, SW-846 method 8000 requires confirmation when the composition of samples is not well characterized. Therefore, even when the identification has been confirmed on a dissimilar column or detector, the agreement of the quantitative results on both columns is evaluated. For

Pesticide and PCB analyses covered in this report, confirmation was performed using a dissimilar analytical column. The laboratory analyzed samples with a gas chromatograph (GC) utilizing simultaneous primary and confirmation data acquisition. Per SW-86 method 8000, 40% RPD criteria was used as the acceptance limit.

Volatile Organic Compounds (VOC) Analyses

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

Blanks

The VOC target parameters detected in blank samples are listed below.

- 1,1-Dichloroethylene was detected in the equipment blank, 720EB006N1, in SDG 75313 at 5.5 µg/L. Sample concentrations less than 27.5 µg/L were flagged 'U' as non-detect.

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

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

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

Recoveries - Surrogate, MS/MSD and LCS/LCSD

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

TABLE 2
Surrogate, MS/MSD, and LCS/LCSD Recoveries Out of QC Limits: VOC
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

SIC	Sample	Parameter	Recovery	Recovery Range	Associated Sample#	Flag
75312	75312003	Bromofluorobenzene	141*	59-113	75312003	Detects only - J
75312	75312004	Bromofluorobenzene	147*	59-113	75312004	Detects only - J
75312	1200385948 LCS	Toluene	116*	74-115	75312 - All	Detects only - J

TABLE 2

Surrogate, MS/MSD, and LCS/LCSD Recoveries Out of QC Limits: VOC
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

SR#	SR#ID	Parameter	RECOVERY	QC LIMIT	RECOVERED SAMPLES	FLAG
75313	1200385126 LCS	Acetone	135.6*	70-130	75313 – All	Detects only - J
* - out of control limits						

Initial and Continuing Calibration Criteria

All initial calibration criteria and continuing calibration criteria were met, except as listed in [Table 3](#).

TABLE 3

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: VOC
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Initial/Continuing Calibration Criteria	Analyte	Relative Standard Deviation of Total Recoveries (%)	Associated Samples
VOA5-CCAL-02/26/03, 0931	Chloroethane	20.6% high	75312 – All
	Carbon tetrachloride	26.2% high	
	2-Hexanone	23.9% high	
	1,2,4-Trichlorobenzene	24.5% high	
VOA2-CCAL-02/24/03, 1009	Bromomethane	20.2% high	75313 – All

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

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

Internal Standard Area

All internal standard areas were within QC limits, except as noted in below.

- The recovery for the internal standard 1,4-dichlorobenzene in sample 75312004 was below QC limits at 53.9 percent. Detects for the associated analytes in the sample were flagged 'J', and non-detects were flagged 'UJ'.

Semivolatile Organic Compounds (SVOC) Analyses

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

Recoveries - Surrogate, MS/MSD and LCS

All Surrogate, Matrix Spike (MS), Matrix Spike Duplicate (MSD), and Laboratory Control Sample (LCS) recoveries were within acceptable quality control limits, except as noted in [Table 4](#) below.

TABLE 4
Surrogate, MS/MSD and LCS Recoveries and RPDs Out of QC Limits: SVOC
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

SEP	Sample	Parameter	Recovery	Recovery Limit	Association Sample	RPD
75312	1200383432 LCS	2,4-Dinitrotoluene	113*	50-109	75312 - All	Detects only - J
		Pentachlorophenol	110*	27-109		
* - out of control limits						

Initial and Continuing Calibration Criteria

All initial calibration criteria and continuing calibration criteria were met, except as listed in [Table 5](#).

TABLE 5
Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: SVOC
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Initial Calibration Date	Parameter	Relative Standard Deviation (RSD) (%)	Association Sample
MSD7-ICAL-02/03/03, 2224	Benzoic acid	R ² = 0.989	75312 - All
	2,4-Dinitrophenol	R ² = 0.982	
	Di-n-octylphthalate	R ² = 0.986	
	Benzo(ghi)perylene	R ² = 0.986	
MSD7-CCAL-02/24/03, 0957	Benzoic acid	22.3% high	75312 - All
	2,6-Dinitrotoluene	28.5% high	
	2,4-Dinitrophenol	28.5% high	
	2,4-Dinitrotoluene	29.2% high	

TABLE 5

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: SVOC
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Initial Calibration Criteria	Analyte	% of Initial Calibration Criteria (R ²)	Calibration Criteria
MSD7-CCAL-02/24/03, 0957	2-Methyl-4,6-dinitrophenol	52.8% high	75312 – All
	Butylbenzylphthalate	30.1% high	
MSD2-ICAL-02/18/03, 2045	Di-n-octylphthalate	R ² =0.983	75313 – All
MSD2-CCAL-02/25/03, 0931	Bis(2-Chloroisopropyl)ether	23.1% high	75313002
	Benzoic acid	55.6% high	
	Hexachlorocyclopentadiene	40.5% high	
	2,4-Dinitrophenol	33.4% high	
	4-Nitrophenol	28.7% high	
	2-Methyl-4,5-dinitrophenol	36.3% high	
	Di-n-butylphthalate	20.4% high	
	Indeno(1,2,3-cd)pyrene	31.4% high	
	Dibenzo(a,h)anthracene	32.8% high	
	Benzo(ghi)perylene	34.9% high	
o-Nitroaniline	28.2% high		
MSD2-CCAL-02/26/03, 1432	Bis(2-Chloroisopropyl)ether	20.9% high	75313001
	Benzoic acid	93.6% high	
	2,4-Dinitrophenol	26.7% high	
	4-Nitrophenol	25.4% high	
	Pyrene	48.8% high	
MSD2-CCAL-02/26/03, 1432	Butylbenzylphthalate	26.2% high	75313001
	Benzo(ghi)perylene	20.6% high	
	o-Nitroaniline	38.2% high	
MSD4-ICAL-02/26/03, 1916	Benzoic acid	R ² =0.989	76284 – All
	Hexachlorocyclopentadiene	R ² =0.986	
	2,4-Dinitrophenol	R ² =0.987	
	Bis(2-ethylhexyl)phthalate	R ² =0.985	
MSD4-CCAL-03/14/03, 1306	Benzoic acid	22.5% low	76284 – All

TABLE 5

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: SVOC
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Instrument/Calibration Date	Analyte	%Relative Standard Deviation (RSD) Calibration Criteria	Associated Sample
MSD4-CCAL-03/14/03, 1306	Diethylphthalate	42.8% high	76284 – All
	p-Nitroaniline	28.5% high	
	Benzidine	20.2% high	
	3,3-Dichlorobenzidine	38.2% high	

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

- When the percent Relative Standard Deviation (%RSD) or correlation coefficient (R^2) was out in the initial calibration, all associated samples were qualified. Detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.
- When the percent difference (%D) was high in the continuing calibration standards, detected compounds were flagged "J", as estimated. Non-detected compounds were not flagged.
- When the percent difference (%D) was low in the continuing calibration standards, detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.

Organochlorine Pesticide Analyses

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

Blanks

The pesticide target parameters detected in blank samples are listed in [Table 6](#).

TABLE 6

Blank Contamination: Pesticides
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

SVOC	Sample ID	Lab Sample ID	Sample Type	Parameter	Lab (%RSD)	Units	Reg. Concentration (EPA Method 8160-G)
75312	1200384604	1200384604	LB	Alpha-BHC	0.14	µg/Kg	0.70 µg/Kg
75312	1200384604	1200384604	LB	Endosulfan I	0.16	µg/Kg	0.80 µg/Kg
75312	1200384604	1200384604	LB	Dieldrin	0.40	µg/Kg	2.0 µg/Kg

TABLE 6

Blank Contamination: Pesticides
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

SEE	Sample ID	Lab Sample ID	Sample	Parameter	Result	Unit	Reporting Limit
75312	1200384604	1200384604	LB	4,4'-DDE	0.44	µg/Kg	2.2 µg/Kg
75312	1200384604	1200384604	LB	Endrin	0.36	µg/Kg	1.8 µg/Kg
75312	1200384604	1200384604	LB	Endosulfan II	0.40	µg/Kg	2.0 µg/Kg
75312	1200384604	1200384604	LB	4,4'-DDD	0.38	µg/Kg	1.9 µg/Kg
75312	1200384604	1200384604	LB	4,4'-DDT	0.48	µg/Kg	2.4 µg/Kg
75312	1200384604	1200384604	LB	Methoxychlor	1.9	µg/Kg	9.5 µg/Kg
75312	1200384604	1200384604	LB	Endrin ketone	0.53	µg/Kg	2.65 µg/Kg
75312	1200384604	1200384604	LB	Endrin aldehyde	0.62	µg/Kg	3.1 µg/Kg
75312	1200384604	1200384604	LB	Gamma-Chlordane	0.38	µg/Kg	1.9 µg/Kg
75312	1200384604	1200384604	LB	Alpha-Chlordane	0.22	µg/Kg	1.1 µg/Kg
75313	1200383960	1200383960	LB	4,4'-DDE	0.013	µg/L	0.065 µg/L
75313	720EB006N1	75313002	EB	4,4'-DDE	0.035	µg/L	0.175 µg/L
75313	720EB006N1	75313002	EB	4,4'-DDD	0.020	µg/L	0.10 µg/L
75313	720EB006N1	75313002	EB	4,4'-DDT	0.075	µg/L	0.375 µg/L

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

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

The results qualified due to blank contamination are listed in [Attachment 1](#).

Recoveries - Surrogate, MS/MSD and LCS

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

- The recoveries for the surrogate decachlorobiphenyl in sample 75313004 were below QC limits of 60 - 150 percent recovery, at 37 and 35 percent on the primary and secondary analytical columns respectively. Detects in the sample were flagged 'J', and non-detects were flagged 'UJ'.

Initial and Continuing Calibration Criteria

All initial calibration criteria and continuing calibration criteria were met, except as listed in [Table 7](#).

TABLE 7

Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: Pesticides
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Initial/Continuing Calibration (Date)	Analyte	% Recovery - Standard Deviation (%D)	Associated Samples
ECD7A#1-CCAL-02/26/03, 1202	Toxaphene	15.5% high	75313001, 75313004
ECD7A#1-CCAL-02/26/03, 1647	Alpha-BHC	17.0% high	75313001, 75313004
ECD7A#1-CCAL-02/26/03, 1812	Alpha-BHC	19.0% high	75313001, 75313004
	Delta-BHC	16.0% high	
ECD7A#2-CCAL-02/26/03, 1812	Alpha-BHC	17.0% high	75313001, 75313004
ECD7A#1-CCAL-02/27/03, 1258	Toxaphene	24.0% high	75313002
ECD7A#1-CCAL-02/27/03, 1310	Chlordane (tech)	20.0% high	75313002

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

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

Second Column Confirmation

The second column confirmation percent difference (%D) for some detected parameters, exceeded the 40 %D criteria. Those results were flagged "J", as estimated. The laboratory reported the lower of the two concentrations. The individual samples and specific compounds that were flagged are listed in [Table 8](#) below.

TABLE 8
 Second Column Confirmation out of Criteria: Pesticides
 Charleston Naval Complex, Zone G, AOC 720 Charleston, SC

Site	Sample ID	Lab Sample ID	Parameter
75312	720SB00602	75312003	Heptachlor
75312	720SB00602	75312003	Endrin
75312	720SB00602	75312003	Endosulfan sulfate
75312	720SB00602	75312003	Endrin ketone

Polychlorinated Biphenyls (PCBs) Analyses

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

Recoveries - Surrogate, MS/MSD and LCS

All Surrogate, Matrix Spike (MS), Matrix Spike Duplicate (MSD), and Laboratory Control Sample (LCS) recoveries were within acceptable quality control limits, except as noted in [Table 9](#) below.

TABLE 9
 Surrogate, MS/MSD and LCS Recoveries Out of QC Limits: PCBs
 Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Site	Sample	Parameter	Recovery	Recovery Limit	Surrogate Sample	Result
75312	75312003	Tetrachloro-m-xylene	47* / 49*	60-150	75312003	Detects-J, non-detects-UJ
		Decachlorobiphenyl	47* / 48*	60-150		
75312	1200384075 LCS	Aroclor-1016	177*	39-119	75312 - All	Detects only - J
75313	75313001	Decachlorobiphenyl	40* / 42*	60-150	75313001	Detects-J, non-detects-UJ
75313	75313004	Decachlorobiphenyl	22* / 23*	60-150	75313004	Detects-J, non-detects-UJ
75313	75313004 MS/MSD	Aroclor-1260	52* / 59*	60-150	75313004	Detects-J, non-detects-UJ
* - out of control limits						

Inorganic Parameters

Quality Control Review

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

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

Metals Analyses

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

Blanks

The metals target parameters detected in blank samples are listed in [Table 10](#).

TABLE 10

Blank Contamination: Metals

Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Site	Sample ID	Lab Sample ID	Sample Type	Parameter	Lab Result	Unit	File
75312	CCB		CCB	Aluminum	40.5	µg/L	10.125 mg/Kg
75312	CCB		CCB	Beryllium	0.148	µg/L	0.037 mg/Kg
75312	CCB		CCB	Calcium	47.3	µg/L	11.825 mg/Kg
75312	CCB		CCB	Chromium	2.32	µg/L	0.58 mg/Kg
75312	CCB		CCB	Lead	2.67	µg/L	0.6675 mg/Kg
75312	CCB		CCB	Sodium	50.7	µg/L	12.675 mg/Kg
75312	CCB		CCB	Zinc	4.28	µg/L	1.07 mg/Kg
75312	1200385870	1200385870	LB	Aluminum	2.24	mg/Kg	11.2 mg/Kg
75312	1200385870	1200385870	LB	Calcium	1.27	mg/Kg	6.35 mg/Kg
75312	1200385870	1200385870	LB	Zinc	0.139	mg/Kg	0.695 mg/Kg
75312	720EB004N1	75313001	EB	Calcium	26.6	µg/L	6.65 mg/Kg
75312	720EB004N1	75313001	EB	Iron	14.2	µg/L	3.55 mg/Kg
75312	720EB004N1	75313001	EB	Manganese	0.936	µg/L	0.234 mg/Kg
75312	720EB004N1	75313001	EB	Sodium	46.6	µg/L	11.65 mg/Kg
75313	CCB		CCB	Aluminum	40.8	µg/L	204.0 µg/L
75313	CCB		CCB	Beryllium	0.296	µg/L	1.48 µg/L
75313	CCB		CCB	Calcium	57.0	µg/L	285.0 µg/L
75313	CCB		CCB	Iron	24.4	µg/L	122.0 µg/L
75313	CCB		CCB	Magnesium	51.4	µg/L	257.0 µg/L
75313	CCB		CCB	Selenium	4.35	µg/L	21.75 µg/L
75313	CCB		CCB	Sodium	354.0	µg/L	1770.0 µg/L

TABLE 10
 Blank Contamination: Metals
 Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Site	Sample ID	Lab Sample ID	Sample Type	Parameter	Lab Result	Unit	QC Limit
75313	1200384952	1200384952	LB	Iron	5.91	µg/L	34.9 µg/L
75313	720EB006N1	75313002	EB	Calcium	15.7	µg/L	78.5 µg/L
75313	720EB006N1	75313002	EB	Coper	5.15	µg/L	25.75 µg/L
75313	720EB006N1	75313002	EB	Sodium	35.0	µg/L	175.0 µg/L

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

The results qualified due to blank contamination are listed in [Attachment 1](#).

Recoveries - MS/MSD and LCS

All Matrix Spike (MS), Matrix Spike Duplicate (MSD), and Laboratory Control Sample (LCS) recoveries were within acceptable quality control limits, except as noted in [Table 11](#) below.

TABLE 11
 MS/MSD, and LCS Recoveries Out of QC Limits: Metals
 Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Site	Sample	Parameter	Recovery	Recovery Range	Associated Samples	Flag
75312	75312001 MS/MSD	Antimony	49.2* / 57.0*	80-120	75312 - All	Detects-J, non-detects-UJ
		Barium	32.2* / 29.9*	80-120		
		Chromium	58.0* / 59.2*	80-120		
		Lead	136* / 135*	80-120	75312 - All	
		Zinc	151* / 181*	80-120		
		Copper	122.9* / 147.3*	80-120		

* - out of control limits

Field Duplicate Samples

All Field Duplicate Samples were within acceptable quality control limits, except as noted in [Table 12](#) below. No flags are applied due to Field Duplicate precision.

TABLE 12

Field Duplicate RPDs Out of QC Limits: Metals
Charleston Naval Complex, , Zone G, AOC 720, Charleston, SC

Site	Sample	Parameter	Original Concentration	Field Duplicate Concentration	RPD	Flag
75312	720SB00602 / 720CB00602	Aluminum	13800 mg/Kg	23600 mg/Kg	52.4*	35
		Calcium	52900 mg/Kg	97000 mg/Kg	58.8*	35
		Chromium	35.6 mg/Kg	69.8 mg/Kg	64.8*	35
		Copper	25.2 mg/Kg	12.2 mg/Kg	69.5*	35
* - out of control limits						

ICP Serial Dilution

All Serial Dilution recoveries were within acceptable quality control limits, except as noted in [Table 13](#) below.

TABLE 13

Serial Dilution Recoveries Out of QC Limits: Metals
Charleston Naval Complex, Zone G, AOC 720, Charleston, SC

Site	Parameter	Recovery	Recovery Limit	Associated Samples	Flag
75312	Calcium	19.4*	10	75312 – All	Detects-J, non-detects-UJ
	Nickel	19.5*	10		
75313	Sodium	11.1*	10	75313 – All	Detects-J, non-detects-UJ
* - out of control limits					

Rejected Data

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

Conclusion

A review of the analytical data submitted regarding the investigation of Zone G, AOC 720 at the Charleston Naval Complex, Charleston, South Carolina by CH2M HILL has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed, and that the analytical results should be considered usable as qualified.

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

Attachment 1 - Changed Qualifiers and Results
Zone G, AOC 720 - Data Validation

Element	Location	Element	SDA	Sample ID	Lab Sample ID	Unit	Lab Result	Lab Unit	Lab Value	Lab Unit	Qualifier	Reasons
METAL	SW6010B	ANTIMONY	75312	720SB00602	75312003	SO	0.876	BN	0.876	J	mg/kg	MS
METAL	SW6010B	ANTIMONY	75312	720CB00602	75312004	SO	1.71	BN	1.71	J	mg/kg	MS
METAL	SW6010B	BARIUM	75312	720SB00602	75312003	SO	51.5	N	51.5	J	mg/kg	MS
METAL	SW6010B	BARIUM	75312	720CB00602	75312004	SO	63.1	BN	63.1	J	mg/kg	MS
METAL	SW6010B	BARIUM	75313	720GB006N1	75313004	WG	82.6	B	82.6	J	ug/L	IB
METAL	SW6010B	BERYLLIUM	75312	720SB00602	75312003	SO	0.745	B	0.745	J	mg/kg	IB
METAL	SW6010B	BERYLLIUM	75313	720GB006N1	75313004	WG	0.421	B	0.421	U	ug/L	BL
METAL	SW6010B	CADMIUM	75312	720SB00602	75312003	SO	0.293	B	0.293	J	mg/kg	IB
METAL	SW6010B	CADMIUM	75312	720CB00602	75312004	SO	0.444	B	0.444	J	mg/kg	IB
METAL	SW6010B	CALCIUM	75312	720SB00602	75312003	SO	52900	E	52900	J	mg/kg	SD
METAL	SW6010B	CALCIUM	75312	720CB00602	75312004	SO	97000	E	97000	J	mg/kg	SD
METAL	SW6010B	CHROMIUM, TOTAL	75312	720SB00602	75312003	SO	35.6	N	35.6	J	mg/kg	MS
METAL	SW6010B	CHROMIUM, TOTAL	75312	720CB00602	75312004	SO	69.8	N	69.8	J	mg/kg	MS
METAL	SW6010B	COBALT	75312	720SB00602	75312003	SO	3.71	B	3.71	J	mg/kg	IB
METAL	SW6010B	COBALT	75312	720CB00602	75312004	SO	3.66	B	3.66	J	mg/kg	IB
METAL	SW6010B	COBALT	75313	720GB006N1	75313004	WG	4.73	B	4.73	J	ug/L	IB
METAL	SW6010B	COPPER	75312	720SB00602	75312003	SO	25.2	N	25.2	J	mg/kg	MS
METAL	SW6010B	COPPER	75312	720CB00602	75312004	SO	12.2	N	12.2	J	mg/kg	MS
METAL	SW6010B	LEAD	75312	720SB00402	75312001	SO	8.7	N	8.7	J	mg/kg	MS
METAL	SW6010B	LEAD	75312	720SB00502	75312002	SO	9.27	N	9.27	J	mg/kg	MS
METAL	SW6010B	LEAD	75312	720SB00602	75312003	SO	23.6	N	23.6	J	mg/kg	MS
METAL	SW6010B	LEAD	75312	720CB00602	75312004	SO	14	N	14	J	mg/kg	MS
METAL	SW6010B	MANGANESE	75313	720GB006N1	75313004	WG	636	B	636	J	ug/L	IB
METAL	SW7471A	MERCURY	75312	720SB00602	75312003	SO	0.03	B	0.03	J	mg/kg	IB
METAL	SW7471A	MERCURY	75312	720CB00602	75312004	SO	0.045	B	0.045	J	mg/kg	IB
METAL	SW6010B	NICKEL	75312	720SB00602	75312003	SO	14.2	E	14.2	J	mg/kg	SD
METAL	SW6010B	NICKEL	75312	720CB00602	75312004	SO	20.5	E	20.5	J	mg/kg	SD
METAL	SW6010B	POTASSIUM	75312	720SB00602	75312003	SO	1130	B	1130	J	mg/kg	IB
METAL	SW6010B	POTASSIUM	75312	720CB00602	75312004	SO	1570	B	1570	J	mg/kg	IB
METAL	SW6010B	POTASSIUM	75313	720GB006N1	75313004	WG	244000	B	244000	J	ug/L	IB

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

Parameter elm	Analysis Method	Parameter	SpC	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
METAL	SW6010B	SELENIUM	75312	720SB00602	75312003	SO	0.866	B	0.866	J	mg/kg	IB
METAL	SW6010B	SELENIUM	75312	720CB00602	75312004	SO	1.05	B	1.05	J	mg/kg	IB
METAL	SW6010B	SELENIUM	75313	720GB006N1	75313004	WG	6.79	=	6.79	U	ug/L	BL
METAL	SW6010B	SODIUM	75312	720SB00602	75312003	SO	1200	B	1200	J	mg/kg	IB
METAL	SW6010B	SODIUM	75312	720CB00602	75312004	SO	1670	B	1670	J	mg/kg	IB
METAL	SW6010B	SODIUM	75313	720GB006N1	75313004	WG	7E+06	E	7E+06	J	ug/L	SD
METAL	SW6010B	VANADIUM	75313	720GB006N1	75313004	WG	36.5	B	36.5	J	ug/L	IB
METAL	SW6010B	ZINC	75312	720SB00602	75312003	SO	66.7	N	66.7	J	mg/kg	MS
METAL	SW6010B	ZINC	75312	720CB00602	75312004	SO	72.6	N	72.6	J	mg/kg	MS
METAL	SW6010B	ZINC	75313	720GB006N1	75313004	WG	179	B	179	J	ug/L	IB
PCB	SW8082	PCB-1016 (AROCHLOR 1016)	75313	720GB006N1	75313004	WG	0.96	U	0.96	UJ	ug/L	SS
PCB	SW8082	PCB-1221 (AROCHLOR 1221)	75313	720GB006N1	75313004	WG	0.96	U	0.96	UJ	ug/L	SS
PCB	SW8082	PCB-1232 (AROCHLOR 1232)	75313	720GB006N1	75313004	WG	0.96	U	0.96	UJ	ug/L	SS
PCB	SW8082	PCB-1242 (AROCHLOR 1242)	75313	720GB006N1	75313004	WG	0.96	U	0.96	UJ	ug/L	SS
PCB	SW8082	PCB-1248 (AROCHLOR 1248)	75313	720GB006N1	75313004	WG	0.96	U	0.96	UJ	ug/L	SS
PCB	SW8082	PCB-1254 (AROCHLOR 1254)	75313	720GB006N1	75313004	WG	1.9	U	1.9	UJ	ug/L	SS
PCB	SW8082	PCB-1260 (AROCHLOR 1260)	75313	720GB006N1	75313004	WG	1.9	U	1.9	UJ	ug/L	SS,MS
PEST	SW8081A	ALDRIN	75313	720GB006N1	75313004	WG	0.04	U	0.04	UJ	ug/L	SS
PEST	SW8081A	ALPHA BHC	75312	720SB00602	75312003	SO	0.9	J	8.3	U	ug/kg	BL
PEST	SW8081A	ALPHA BHC	75313	720GB006N1	75313004	WG	0.04	U	0.04	UJ	ug/L	SS
PEST	SW8081A	ALPHA-CHLORDANE	75313	720GB006N1	75313004	WG	0.04	U	0.04	UJ	ug/L	SS
PEST	SW8081A	BETA BHC	75313	720GB006N1	75313004	WG	0.04	U	0.04	UJ	ug/L	SS
PEST	SW8081A	Chlordane	75313	720GB006N1	75313004	WG	0.4	U	0.4	UJ	ug/L	SS
PEST	SW8081A	DELTA BHC	75313	720GB006N1	75313004	WG	0.04	U	0.04	UJ	ug/L	SS
PEST	SW8081A	DIELDRIN	75312	720SB00602	75312003	SO	2.2	J	16	U	ug/kg	BL
PEST	SW8081A	DIELDRIN	75313	720GB006N1	75313004	WG	0.08	U	0.08	UJ	ug/L	SS
PEST	SW8081A	ENDOSULFAN I	75313	720GB006N1	75313004	WG	0.04	U	0.04	UJ	ug/L	SS
PEST	SW8081A	ENDOSULFAN II	75312	720SB00602	75312003	SO	2.2	J	16	U	ug/kg	BL
PEST	SW8081A	ENDOSULFAN II	75313	720GB006N1	75313004	WG	0.08	U	0.08	UJ	ug/L	SS
PEST	SW8081A	ENDOSULFAN SULFATE	75312	720SB00602	75312003	SO	2.2	JP	2.2	J	ug/kg	2C

Attachment 1 - Changed Qualifiers and Results
Zone G, AOC 720 - Data Validation

Parameter Name	Analysis Method	Parameter	SDC	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Reg Result	Reg Qual	Units	Reasons
PEST	SW8081A	ENDOSULFAN SULFATE	75313	720GB006N1	75313004	WG	0.08	U	0.08	UJ	ug/L	SS
PEST	SW8081A	ENDRIN	75312	720SB00602	75312003	SO	2.2	JPB	16	U	ug/kg	BL
PEST	SW8081A	ENDRIN	75313	720GB006N1	75313004	WG	0.08	U	0.08	UJ	ug/L	SS
PEST	SW8081A	ENDRIN ALDEHYDE	75312	720SB00602	75312003	SO	2.8	J	16	U	ug/kg	BL
PEST	SW8081A	ENDRIN ALDEHYDE	75313	720GB006N1	75313004	WG	0.08	U	0.08	UJ	ug/L	SS
PEST	SW8081A	ENDRIN KETONE	75312	720SB00602	75312003	SO	3.4	JPB	16	U	ug/kg	BL
PEST	SW8081A	ENDRIN KETONE	75313	720GB006N1	75313004	WG	0.08	U	0.08	UJ	ug/L	SS
PEST	SW8081A	GAMMA BHC (LINDANE)	75313	720GB006N1	75313004	WG	0.04	U	0.04	UJ	ug/L	SS
PEST	SW8081A	GAMMA-CHLORDANE	75313	720GB006N1	75313004	WG	0.04	U	0.04	UJ	ug/L	SS
PEST	SW8081A	HEPTACHLOR	75312	720SB00602	75312003	SO	1.5	JP	1.5	J	ug/kg	2C
PEST	SW8081A	HEPTACHLOR	75313	720GB006N1	75313004	WG	0.04	U	0.04	UJ	ug/L	SS
PEST	SW8081A	HEPTACHLOR EPOXIDE	75313	720GB006N1	75313004	WG	0.04	U	0.04	UJ	ug/L	SS
PEST	SW8081A	METHOXYCHLOR	75312	720SB00602	75312003	SO	10.8	J	82.8	U	ug/kg	BL
PEST	SW8081A	METHOXYCHLOR	75313	720GB006N1	75313004	WG	0.38	U	0.38	UJ	ug/L	SS
PEST	SW8081A	p,p'-DDD	75313	720GB006N1	75313004	WG	0.08	U	0.08	UJ	ug/L	SS
PEST	SW8081A	p,p'-DDE	75313	720GB006N1	75313004	WG	0.0079	JBP	0.08	UJ	ug/L	BL,SS
PEST	SW8081A	p,p'-DDT	75312	720SB00602	75312003	SO	4	J	16	U	ug/kg	BL
PEST	SW8081A	p,p'-DDT	75313	720GB006N1	75313004	WG	0.022	J	0.08	UJ	ug/L	BL,SS
PEST	SW8081A	TOXAPHENE	75313	720GB006N1	75313004	WG	2.5	U	2.5	UJ	ug/L	SS
SVOA	SW8270C	2,4-DINITROPHENOL	75312	720SB00602	75312003	SO	2040	U	2040	UJ	ug/kg	IC
SVOA	SW8270C	2,4-DINITROPHENOL	75312	720CB00602	75312004	SO	2110	U	2110	UJ	ug/kg	IC
SVOA	SW8270C	2,4-DINITROPHENOL	76284	720GP006	76284001	WG	50	U	50	UJ	ug/L	IC
SVOA	SW8270C	BENZO(g,h,i)PERYLENE	75312	720SB00602	75312003	SO	128	J	128	J	ug/kg	IC
SVOA	SW8270C	BENZO(g,h,i)PERYLENE	75312	720CB00602	75312004	SO	435	U	435	UJ	ug/kg	IC
SVOA	SW8270C	Benzoic acid	75312	720SB00602	75312003	SO	2040	U	2040	UJ	ug/kg	IC
SVOA	SW8270C	Benzoic acid	75312	720CB00602	75312004	SO	2110	U	2110	UJ	ug/kg	IC
SVOA	SW8270C	Benzoic acid	76284	720GP006	76284001	WG	50	U	50	UJ	ug/L	IC,CC
SVOA	SW8270C	bis(2-ETHYLHEXYL) PHTHALATE	76284	720GP006	76284001	WG	10	U	10	UJ	ug/L	IC
SVOA	SW8270C	DI-n-BUTYL PHTHALATE	75312	720SB00602	75312003	SO	422	U	422	UJ	ug/kg	IC
SVOA	SW8270C	DI-n-BUTYL PHTHALATE	75312	720CB00602	75312004	SO	435	U	435	UJ	ug/kg	IC

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

Parameter Code	Analytical Method	Parameter	SPID	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Flag	Final Qual	Units	Reasons
SVOA	SW8270C	HEXACHLOROCYCLOPENTADIENE	76284	720GP006	76284001	WG	10	U	10	UJ	ug/L	IC
VOA	SW8260B	1,1,2,2-TETRACHLOROETHANE	75312	720CB00602	75312004	SO	5.8	U	5.8	UJ	ug/kg	IS
VOA	SW8260B	1,2,3-Trichlorobenzene	75312	720CB00602	75312004	SO	5.8	U	5.8	UJ	ug/kg	IS
VOA	SW8260B	1,2,4-TRICHLOROBENZENE	75312	720CB00602	75312004	SO	5.8	U	5.8	UJ	ug/kg	IS
VOA	SW8260B	1,2-DICHLOROBENZENE	75312	720CB00602	75312004	SO	5.8	U	5.8	UJ	ug/kg	IS
VOA	SW8260B	1,3-DICHLOROBENZENE	75312	720CB00602	75312004	SO	5.8	U	5.8	UJ	ug/kg	IS
VOA	SW8260B	1,4-DICHLOROBENZENE	75312	720CB00602	75312004	SO	5.8	U	5.8	UJ	ug/kg	IS
VOA	SW8260B	ACETONE	75312	720SB00602	75312003	SO	31.2	=	31.2	J	ug/kg	SS
VOA	SW8260B	ACETONE	75312	720CB00602	75312004	SO	21.3	=	21.3	J	ug/kg	SS
VOA	SW8260B	BROMOFORM	75312	720CB00602	75312004	SO	5.8	U	5.8	UJ	ug/kg	IS

CH2M HILL Chain of Custody/ Laboratory Analysis Form

Laboratory: **GEL**

Project Name: **Charleston Navy Complex** Site Name: **Zone G, AOC 720**

Project Number: **158814.PM.04** TAT: **standard**

Project Manager: **Tom Beisel** QA Level: **level 3**

Address: **GNV: 3011 SW Williston Rd., Gainesville, FL 32605**
ATL: 115 Perimeter Center Place NE, Suite 700, Atlanta, GA 30346-1278

Send Report To: **see last page of COC** EDD: **CNC format**

Sample ID	Station ID	Sample Description	Depth		Date & Time Collected	Matrix	# of containers	3 - 5g Encore & See jar	1 - 4 ounce jar	1 - 4 ounce jar	1 - 4 ounce jar	3 - 40mL vial, HQ	3 - 1L amber	1 - 0.5L HDPE, HNO3	1 - 4 ounce jar
			VOCs (SW8260B)	SVOCs (SW8270C)				Pesticides/PCBs (SW8081A/8082)	Metals * (SW6010B/ 7000 series)	VOCs (SW8260B)	SVOCs (SW8270C)	Pesticides/PCBs (SW8081A/8082)	Metals * (SW6010B/ 7000 series)	Lead (SW6010B)	
720SB00402 ✓	G720SB004	3' B G720SB003	3	5	2-20-03/1345	SO	1								X
720SB00502 ✓	G720SB005	3' NW G720SB003	3	5	2-20-03/1410	SO	1								X
720SB00602 ✓	G720SB006	20' NE G720SB003	3	5	2-20-03/1355	SO	6	X	X	X	X				
720GB00602 ✓	G720SB006	20' NE G720SB003	3	5	2-20-03/1355	SO	6	X	X	X	X				
720GB006N1	G720GB006	GW 20' NE G720SB003			2-20-03/1420	WG	7					X	X	X	X
720EB004N1	G720EB004	soil EB			2-20-03/1415	SQ	7					X	X	X	X
720EB006N1	G720EB006	water EB			2-20-03/1425	WQ	7					X	X	X	X
720EB004N1	G720TB004	TB			LAB supplied	SQ						X			

Lab Batch/SDG:
 75312-soils
 75313-water and blanks

RCRA
 DPT
 samples complete

Sampled By: **ANDREW O'LOUGHER** Date/Time: **2/20/03 1630** Relinquished by: **[Signature]** Date/Time: **2-20-03/1630**

Additional Samplers: _____

Received by Lab: **[Signature]** Date/Time: **2-20-03 1630** Relinquished by: _____ Date/Time: _____

Received by: _____ Date/Time: _____

Remarks: _____ Shipped Via: **UPS FedEx Hand Other** Tracking#: _____

Temperature: **50**

Reception: _____

CH2. ILL Chain of Custody/ Laboratory Analysis Form

Relo 76284
(no-sample)

COC Tracking #: ZG720-021703-01 page 1 of 2

Laboratory: GEL
 Project Name: Charleston Navy Complex Site Name: Zone G, AOC 720
 Project Number: 158814.PM.04 TAT: standard
 Project Manager: Tom Beisel QA Level: level 3
 Address: GNV: 3011 SW Williston Rd., Gainesville, FL 32605
ATL: 115 Perimeter Center Place NE, Suite 700, Atlanta, GA 30346-1278
 Send Report To: see last page of COC EDD: CNC format

Sample ID	Station ID	Sample Description	Depth		Date & Time Collected	Matrix	# of containers	3 - 5g Encore & 1 - 4 ounce jar	1 - 4 ounce jar	1 - 4 ounce jar	1 - 4 ounce jar	3 - 40mL vial, HCl	3 - 1L amber	1 - 0.5L HDPE, HNO3	1 - 4 ounce jar
			VOCs (SW8260B)	SVOCs (SW8270C)				Pesticides/PCBs (SW8081A/8082)	Metals * (SW6010B/7000 series)	VOCs (SW8260B)	SVOCs (SW8270C)	Pesticides/PCBs (SW8081A/8082)	Metals * (SW6010B/7000 series)	Lead (SW6010B)	
720SB00402	G720SB004	3' E G720SB003	3	5	2-20-03/1345	SO	1								X
720SB00502	G720SB005	3' NW G720SB003	3	5	2-20-03/1410	SO	1								X
720SB00602	G720SB006	20' NE G720SB003	3	5	2-20-03/1355	SO	6	X	X	X	X				
720CB00602	G720SB006	20' NE G720SB003	3	5	2-20-03/1355	SO	6	X	X	X	X				
720GB006N1	G720GB006	GW 20' NE G720SB003			2-20-03/1420	WG	7					X	X	X	X
720EB004N1	G720EB004	soil EB			2-20-03/1415	SQ	7					X	X	X	X
720EB006N1	G720EB006	water EB			2-20-03/1425	WQ	7					X	X	X	X
720TB004N1	G720TB004	TB			LAB supplied	SQ						X			

Lab Batch/SDG:

75312 sub
75313 met. book

RCRA
DPT samples complete

Sampled By ANDREW O'CONNOR Date/Time 2/20/03 1650 Relinquished by [Signature] Date/Time 2.20.03/1630

Additional Samplers: _____

Received By Lab: [Signature] Date/Time 2-20-03 1630 Relinquished by: _____ Date/Time _____

Received By: _____ Date/Time _____ Shipped Via: UPS FedEx Hand Other Tracking#: _____

Remarks: _____ Temperature: 50

Receipt Exceptions: _____



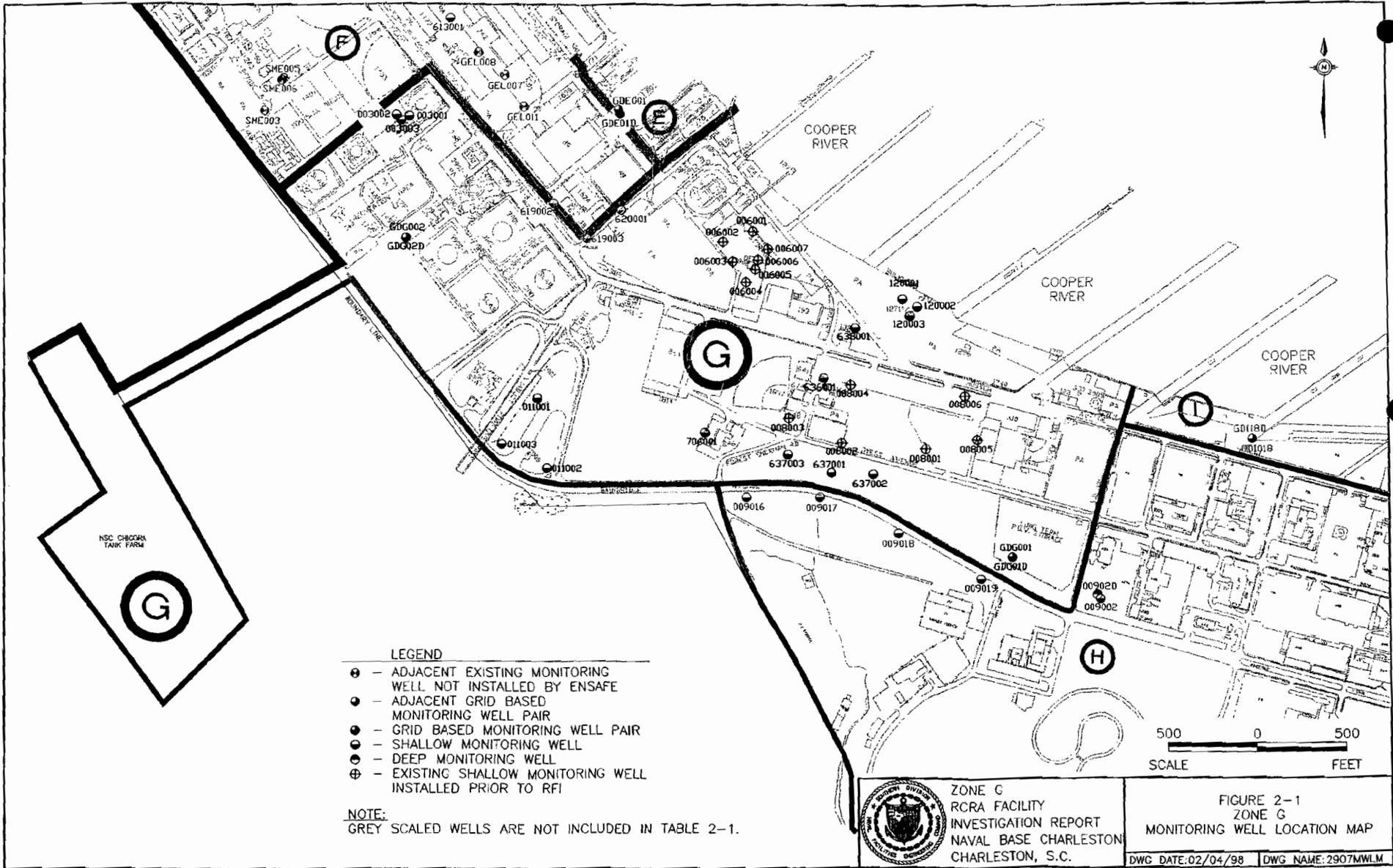
PROJECT NUMBER 158814	DPT NUMBER G720GP001	page 1 of 1
DPT GROUNDWATER SAMPLE LOG		

PROJECT : Charleston Naval Complex, Charleston, SC **LOCATION :** Charleston, SC **NORTHING:** 371465.4
ELEVATION : NA **DRILLING CONTRACTOR :** Prosonic Corporation License # 1435 **EASTING:** 2322499.0
DRILLING METHOD AND EQUIPMENT USED : Geoprobe Direct-Push Sampling, 4 ft screen
START : 06/18/2002 **END:** 06/18/2002 **LOGGER :** D. Gates/NVR

DEPTH BELOW SURFACE (FT)	SAMPLING DEPTH		COMMENTS
	SCREEN INTERVAL		ABANDONMENT METHOD TESTS, INSTRUMENTATION SOIL DESCRIPTION, IF VISIBLE
5			
	Top of Sampling Interval		
10			
	Bottom of Sampling Interval		
15			
20			
25			
30			
			After sampling the boring was pressure grouted from bottom to top with Type 1 Portland Cement

Appendix E

2.0	PHYSICAL SETTING	1
2.1	Regional Setting	2
2.1.1	Regional Physiographic and Geologic Description	3
	The NAVBASE area regional physiographic and geologic settings are described in Section 2.1.1 of the <i>Draft Zone A RFI Report</i> .	4 5
2.1.2	Regional Hydrologic and Hydrogeologic Background	6
	Regional hydrology and hydrogeology for the NAVBASE area are described in Section 2.2.1 of the <i>Draft Zone A RFI Report</i> .	7 8
2.1.3	Regional Climate	9
	Regional climate is discussed in Section 2.3 of the <i>Draft Zone A RFI Report</i> .	10
2.2	Zone G Geologic Investigation	11
	Geologic and stratigraphic information was obtained from samples collected during soil and monitoring well boring advancement. The borings were advanced using hollow-stem auger and rotasonic drilling methods. Soil samples were collected with a two-foot split-spoon sampler, or continuous sampler depending on the drilling method in use. The stratigraphy was logged by an EnSafe geologist in accordance with the approved <i>Final Comprehensive Sampling and Analysis Plan (CSAP) RCRA Facility Investigation (Revision No: 02) (E/A&H 1996c)</i> .	12 13 14 15 16 17
2.2.1	Monitoring Wells	18
	Nineteen monitoring wells (17 shallow and two deep) were installed at Zone G between August 1996 and April 1997 for the groundwater investigation of the Zone G sites. In addition, 13 shallow wells, installed in 1993 at SWMUs 6, 7 and 8 were also used in the RFI. The Zone G	19 20 21



LEGEND

- ⊕ - ADJACENT EXISTING MONITORING WELL NOT INSTALLED BY ENSAFE
- - ADJACENT GRID BASED MONITORING WELL PAIR
- - GRID BASED MONITORING WELL PAIR
- - SHALLOW MONITORING WELL
- - DEEP MONITORING WELL
- ⊕ - EXISTING SHALLOW MONITORING WELL INSTALLED PRIOR TO RFI

NOTE:
GREY SCALED WELLS ARE NOT INCLUDED IN TABLE 2-1.




ZONE G
 RCRA FACILITY
 INVESTIGATION REPORT
 NAVAL BASE CHARLESTON
 CHARLESTON, S.C.

FIGURE 2-1
ZONE G
MONITORING WELL LOCATION MAP
 DWG DATE: 02/04/98 | DWG NAME: 2907MWLM

well locations are illustrated in Figure 2-1. The deep wells were installed at two non-biased (grid-based) locations, each paired with a shallow well. Lithologic boring logs and well construction diagrams are contained in Appendix A. Table 2.1 lists the monitoring wells used for the Zone G RFI, along with pertinent information regarding well construction.

2.2.2 Geotechnical Analyses

Shelby tube soil samples were collected to characterize physical properties of Zone G soils during the RFI. These samples were analyzed for porosity, bulk density, grain-size distribution, specific gravity, percent moisture, and vertical permeability. Shelby tube sample intervals were selected for geotechnical analysis based upon areal distribution and lithology. Additional geotechnical information was obtained from borings advanced at AOCs 628, 633, 637, 642 and 643. Samples were collected from the additional locations to provide supplemental moisture content and grain-size data in specific areas of interest. Zone G geotechnical results are summarized in Table 2.2. Laboratory analyses of Shelby tube samples are in Appendix B.

2.2.3 Zone G Geology

Only Quaternary and Tertiary age sediments were encountered during the Zone G RFI. The lowermost stratigraphic unit identified in Zone G is the Ashley Formation member of the Mid-Tertiary age Cooper Group. Overlying the Ashley are younger Upper-Tertiary and Quaternary- age stratigraphic units. Stratigraphic units encountered during the RFI are presented in the following sections in ascending order. Lithologic cross sections for Zone G are presented in Figures 2-2 and 2-3. The deepest borehole in Zone G (GDG01D) limited available stratigraphic information to the upper 68-feet of unconsolidated sediments. Figure 2-4 presents the topography of the top of the Ashley Formation in Zones F and G. Zone G geologic maps and cross sections were developed from split-spoon and rotasonic core lithologic sample data.

Table 2.1
 Zone G
 Monitoring Well Construction Data

Well Identifier	Date Installed	TOC Elevation (ft msl)	Ground Elevation (ft msl)	Construction Depths (ft bgs)			GW Elev.* Low Tide (ft msl)	GW Elev.* High Tide (ft msl)
				TOS	BOS	BOW		
RFI Wells								
003001	10/30/96	12.91	13.1	4.0	13.4	14.0	5.41*	5.53*
003002	10/31/96	12.86	13.0	4.0	13.4	14.0	5.01*	5.14*
003003	10/31/96	12.71	12.9	4.0	13.4	14.0	6.07*	6.24*
011001	9/9/96	10.14	10.4	2.5	11.9	12.5	5.22	5.33
011002	9/12/96	11.45	8.7	2.4	11.8	12.4	5.96	5.86
011003	9/9/96	11.83	9.5	2.3	11.7	12.3	6.46	6.53
120001	8/30/96	6.05	6.2	2.5	11.9	12.5	3.79	4.29
120002	8/30/96	7.01	7.2	2.5	11.9	12.5	4.20	4.22
120003	9/3/96	6.34	6.4	2.6	12.0	12.6	4.32	4.30
636001	9/11/96	5.41	5.5	2.3	11.7	12.3	1.44	2.70
637001	9/11/96	8.15	3.1	2.5	11.9	12.5	3.83	4.58
637002	4/17/97	5.43	5.6	2.0	11.5	12.0	3.98	3.82
637003	4/17/97	7.10	4.2	2.0	11.5	13.0	4.48	4.44
638001	9/11/96	9.87	7.4	2.4	11.8	12.4	4.22	4.13
706001	4/17/97	5.90	6.1	4.0	13.5	14.0	4.36	4.40
GDG001	8/28/96	8.49	6.0	2.6	12.0	12.6	4.69	4.72

Table 2.1
Zone G
Monitoring Well Construction Data

Well Identifier	Date Installed	TOC Elevation (ft msl)	Ground Elevation (ft msl)	Construction Depths (ft bgs)			GW Elev.* Low Tide (ft msl)	GW Elev.* High Tide (ft msl)
				TOS	BOS	BOW		
GDG01D	9/15/96	8.71	6.0	46.7	55.7	56.5	5.43	5.43
GDG002	8/28/96	10.96	8.5	2.8	12.2	12.8	7.08	8.54
GDG02D	8/30/96	10.37	8.4	21.7	25.7	26.5	6.27	6.38
Previously Constructed Wells								
006001	9/23/93	8.49	5.6	5.5	15.5	15.5	3.17	3.32
006002	9/21/93	7.83	4.8	4.0	14.0	14.0	3.05	3.11
006003	9/21/93	8.06	5.3	3.5	13.5	13.5	3.40	3.53
006004	9/22/93	8.20	5.3	4.5	14.5	14.5	2.93	3.02
006005	9/22/93	9.11	6.2	5.0	15.0	15.5	2.72	2.99
006006	9/22/93	9.41	6.4	4.5	14.5	14.5	2.71	3.02
006007	9/23/93	8.49	5.9	5.0	15.0	15.0	0.78	3.10
008001	9/24/93	7.37	4.5	10.2	20.2	20.2	3.45	3.66
008002	9/25/93	8.62	5.8	4.3	14.3	14.3	3.82	4.03
008003	9/25/93	8.33	5.4	10.3	20.3	20.3	4.91	4.93
008004	9/27/93	8.63	5.8	3.3	13.3	13.3	0.94	3.34
008005	9/29/93	8.52	5.8	3.8	13.8	13.8	4.60	5.22
008006	9/30/93	6.87	6.5	5.4	15.4	15.4	3.52	3.41

Notes:

TOC = Top of well casing
TOS = Top of screened interval
BOS = Bottom of screened interval
BOW = Bottom of well (end cap)
GW = Groundwater
ft = Feet
msl = Mean sea level
bgs = Below ground surface
* = Data collected 4/29/97
= Data collected 6/6/97

Table 2.2
 Zone G
 Geotechnical Sample Data

Sample Identifier	Sample Depth (ft bgs)	Lith Type	Moisture Content (%)	Bulk Dry Density (g/cm ³)	Bulk Wet Density (g/cm ³)	Specific Gravity (g/cm ³)	Percent Porosity	Vertical Permeability		Grain-Size Distribution		
								cm/sec	ft/day	Percent Sand	Percent Silt	Percent Clay
003002	2-4	Fill	9.6	—	1.94	2.62	33.1	7.70E-04	2.18	78	6	16
003002	6-8	Qs	18.7	—	1.90	2.62	41.0	3.20E-04	0.907	85	4	11
003002	8-10	Qc	20.1	—	—	2.76	37.4	2.22E-06	6.29E-03	55	15	30
003002	10-12	Qs	26.2	—	1.78	2.71	51.5	1.34E-03	3.80	92	2	6
011001	6-8	Qc	19.6	—	—	2.66	35.5	6.36E-07	1.80E-03	56	15	29
011001	8-10	Qs	20.4	1.54	—	2.69	43.0	4.60E-05	1.30E-01	74	10	16
011002	2-4	Fill	10.0	—	1.53	2.67	48.3	6.70E-03	19.0	96	1	3
011003	8-10	Qc	19.2	1.69	—	2.69	34.9	1.17E-06	3.32E-03	57	15	28
120001	6-8	Qm	79.8	0.82	—	2.69	80.1	8.24E-08	2.34E-04	2	33	65
120002	4-6	Fill	40.8	—	—	2.60	59.7	1.08E-06	3.06E-03	68	14	18
120002	8-10	Qs	32.0	1.18	—	2.73	56.6	8.30E-04	2.35	87	6	7
636001	9-11	Qm	56.4	1.04	—	2.63	73.8	6.70E-08	1.90E-04	46	16	38
638001	8-10	Qm	83.4	0.85	—	2.71	80.5	1.29E-07	3.66E-04	4	37	59
GDG01D	65-67.5	Ta	44.8	1.25	—	2.69	56.6	8.69E-06	2.46E-02	34	41	25
628002	—	—	41.3	—	—	2.63	—	—	—	47	24	29
633009	—	—	15.1	—	—	2.69	—	—	—	88	6	6
637007	—	—	25.7	—	—	2.63	—	—	—	76	9	15

Table 2.2
 Zone G
 Geotechnical Sample Data

Sample Identifier	Sample Depth (ft bgs)	Lith Type	Moisture Content (%)	Bulk Dry Density (g/cm ³)	Bulk Wet Density (g/cm ³)	Specific Gravity (g/cm ³)	Percent Porosity	Vertical Permeability		Grain-Size Distribution		
								cm/sec	ft/day	Percent Sand	Percent Silt	Percent Clay
642004	—	—	17.7	—	—	2.74	—	—	—	92	3	5
643007	—	—	15.4	—	—	2.69	—	—	—	86	5	9

Notes:

- ft bgs = feet below ground surface
- g/cm³ = grams per cubic centimeter
- cm/sec = centimeters per second
- ft/day = feet per day
- Qs = Quaternary sand
- Qc = Quaternary clay
- Qm = Quaternary marsh clay
- Ta = Ashley Formation
- = Parameter not measured

2.2.3.1 Tertiary-Age Sediments

Ashley Formation

The oldest sediment encountered during the Zone G RFI was the Ashley Formation (Ta), the youngest member of the Eocene-Oligocene age Cooper Group. The Ta was deposited in an open-marine shelf environment during a rise in sea level in the late Oligocene (Weems and Lemon, 1993).

The Ta was encountered throughout Zone G at elevations ranging from -16.6 feet mean sea level (ft msl) at location GDG02D to -49 feet msl at location GDG01D (Figure 2-3). Figure 2-4 shows that the Ta is higher in the eastern portion of Zone G than in the western and southern portions and that the Ta contact with overlying Zone G sediments is undulatory due to its scoured nature.

The Ta is an olive-yellow to olive-brown, tight, slightly calcareous, clayey silt with varying amounts of very fine to fine grained sand that decrease rapidly with depth. It is firm to stiff, low in plasticity, and moist to wet. Laboratory analysis of a Shelby tube sample taken from 65 to 67.5 feet bgs at GDG01D of Ta sediment resulted in a grain-size distribution of 34 % fine sand, 41 % silt, and 25 % clay, and a porosity of 56.6%. This laboratory analysis compares favorably to those presented in the *Zone F RFI Report* (EnSafe, December, 1997) and *Zone H RFI Report* (E/A&H, July, 1996).

Tertiary Undifferentiated Unit

According to Weems and Lemon (1993) four Tertiary age units are placed stratigraphically above the Ta. These units are (in ascending order) the Chandler Bridge, Edisto, Marks Head, and Goose Creek Limestone formations. Upper-Tertiary marine regression-transgression sequences have resulted in considerable erosion before subsequent deposition. This erosion has resulted in typically unconformable contacts, where many of the intervening stratigraphic units are no longer

present. These stratigraphic units are quite difficult to identify in the field and have not been identified. For this report, these units have been grouped as undifferentiated Upper Tertiary (Tu).

The Tu is likely present in the western portion of Zone G near the boundary of Zone F (Figure 2-2); however, no boreholes in the western portions of Zone G were advanced greater than 20 ft below ground surface (bgs) to substantiate the presence of Tu. Geotechnical data on Tu sediments were unobtainable elsewhere in Zone G as this unit was not encountered at either deep monitoring well locations (GDG01D and GDG02D). Tu sediment data are, however, available from zones adjacent to Zone G. Immediately north of Zone G in the southeastern portion of Zone E (location GDE01D), Tu occurs at 11 ft bgs and is 23 feet thick (EnSafe, November, 1997).

The Tu is characterized as an olive-gray to green silt with varying amounts of clay, and very fine to fine quartz and phosphate sand. It is slightly plastic, soft, and intermixed with phosphate pebbles, shell hash, and oyster shells. Tu geotechnical data, available from samples collected in the adjacent portion of Zone F, revealed an average grain size distribution of 58% sand, 19% silt, and 23% clay, with an average porosity of 48% (EnSafe, December, 1997). Also in adjacent Zone E, the average grain size distribution for four Tu sediment samples was 57% sand, 43% silt and clay, with an average porosity of 42% (EnSafe, November, 1997).

2.2.3.2 Quaternary-Age Sediments

The Quaternary Period began with the Pleistocene Epoch and continues with the Holocene (Recent) Epoch. During the Quaternary, several marine transgression-regression sequences occurred which resulted in a complex network of terraces composed of coastal depositional environments such as barrier islands, back-barrier lagoons, tidal inlets, and shallow-marine shelf systems. During the Quaternary, regional crustal uplift in the Charleston region preserved many barrier and back-barrier lagoon deposits as terraces. Succeeding transgressions reworked the

shallow-marine shelf deposits on the seaward side of each older barrier ridge or island. This activity resulted in a younger sequence of sediments on the seaward side, laterally adjacent to the previous (older) coastal deposit (Weems and Lemon, 1993). Weems and Lemon (1993) have identified and correlated several formations of Quaternary age sediments. However, field identification of these formational units is difficult since many characteristics may be evident only at the microscopic level.

Throughout Zone G, Quaternary-age sediments were observed from the top of Tertiary-age sediments to the surface. These sediments range from 25 feet thick at GDG02D to 55 feet thick at GDG01D, including fill and other anthropogenic deposits. These sediments comprise the Pleistocene-age Wando Formation, which is overlain by Holocene-age sand and clay deposits.

According to Weems and Lemon (1993), the Wando depositional period encompasses three distinct high sea-level stands in the late Pleistocene. As a result, Wando composition consists of vertically and sometimes laterally repeating sequences of clayey sand and clay deposits overlying barrier sand deposits which, in turn, overlie fossiliferous shelf-sand deposits.

During the Holocene, rivers and streams have down cut these sediment sequences, leaving scours that have become filled with clay and silty sand deposits typical of low energy environments. These younger deposits may resemble Wando-age deposits and further complicate the interpretation of local geology. Various distinct Quaternary-age litho-stratigraphic units have been identified and correlated in the geologic cross sections prepared for the Zone G RFI report. The following three Zone G Quaternary-age units are described below: Quaternary Clay (Qc), Quaternary Marsh Clay (Qm), and Quaternary Sand (Qs).

Quaternary Clay

The Qc deposits consist of a stiff, brown to brownish red to gray, very fine to fine grained sandy and silty clay. This unit is often interbedded with brown sandy nodular laminae. The clay ranges from low to high plasticity with low organic content. The Qc unit is most often found in the upper 10 to 15 feet of the shallow subsurface.

Three Shelby tube samples of the Qc unit were obtained from locations within Zone G. These sample locations were 003002 (8 to 10 feet bgs), 011001 (6 to 8 feet bgs), and 011003 (8 to 10 feet bgs) and revealed an average grain size distribution of 29% clay, 15% silt, and 56% sand. The average porosity value was 35.9%.

Quaternary Marsh Clay

The Qm is a dark gray to black, soft, sticky clay, occasionally laminated with sand, silt, and shelly lenses. It is typified by a high organic content, often intermixed with grass and wood fragments. The Qm has low plasticity and a distinctive hydrogen sulfide odor.

Data gathered during previous RFIs suggest that the thickness of the Qm unit varies throughout NAVBASE. Well borings in Zone G support this observation. In the southeastern portion of Zone G, the Qm is approximately 45 feet thick at location GDG01D, while it decreases to approximately 7 feet thick at GDG02D in the western portion of Zone G (Figures 2-2 and 2-3).

Three Shelby tube samples of Qm in Zone G were collected. The average grain size distribution, based on the samples from 120001 (6 to 8 ft bgs), 636001 (9 to 11 ft bgs), and 638001 (8 to 10 ft bgs), was found to be 17% sand, 29% silt, and 54% clay. The average porosity was 78%. Similarly, Qm samples from Zone F exhibited an average grain size distribution of 8% sand, 41% silt, and 51% clay, with a porosity of 68% (EnSafe, December, 1997).

Quaternary Sand 1

The Qs unit is typically gray, orange, and brown, very fine to medium silty sand, well to 2
moderately well sorted and loose. Grain size tends to increase with depth to medium sand. 3
Occasional laminae of brown to black silt, as well as small shell fragments, are often present. This 4
unit lacks the clay content associated with the Qc unit. 5

The Qs deposits in Zone G range from thin lenticular bodies ranging from 0.5 to 1.7 feet thick 6
at GDG01D to thicker lenses about four-feet thick at GDG02D (Figure 2-2). Four Shelby tube 7
samples of Qs were collected at Zone G. The average grain-size distribution exhibited by this unit 8
is 85 % sand, 6 % silt, and 9 % clay with an average porosity of 48 %. 9

2.2.3.3 Soil 10

Due to extensive surface soil disturbance at NAVBASE during its operational history, 11
approximately the upper five-feet of the subsurface are typically a mixture of fill and native 12
sediments. However, the extent of fill placement varies throughout NAVBASE. Areas of 13
extensive excavations or areas where native soils may have been unsuitable for foundation support 14
may have undergone more extensive fill placement. The fill includes materials dredged from the 15
Cooper River and Shipyard Creek, which are an unsorted mixture of sands, silts, and clays. 16

Three Shelby tube samples of fill material were collected from borings 003002, 120002, and 17
011002. The average grain-size distribution of these samples was 81 % sand, 7 % silt, and 12 % 18
clay. Sample porosities averaged 47 %. 19

2.3 Zone G Hydrogeology 20

Hydrogeological information was obtained from slug test analyses and water-level measurements 21
conducted during the Zone G RFI. Grain-size analysis, porosity data, and estimates of vertical 22

permeability (K_v), were determined from laboratory analysis of Zone G Shelby tube samples collected during the RFI.

2.3.1 Surficial Aquifer

The surficial aquifer extends from the water table to the top of the Ta, which serves as a regional confining unit. Aquifer thickness varies throughout Zone G, based upon the water table, the surface elevation, and elevation of the top of the Ta (Figure 2-4). Based on two deep well borings in Zone G, the surficial aquifer ranges from 25 to 55 feet thick. Figures 2-2 and 2-3 exhibit the variable thickness and lithology of the surficial aquifer.

In the western portion of Zone G, the boring log for GDG02D shows that the surficial aquifer is 25 feet thick and, from the bottom to top, consists of three feet of Qs overlain by 13 feet of Qc. The Qc is overlain by seven feet of Qm followed by 2 feet of fill to ground surface. The upper portions of the surficial aquifer in this region of Zone G are probably unconfined to semiconfined depending upon the nature of the fill materials, while the Qs at the bottom of the aquifer is confined by the 13 feet of Qc above it.

Aquifer characteristics differ somewhat in the southeastern portion of Zone G, near deep boring GDG01D. At this location, the aquifer is 55 feet thick and is composed of two feet of Qs, which is overlain by 48 feet of Qm. The Qm becomes interbedded with Qs lenses between 10 and 13.5 feet bgs. At the top of the surficial aquifer, the Qm is overlain by five feet of fill. Similar to GDG02D, the Qs at the base of the aquifer is confined by the thick sequence of Qm above it. Water levels in shallow well GDG001 during this study have resided within the interval of fill material overlying the Qm. This suggests unconfined to perched water table conditions or possibly semi-confined conditions for near surface material overlying the Qm, depending upon the permeability of the fill deposits.

2.3.2 Groundwater Flow Direction

Water levels in the shallow and deep wells in Zone G and selected wells from surrounding zones were generally measured during low and high tides on April 29, 1997. Water level data were recorded by well depth and tidal stage.

Shallow Wells

Figures 2-5 and 2-6 depict groundwater elevation contours in selected shallow wells at low and high tide, respectively. These figures represent the potentiometer groundwater surface. Both maps indicate that shallow groundwater flow in the surficial aquifer is highly variable in gradient and direction. Throughout the zone, groundwater flow is governed by the locations and orientation of groundwater elevational highs and lows.

In the western portion of Zone G, high groundwater elevations at GDG002 and FDS08B, and 619002 in Zone F define a groundwater mound that directs flow towards the northwest, north, northeast, and east. From Hobson Avenue north, groundwater flows toward the Cooper River as expected, except for the area nearest SWMU 8. A groundwater depression is near AOC 636; the lowest groundwater elevation occurs at FDS05B during both tidal events. In the southeastern portion of Zone G, groundwater flow is west and north from a groundwater high in Zone H. Groundwater generally flows either to the Cooper River or the depression at SWMU 8 from these higher elevations.

Deep Wells

Figures 2-7 and 2-8 are contour maps of groundwater elevation data from the deep wells during low and high tide, respectively. These figures depict the potentiometric surface of the water bearing unit at the base of surficial aquifer. A comparison of these maps indicates no significant change in groundwater flow direction from low to high tide. Groundwater generally flows north

in the western section of Zone G. Throughout the central and eastern portions, groundwater flows northeast and north, respectively. The Cooper River is the ultimate receptor for deep groundwater originating in Zone G.

2.3.3 Horizontal Hydraulic Gradient

The horizontal hydraulic gradient (i) measures the difference in hydraulic head (Δh) (i.e., change in groundwater elevation) between two points divided by the distance between the points (Δx). It is a unitless value used to quantitatively determine the magnitude of potential groundwater flow. Groundwater elevation contour maps for shallow wells (Figures 2-5 and 2-6) and deep wells (Figures 2-7 and 2-8) were examined to find representative ranges in horizontal hydraulic gradient at both low and high tide for the shallow and deep wells. Locations used to determine these gradients were taken along groundwater flow lines labeled "A" through "D" in Figures 2-5 and 2-6 for shallow groundwater flow and "E" and "F" in Figures 2-7 and 2-8 for deep groundwater flow. The calculated horizontal hydraulic gradients for Zone G are presented in Table 2.3.

2.3.4 Horizontal Groundwater Conductivity

Slug test data were used to evaluate the horizontal hydraulic conductivity of an aquifer at a single point. The resulting horizontal hydraulic conductivity (K_h) values from these slug tests are presented in Table 2.4 for shallow, and deep wells. Because hydraulic conductivity data are lognormally distributed, the geometric mean is the best measure of central tendency. Therefore, the representative hydraulic conductivity for each well is presented as the geometric mean of the falling and rising head values.

Data from the slug tests were compiled using the computer program AQTESOLV (Aquifer Test Solver) by the Geraghty and Miller Modeling Group (1989). AQTESOLV has several widely published and accepted analytical solutions for many different kinds of aquifer tests. Rising and falling head slug test data from shallow wells were plotted using an unconfined aquifer solution.

Table 2.3
 Zone G
 Horizontal Hydraulic Gradients

Measurement Points	Tide	Δh (ft)	Δx (ft)	i
Shallow Groundwater				
A	Low	3.08	695	0.0044
	High	4.54	500	0.0090
B	Low	2.88	780	0.0037
	High	3.24	820	0.0040
C	Low	3.02	530	0.0057
	High	3.29	825	0.0040
D	Low	3.91	310	0.0126
	High	3.93	275	0.0143
Deep Groundwater				
E	Low	2.27	900	0.0025
	High	2.38	690	0.0034
F	Low	3.43	970	0.0035
	High	3.43	900	0.0038

Notes:

Water level measurements from 4/29/97 used for calculations.

- Δh (ft) = Hydraulic head difference
- Δx (ft) = Distance between points
- i = Horizontal hydraulic gradient

Table 2.4
 Zone G
 Horizontal Hydraulic Conductivities

Well	Falling Head Hydraulic Conductivity ^a	Rising Head Hydraulic Conductivity ^a	Geometric Mean ^b
Shallow Wells			
GDG001	1.1	1.9	1.4
GDG002	0.30	0.34	0.32
011001	4.3	3.6	3.9
011002	NM	3.1	3.1
636001	0.41	0.34	0.37
637001	3.2	3.3	3.3
008004	6.4	5.8	6.1
008006	8.0	7.4	7.7

Table 2.4
Zone G
Horizontal Hydraulic Conductivities

Well	Falling Head Hydraulic Conductivity ^a	Rising Head Hydraulic Conductivity ^a	Geometric Mean ^b
Deep Wells			
GDG01D	31	20	25
GDG02D	0.51	0.42	0.46

Notes:

- a = Slug test results in ft/day.
- b = Calculated using the falling and rising head values.
- NM = Not measured, well recovery was too slow to evaluate conductivity.

For this solution, time (elapsed) versus displacement (change in water level) was plotted on semi-logarithmic graph paper. Hydraulic conductivity (K) was computed by the program using an equation developed by Bouwer and Rice (1976) for unconfined aquifers. Slug test results and program printouts are included in Appendix C.

Data from deep wells were analyzed using a confined solution by Cooper, Bredehoeft, and Papadopoulos (1967). This solution uses time (elapsed) plotted against changes in head on semi-logarithmic graph paper to calculate aquifer transmissivity (T) and storativity (S). Again, results and printouts are included in Appendix C.

The Bower and Rice and Cooper et al. methods assume the following conditions:

- A homogeneous, isotropic aquifer of uniform thickness
- Horizontal water table/potentiometric surface prior to test
- Instantaneous change in head
- Negligible well losses

- Well storage is not negligible and is accounted for 1
- Fully or partially penetrating wells 2
- Steady state flow 3

A line of best fit was matched to the plotted data that was thought to best represent the “true” aquifer response. Given all the above qualifiers, hydraulic conductivity data from these tests are presented only to two significant figures. 4
5
6

Transmissivities from the Cooper et al. confined solution were converted to hydraulic conductivity values with the following relationship: 7
8

$$K = \frac{T}{b}$$

- where:** 9
- K = hydraulic conductivity 10
 - T = transmissivity 11
 - b = aquifer thickness 12

The aquifer thickness (b) at each tested well was obtained from the well boring log by summing the thicknesses of suspected water producing layers that intersect the well filterpack. 13
14

Figure 2-9 presents the aerial distribution of hydraulic conductivity (shallow wells/deep wells) in the surficial aquifer using values from Table 2.4. Hydraulic conductivities in the shallow portion of the aquifer range from 0.32 to 7.7 ft/day with a geometric mean of 2.1 ft/day. The two deep wells exhibited horizontal hydraulic conductivities ranging from 0.46 to 25 ft/day and a geometric mean of 3.4 ft/day. 15
16
17
18
19

2.3.5 Horizontal Groundwater Velocity

Horizontal groundwater velocity was calculated using the following formula:

$$V = \frac{K * i}{n_e}$$

where:

- V = horizontal groundwater velocity
- K = hydraulic conductivity
- i = horizontal hydraulic gradient
- n_e = effective porosity

Horizontal hydraulic velocities were calculated for the horizontal gradients presented in Table 2.3. Shallow wells GDG001, 011001, 011002, 008004, and 008006 were completed in Quaternary sand and represent the highest K values in the shallow subsurface of Zone G. A geometric mean of the K values at each of these wells was used to calculate shallow groundwater velocities.

To determine the most conservative (highest) shallow groundwater velocities, the lowest porosity from laboratory data is desirable. Using the Shelby tube data analyses, the lowest porosity from Qs deposits was found to be 41% from the 6 to 8 foot bgs interval at location 003002. This value was used as effective porosity in the velocity calculations.

Limited hydraulic and laboratory data is available from deep well locations in Zone G. However, assuming the 41% porosity for deeper Qs deposits and using the two geometric mean K_h values from the Zone G deep wells, an estimate of two possible groundwater velocity estimates may be made.

Table 2.5 presents the calculated groundwater flow velocity estimates.

Table 2.5
Zone G
Groundwater Velocity Results

Aquifer Location	Tide	n_e	K (ft/day)		Gradient (i)	Estimated Velocity (ft/day)	
Shallow Groundwater							
A	Low	0.41	3.8		0.0044	0.04	
	High				0.0090	0.08	
B	Low	0.41	3.8		0.0037	0.03	
	High				0.0040	0.04	
C	Low	0.41	3.8		0.0057	0.05	
	High				0.0040	0.04	
D	Low	0.41	3.8		0.0126	0.12	
	High				0.0143	0.13	
Deep Groundwater							
			K_1	K_2		V_1	V_2
E	Low	0.41	0.46	25	0.0025	0.003	0.15
	High				0.0034	0.004	0.20
F	Low	0.41	0.46	25	0.0035	0.004	0.21
	High				0.0038	0.004	0.23

Notes:

- ft/day = Feet per day
- i = Horizontal hydraulic gradient
- n_e = Effective porosity

2.3.6 Tidal Influence

The numerical difference in groundwater elevation from low to high tide for shallow wells is shown in Figure 2-10. Static water level elevations for high and low tide are presented in Table 2.1. Wells with larger tidal difference values are more highly influenced by tidal fluctuations than wells with lower values. A negative tidal variation value indicates a decrease in water level elevation from low to high tide. Conversely, a positive tidal variation indicates an

increase in water level from low to high tide. Wells with low or negative tidal differences may have higher tidal lag times than wells with high values. High lag times often occur in wells that have limited hydrologic connection with or are at great distances from tidal water bodies (Cooper River).

A comparison of the low and high tide groundwater elevation maps indicates that subtle, local changes in groundwater flow direction occur in response to tidal changes in the surficial aquifer. For example, the sizes and shapes of the groundwater high in the western portion and the depression in the central portion of the zone have been slightly altered.

From Figure 2-10 the distribution and magnitude of tidal change exhibits no regular pattern and little or no consistency throughout most of Zone G. Negative changes were more easily grouped than positive changes. The negative changes were confined to the southern extent of Zone G along Bainbridge Avenue and two areas along Hobson Avenue — just north of SWMU 8 and the other southeast of SWMU 3. Positive changes were isolated and less widespread aerially.

2.3.7 Vertical Hydraulic Gradient

Water levels were measured in the two shallow/deep well pairs (GDG001/GDG01D and GDG002/GDG02D) on April 29, 1997. Table 2.6 presents the calculated vertical hydraulic gradients between these well pairs during that event. The vertical gradients were calculated by dividing the difference between water levels at each well pair by the vertical distance between the bottom of each well screen in the pair. Positive values indicate downward vertical gradients whereas negative values indicate an upward vertical gradient.

Table 2.6
Zone G
Vertical Hydraulic Gradients

Well Pair	Vertical Distance (ft)	Date	Low Tide		High Tide	
			Groundwater Elevation Difference (ft)	Vertical Hydraulic gradient	Groundwater Elevation Difference (ft)	Vertical Hydraulic gradient
GDG001/01D	43.9	4/29/97	-0.74	-0.017	-0.71	-0.016
GDG002/2D	13.7	4/29/97	0.81	0.059	2.16	0.157

Areal distribution of vertical gradients from wells are graphically presented in Figure 2-11. This figure shows gradients measured between shallow and deep wells at low tide (red) and high tide (blue).

Well pair GDG001/01D exhibited an upward vertical gradient at low and high tides. This indicates an upward flow potential from the Qs layer at the bottom of the surficial aquifer to the interfingering Qm/Qs layers in the upper portion of the aquifer.

A downward vertical gradient was measured at well pair GDG002/02D during both low and high tide. The magnitude of this gradient was much greater during high tide.

2.3.8 Lithologic Unit Summary

The following sections discuss the hydrologic properties and role of the predominant lithologic units in the groundwater flow regime at Zone G.

2.3.8.1 Tertiary Age Units

Ashley Formation

The Ta is important because of its role as a confining unit between the lower members of the Cooper Group and the Eocene-age Santee Limestone and the overlying water-bearing strata of the Quaternary sediments (Park, 1985). Lithologic cross sections presented by Weems and Lemon (1993) show the Ta to have a laterally consistent overall thickness. Samples collected from this unit at NAVBASE have shown high clay and silt contents and varying sand contents, depending greatly upon depth.

One Shelby tube sample collected from the Ta at GDG01D exhibited a vertical permeability of $8.7E-06$ centimeters per second (cm/sec) (0.025 ft/day). Zone G Ta permeability is comparable with that of adjoining zone Ta sediments. To the northwest in Zone F, the one Shelby tube sample collected from the Ta exhibited a vertical permeability of $4.5E-06$ cm/sec (0.013 ft/day) (EnSafe, December 1997). To the east in Zone E, seven Shelby tube samples exhibited a geometric mean vertical permeability of $1.7E-05$ cm/sec (0.048 ft/day) (EnSafe, November 1997). According to Fetter (1988), sediments with vertical permeabilities of $1E-05$ cm/sec (0.028 ft/day) or less can be considered confining units.

Upper Tertiary Undifferentiated

Though geotechnical data on Tu sediments was unobtainable in Zone G, this unit was encountered to the northwest in adjacent Zone F. The vertical hydraulic conductivity from sample 60704D in Zone F was $6.20E-05$ cm/sec (0.176 ft/day) (EnSafe, December 1997). Three Shelby tube samples collected from the Tu in Zone E revealed a significant range in vertical permeabilities, from $5.40E-06$ cm/sec (0.0153 ft/day) to $4.11E-04$ cm/sec (1.165 ft/day) (EnSafe, November 1997).

2.3.8.2 Quaternary Age Sediments 1

During the field investigation, Shelby tube samples were obtained from the Qc, Qs, and Qm 2
deposits beneath Zone G. The results of laboratory vertical permeability testing were presented 3
in Table 2.2. This section discusses the viability of these lithologic units as aquifers. 4

Quaternary Clay 5

For the Qc unit, the geometric mean vertical hydraulic conductivity calculated from three Shelby 6
tube samples was 1.18E-06 cm/sec (3.35E-03 ft/day). This is approximately an order of 7
magnitude greater than the geometric mean of 1.2E-07 cm/sec (3.5E-04 ft/day) from five samples 8
collected in Zone F. Based upon K_v values, Qc should be an effective barrier to vertical 9
groundwater flow. If Qc sediments are interbedded with sand, Qc may act as a leaky confining 10
unit if the sand interbeds are connected vertically. Aquifer characterization during previous all 11
zone-wide RFIs at NAVBASE have suggested that Qc sediments have K_h values less than 1 ft/day 12
(EnSafe, November 1997). These low K_h values suggest very limited potential for horizontal 13
groundwater movement through these sediments. However, Qc sediments are often interbedded 14
with thin sand units which may act as preferential flow paths for lateral groundwater movement. 15

Quaternary Marsh Clay 16

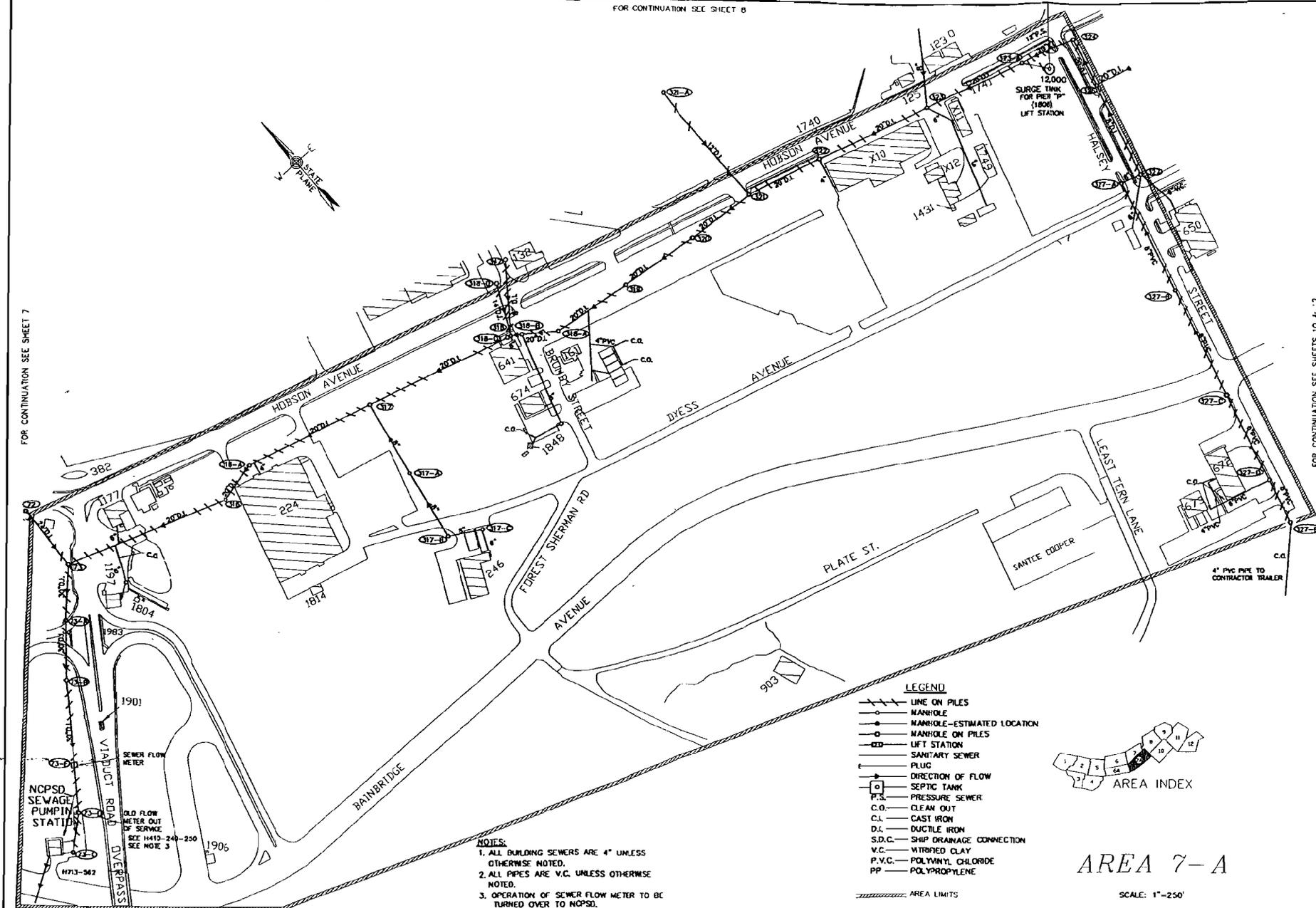
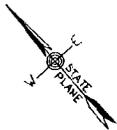
Three Shelby tube samples of Qm from Zone G exhibited a geometric mean vertical hydraulic 17
conductivity of 8.9E-08 cm/sec (2.5E-04 ft/day). This compares favorably with geometric means 18
of 1.6E-07 cm/sec (4.5E-04 ft/day) and 1.2E-06 cm/sec (3.3E-03 ft/day) Zone F and Zone E 19
Shelby tubes samples, respectively (EnSafe, December 1997; EnSafe, November 1997). Based 20
on this data, Qm sediments would be expected to act as an aquitard to vertical groundwater 21
migration. However, Qm may allow limited horizontal groundwater movement due to the 22
increased conductivity of occasional thin interbedded sand units. 23

Quaternary Sand

Four Shelby tube samples of Qs from Zone G exhibited a vertical hydraulic conductivity geometric mean of $3.6E-04$ cm/sec (1.0 ft/day). Two Shelby tube samples of Qs from Zone F exhibited a K_v geometric mean of $6.4E-07$ cm/sec ($1.8E-03$ ft/day) (EnSafe, December 1997). To the east in Zone E, seven Qs Shelby tube samples had a geometric mean vertical hydraulic conductivity of $4.7E-04$ cm/sec (1.3 ft/day) (EnSafe, November 1997).

Horizontal hydraulic conductivities for Qs deposits in Zone G ranged between 1.4 to 7.7 ft/day. Similarly, Qs deposits in Zone E were found to range from 3 to 20 ft/day in Zone E (EnSafe, November 1997). As a result, Qs deposits constitute the primary water-bearing and transmissive unit in Zone G. Vertical flow within the Qs may vary greatly depending upon the percentage of fines and interlaying of thin silty clay laminae, as shown in the K_v values from Zone F Shelby tube samples. Consequently, Qs deposits may act as a vertical aquitard in very limited local areas. However, heterogeneities in Qs sediment may provide intervals of preferential flow within the unit itself and as interbeds within low permeability Qm and Qc deposits. These intervals of preferential flow within the groundwater system may affect flow direction and velocity.

FOR CONTINUATION SEE SHEET 7



- LEGEND**
- LINE ON PILES
 - MANHOLE
 - MANHOLE - ESTIMATED LOCATION
 - MANHOLE ON PILES
 - ⊠ LIFT STATION
 - SANITARY SEWER
 - PLUG
 - DIRECTION OF FLOW
 - SEPTIC TANK
 - P.S. PRESSURE SEWER
 - C.O. CLEAN OUT
 - C.I. CAST IRON
 - D.I. DUCTILE IRON
 - S.D.C. SHIP DRAINAGE CONNECTION
 - V.C. VITRIFIED CLAY
 - P.V.C. POLYVINYL CHLORIDE
 - PP POLYPROPYLENE



AREA 7-A

SCALE: 1"=250'

- NOTES:**
1. ALL BUILDING SEWERS ARE 4" UNLESS OTHERWISE NOTED.
 2. ALL PIPES ARE V.C. UNLESS OTHERWISE NOTED.
 3. OPERATION OF SEWER FLOW METER TO BE TURNED OVER TO NCPSS.

AREA LIMITS

FOR CONTINUATION SEE SHEETS 10 & 7

<p>DAVIS FLOYD</p> <p>ENGINEERS ARCHITECTS PLANNERS SCIENTISTS GENERAL CONTRACTORS CIVIL ENGINEERS</p>	<p>WASTEWATER NETWORK AREA 7-A</p> <p>DRAWING TITLE</p>	<p>CHARLESTON NAVAL COMPLEX WASTEWATER SYSTEM EVALUATION STUDY</p> <p>PROJECT TITLE</p>	<p>CHARLESTON NAVAL COMPLEX REDEVELOPMENT AUTHORITY</p> <p>OWNER</p>
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I:\johns\30133\swreport\southend.dwg PLOT V.plt7A

CH2MHILL TRANSMITTAL

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

From: Louise Palmer/CH2M-Jones

Date: January 23, 2003

Re: CH2M-Jones' Responses to Comments by SCDHEC regarding the *Confirmatory Sampling Investigation Report, Area of Concern 720, Zone G, Charleston Naval Complex* (Revision 0)

Quantity	Description
4	CH2M-Jones' Responses to Comments by SCDHEC regarding the <i>Confirmatory Sampling Investigation Report, Area of Concern 720, Zone G, Charleston Naval Complex</i> (Revision 0) – Originally Submitted on September 26, 2002

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

Remarks:

Copy To:

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

SCDHEC Engineering Comments Prepared by Jerry Stamps:

1. General Comment:

The Department maintains that a professional engineer certified in the state of South Carolina must certify that the integrity of the OWSs and the ancillary piping remains in tact. This certification and supporting analytical data is especially important for units that remain in place which have potential future use by subsequent landowners. Please note that this requirement is being applied consistently to all facilities regulated under RCRA Subtitle C administered by the Corrective Action Engineering Section.

CH2M-Jones Response:

The OWS unit in the CSI Report for OWS AOC 720 is permanently out of service. Therefore, it is not clear what the benefit of an integrity assessment would be. CH2M-Jones understands the Department's concerns about the potential for releases from OWSs in the event that they continue to be operated in the future. CH2M-Jones and the Navy believe it is the responsibility of any future owner or operator who chooses to operate these units to conduct the required integrity assessment. We suggest that we work together with SCDHEC to find a manner to address this issue that is acceptable to all parties.

2. General Comment:

The figures seem to indicate that the soil samples were collected 10 feet or more from the units under investigation. However, the Department understands that the icon used to represent the OWS may not necessarily represent the actual size of the unit. Consequently, the Navy must verify that the samples locations are indeed adjacent to the respective units. If so, the text should be revised to clarify this fact.

Furthermore, the Navy must verify that the subsurface soil samples were collected at sufficient depth corresponding to the depth of the OWS. If so, the text should be revised to clarify this fact. A groundwater sample immediately downgradient of this unit will be sufficient to determine if a release has occurred at the bottom of the unit.

CH2M-Jones Response:

Soil samples were collected approximately 10 ft from the estimated center of the OWS, to make sure that it surrounded the unit because its exact location was unknown. The text states that the subsurface soil samples were collected at 3 to 5 ft below grade; this depth was intended to intersect potential releases from the OWS base, inlet, and outlet piping. The location and depth of the soil samples will be further clarified in the text. As stated in the text, a groundwater sample was attempted on the east side of the unit, but no groundwater was available. We will work with SCDHEC to evaluate appropriate locations for additional samples, if needed.

3. Section 2.1.1, Metals in Soil Samples

Sample G720SB003 had an elevated lead concentration of 890 ppm in subsurface soil; however, a duplicate sample was collected from the same location which resulted in a

lead concentration of 13 ppm. Though the Department acknowledges that a metal fragment may have contributed to the elevated lead concentration, unfortunately there is no evidence supporting this conclusion. Therefore, the Department recommends collecting additional sample(s) in the vicinity of SB003 for lead analysis in order to "tip the scale" one way or the other to verify that this elevated lead concentration is anomalous. The need for this verification is further supported by the lack of metals analysis of groundwater samples.

CH2M-Jones Response:

We will coordinate with SCDHEC on any additional samples at this site, if needed. The proposed additional soil samples that need to be collected have been discussed by Mansour Malik of SCDHEC and Louise Palmer of CH2M-Jones, and a sampling plan is being submitted under separate cover.

SCDHEC Hydrogeology Comments Prepared by Paul Bergstrand:

1. **Page 1-1, Introduction, Lines 18 – 19 and 24 – 25**

This section states *“There is no reason to believe that hazardous materials have been released from this OWS unit.”* and *“No Further Action is proposed for the OWS AOC, as the results of the recent CSI conclude that there is no contamination present at the site.”* The Department has not been able to reach this definitive conclusion based on the information provided in this report. The Department’s correspondence of 22 February 2001, which informed the Navy of the Department’s Discovery of a New Site (Potential SWMU), noted stains on the wash rack floor and a shed with a hazard notification plaque. Please provide documentation to support the Navy’s statement or revise this section.

CH2M-Jones Response:

Davis & Floyd sanitary sewer records show that the OWS likely serviced the wash pad only. The shed is not associated with the OWS. The closest aboveground structure to the wash rack is approximately 100 ft away, and is not known to be connected by above- or below-grade piping.

2. **Page 1-1, Introduction, Lines 22 – 23.**

This section states that *“CSI activities were conducted to evaluate the nature and extent of potential contamination from the OWS historical operation.”* This statement does not coincide with the goals as printed in the SAP. The stated goal of the SAP is *“to conduct Confirmatory Sampling Investigations (CSIs) to evaluate the presence or absence of contamination from potential releases from the Oil/Water Separators.”* Please revise this section.

CH2M-Jones Response:

The objective of a SAP is different than the objective of a CSI report. A SAP is a work plan that describes only proposed sampling and analysis activities. A SAP has specific goals that are different than the goals of a CSI report. A CSI report addresses a broader set of issues related to a site than a SAP. As such, it is expected that the stated goal of a SAP would necessarily be different from the stated goal of a CSI report. Consequently, it does not make sense to change the stated goal of a CSI report to a verbatim restatement of the goal of an SAP. Both of the sentences referred to above adequately reflect the intent of their respective reports. There is no need to revise the CSI Report based on this comment.

3. **Page 1-2, AOC 720 Background and Setting, Lines 22 – 23.**

This section states *“The OWS is not evident from the surface and is not accessible (there is no manhole).”* It would be highly unusual for an OWS not to have some form of access. The Navy should describe in detail how it is able to determine the location of the OWS if there is no surface evidence and if there is not an access port or manhole.

CH2M-Jones Response:

The OWS location was estimated in the field by PVC piping extending above the surface; no access port or manhole was visible. At the December 30, 2002 site visit, CH2M-Jones, SCDHEC, and the Navy discovered that the PVC piping had been removed by contractors for the State of South Carolina Highway Department of Transportation. The OWS site is now marked by gravel and crushed stone/slag on the ground surface.

4. Page 1-2, AOC 720 Background and Setting, Line 24.

This section states *"Information regarding the configuration of the OWS is not available."* If the Navy decides to close the OWS this information would be obtainable in the field. Understanding the configuration of the OWS is crucial to evaluating sample location and the relevance of analytical data. The Navy should acquire and provide the OWS details to include dimensions, piping, distance below land surface, and the measured depth of the bottom of the unit.

CH2M-Jones Response:

If the Navy chooses to close the unit, it will obtain information about its configuration during closure. The closure procedure would likely include sampling its contents, if any contents are present.

5. Page 1-2, AOC 720 Background and Setting, Lines 24 – 26.

This section states *"PVC piping extending above grade south of the equipment pad may have been used as part of the OWS operation."* It is common for an OWS to have an access point, such as a pipe, to remove oils and sludges. The Navy should determine the layout and function of the PVC piping. The Navy is advised to collect a sample of the contents (oils, water & sludge) of the OWS.

CH2M-Jones Response:

This comment was previously addressed in responses to Comment Nos. 3 and 4.

6. Page 1-2, AOC 720 Background and Setting, Lines 26 – 27.

This section states *"A report of the wastewater lines prepared by Davis and Floyd (1998) indicates that the OWS drained northward to the sanitary sewer at Hobson Avenue."* A copy of the relevant information, as requested by the Department in the SAP approval, was not included in this Report. Understanding the configuration of the OWS is critical to evaluating sample location and the relevance of analytical data. The Navy should include a copy of the relevant information regarding wastewater lines from the Davis and Floyd report.

CH2M-Jones Response:

The figure by Davis & Floyd relevant to this site will be appended to the report. This figure shows a sanitary sewer line leading from the wash pad at AOC 720 to the main line along Hobson Avenue.

7. **Page 2-1, Environmental Sampling at AOC 720, Lines 3 – 5.**

This section states “These samples were collected as described in the Sampling and Analysis Plan; AOC 713, Zone F; AOC 720 Zone F (sic) Oil/Water Separators; Charleston Naval Complex; (CH2M-Jones, March 2002).” The sample locations, as described in this CSI Report, are not in the same locations that were proposed and approved by the Department in the SAP. It is not clear why the sample locations were modified or who made the decision to relocate them.

The decision to relocate soil and groundwater sampling points constitutes a change to the SAP that should have been discussed with the Department during field activities. As originally proposed, the east and west samples would have been downgradient of the OWS and the southern sample would have been upgradient of and adjacent to the OWS. The sample locations as reported in the CSI Report were all moved upgradient such that the east and west samples were side-gradient of the OWS and the south sample was nearly 10 feet upgradient of the unit. The result is there are no soil or groundwater samples adjacent to or downgradient of the OWS. The Navy must collect soil and groundwater samples adjacent to and downgradient of the OWS. Please submit the monitoring well request to my attention (see comment 9).

CH2M-Jones Response:

The samples were shifted to surround the PVC piping slightly to the west of the circular symbol on Figure 2-1, in anticipation that the OWS unit may extend toward the piping instead of being located directly south of the equipment pad. At the time of sampling, the adjacent equipment pad had been demolished and the wash pad was covered with soil and rubble. The two sample locations shown in the SAP, located north of the assumed OWS location, were physically inaccessible at the time of sampling. We will coordinate additional sample locations, if any are necessary, with SCDHEC.

8. **Page 2-2, VOCs in Soil Samples, Lines 17 – 22.**

This section states “As shown in Table 2-1, trace amounts of cis-1,2-dichloroethene (cis-1,2-DCE) and carbon disulfide were detected in one of the three soil samples collected in the AOC 720 area.” This is not correct. Table 2-1 indicates that cis-1,2-DCE was detected in one of three soil samples. Carbon disulfide was detected in two of the three soil samples. Please revise this section.

CH2M-Jones Response:

The statement in the report is correct. Inspection of Table 2-1 shows that trace amounts of cis-1,2-DCE and carbon disulfide were detected in G720SB003. No other samples had these two chemicals detected. The statements that follow in Section 2.1.4 clearly indicate that other VOCs were also detected. No revisions to this statement appear to be needed.

9. **Page 2-2, VOCs in Soil Samples, Lines 17 - 22.**

Soil boring G720SB003 was relocated 7 to 10 feet upgradient of the OWS without Department knowledge or approval. Evaluation of these VOC detections is further complicated by the lack of OWS piping diagrams, OWS dimensions, and depth of the bottom of the unit. The Navy has not demonstrated the release is localized or confined. Should the Navy assume that the contamination released was from the OWS, the lack of a downgradient monitoring well would preclude detection. The detections of VOCs in G720SB003 have confirmed the presence of contamination from potential releases from the OWS. Because the CS Report has documented a release, the Navy must submit a RFI sampling workplan with at least 4 soil sample locations around the OWS and at least three permanent monitoring wells in upgradient and downgradient locations. Analysis must be for VOCs, SVOCs, and metals. Deep monitoring wells are not required at this time. The Department is willing to assist the Navy in scoping the workplan.

CH2M-Jones Response:

Three subsurface soil samples have been collected at AOC 720, and analyzed for VOCs, SVOCs, metals, PCBs, and pesticides. Trace amounts of VOCs have been identified at levels an order of magnitude less than screening criteria. The origin of the VOCs is unknown. No VOCs have been detected in groundwater samples at the site. The data indicate that an RFI is not warranted at this site.

10. **Page 2-2, VOCs in Soil Samples, Lines 17 - 22.**

This section stated that *"trace amounts of the field/laboratory contaminants acetone and methyl ethyl ketone were detected in all three soil samples."* This statement implies that the contaminants detected were the result of field contamination during sample collection or laboratory contamination during sample analysis. The Navy's position is not supported by the Data Validation Summary located in Appendix B. The Data Validation Summary states that the trip blank reported 4.2 ug/l methylene chloride. Neither acetone or methyl ethyl ketone were detected in the sample blanks. Because both acetone and methyl ethyl ketone could have been disposed into the OWS, the Navy must consider them as actual detections in the soil samples. Please revise this section.

CH2M-Jones Response:

Acetone and methyl ethyl ketone are considered as actual detections. Because the detected concentrations are below the COPC screening criteria agreed to by the BCT, they are not considered COPCs or COCs at this site. The section will be revised to more clearly indicate that the reference to acetone and methyl ethyl ketone being field and laboratory contaminants relates to the EPA guidance documents that include these chemicals as common laboratory contaminants.

11. Page 2-2, Groundwater Sampling and Analysis, Lines 24 - 28.

This section states "Data from the two direct-push technology (DPT) locations were used to evaluate groundwater quality at AOC 720." The Navy is therefore relying on upgradient to sidegradient DPT monitoring wells to determine groundwater quality and has discounted the necessity of downgradient monitoring well locations. This is not a standard sampling approach and is not acceptable. Downgradient monitoring wells are required to assess groundwater quality at AOC 720. See comments 7 and 9.

CH2M-Jones Response:

We will coordinate with SCDHEC any additional samples needed to characterize this site.

12. Page 2-3, Groundwater Sampling and Analysis, Lines 3- 4.

This section states "Logs of the DPT groundwater samples are presented in Appendix D." The logs in Appendix D are for DPT points G720GP001 and G720GP002. The monitoring well record (log) for the third DPT, which would not produce enough water to sample, was not included in the Appendix. This third well record must be submitted.

The Logs for DPT points G720GP001 and G720GP002 did not include the following information as required in the June 2, 1985 South Carolina Well Standards and Regulations R.61-71.11(E)(2):

- Driller (name)
- Geologist's log
- Depth to the Water Table and time measured
- Surveyed elevation of measuring point.

This information must be submitted.

Condition 2 of the monitoring well approval #HW-02-038, dated 16 April 2002, stated "The monitoring well record (R.61-71.11.E.2) shall be submitted to the Department within 30 days after installation of the last point." The well logs in Appendix D indicate the wells were installed on July 18, 2002. According to the monitoring well approval the well records were to be submitted on or before August 18, 2002. The Report was received on September 27, 2002. This constitutes a violation of the South Carolina Well Standards and Regulations R.61-71.11(E)(2) by the Navy.

CH2M-Jones Response:

a) A record of the third DPT effort is submitted with this response.

b) *The DPT method used to collect groundwater samples at this site did not involve measuring the water table depth or gathering soil samples or cuttings. The screen depth was measured from the ground surface; however, the surface elevation was not surveyed. Therefore, no geologist's log of lithography or water table depths are reported.*

c) *We understand that the completed logs were submitted to SCDHEC at the August, 2002 BCT meeting, before the CSI report was submitted.*

13. Page 2-3, Groundwater Sampling and Analysis, Lines 5- 12.

This section states "*The only compound detected in groundwater was acenaphthene at sample location G720GP001.*" Because estimated contamination concentration is less than the adjusted Risk Based Concentration (RBC) this section concludes by stating "*the data indicate that there are no COPCs in groundwater at AOC 720.*" G720GP001 was a temporary monitoring well that is sidegradient of the OWS. Furthermore, the detection of acenaphthene in G720GP001 has confirmed a potential release from the OWS. As stated above, the Navy must submit a RFI sampling workplan to address the contamination. The workplan should be submitted within 90 days.

CH2M-Jones Response:

The detected concentration 0.49 µg/L is very close to the instrument detection limit and much lower than the typical reporting limit (non-detect) of 10 µg/L. This detection does not indicate a release from the OWS, and is much lower than the range of detected concentrations in background grid wells at CNC (2 to 43 µg/L). Additional samples at this site will be coordinated with SCDHEC.

14. Page 2-4, Investigation Summary, Lines 13 - 23.

The items contained within this summary have been addressed in greater detail in the previous comments. A summary of those items are as follows:

- Basic information on the OWS was not included.
- The sampling locations were moved from the approved locations.
- Two monitoring well records (logs) were not complete and one was not submitted.
- The report documents a release to the environment, requiring an RFI workplan.

CH2M-Jones Response:

A summary of the previous responses to the bulleted items follows:

- *No information regarding the OWS is available. The Davis & Floyd sewer map will be appended to the report.*
- *Sampling locations were adjusted to accommodate site conditions and to surround the most likely location of the OWS, near the PVC piping.*

- *DPT logs were completed with all available information. The record for a sample that never encountered water will be submitted.*
- *The data do not indicate COCs requiring further investigation. However, additional samples, if needed, will be coordinated with SCDHEC.*

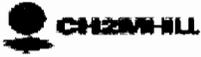
15. Page 3-1, Conclusions and Recommendations, Lines 23 - 24.

This section states "AOC 720 is recommended for NFA status." As stated in previous comments, additional sampling is necessary. This document cannot be approved as submitted and the Department cannot concur with a NFA at this time.

CH2M-Jones Response:

Resolution of comments is currently in progress.

Attachment



PROJECT NUMBER 158814	DPT NUMBER G720GP001	page <u>1</u> of <u>1</u>
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DPT GROUNDWATER SAMPLE LOG

PROJECT : Charleston Naval Complex, Charleston, SC LOCATION : Charleston, SC NORTHING: 371465.4
ELEVATION : NA DRILLING CONTRACTOR : Prosonic Corporation - R. Mooney License # 1435 EASTING: 2322489.0
DRILLING METHOD AND EQUIPMENT USED : Geoprobe Direct-Push Sampling, 4 ft screen
START : 06/18/2002 END: 06/18/2002 LOGGER : D. Gates/NVR

DEPTH BELOW SURFACE (FT)	SAMPLING DEPTH	COMMENTS
	SCREEN INTERVAL	ABANDONMENT METHOD TESTS, INSTRUMENTATION SOIL DESCRIPTION, IF VISIBLE
5		
	Top of Sampling Interval	
10		
	Bottom of Sampling Interval	
15		After sampling the boring was pressure grouted from bottom to top with Type 1 Portland Cement
20		
25		
30		

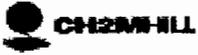


PROJECT NUMBER 158814	DPT NUMBER G720GP002	page 1 of 1
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DPT GROUNDWATER SAMPLE LOG

PROJECT : Charleston Naval Complex, Charleston, SC	LOCATION : Charleston, SC	NORTHING:	371453.0
ELEVATION : NA	DRILLING CONTRACTOR : Prosonic Corporation - R. Mooney	License # 1435	EASTING: 2322502.5
DRILLING METHOD AND EQUIPMENT USED : Geoprobe		Direct-Push Sampling, 4 ft screen	
START : 06/18/2002	END: 06/18/2002	LOGGER : D. Gates/NVR	

DEPTH BELOW SURFACE (FT)	SAMPLING DEPTH		COMMENTS
	SCREEN INTERVAL		ABANDONMENT METHOD TESTS, INSTRUMENTATION SOIL DESCRIPTION, IF VISIBLE
5			
	Top of Sampling Interval		
10			
	Bottom of Sampling Interval		
15			After sampling the boring was pressure grouted from bottom to top with Type 1 Portland Cement
20			
25			
30			



PROJECT NUMBER 158814	DPT NUMBER G720GP003	page <u>1</u> of <u>1</u>
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DPT GROUNDWATER SAMPLE LOG

PROJECT : Charleston Naval Complex, Charleston, SC	LOCATION : Charleston, SC	NORTHING: 371453.0
ELEVATION : NA	DRILLING CONTRACTOR : Prosonic Corporation - R. Mooney	License # 1435 EASTING: 2322502.5
DRILLING METHOD AND EQUIPMENT USED : Geoprobe		Direct-Push Sampling, 4 ft screen
START : 06/18/2002	END: 06/18/2002	LOGGER : D. Gates/NVR

DEPTH BELOW SURFACE (FT)	SAMPLING DEPTH		COMMENTS
	SCREEN INTERVAL		ABANDONMENT METHOD TESTS, INSTRUMENTATION SOIL DESCRIPTION, IF VISIBLE
5			
	Top of Sampling Interval		
10	First Sample Interval Formation too tight for to collect groundwater, Dry		
	Bottom of Sampling Interval		
	Top of Sampling Interval		After sampling the boring was pressure grouted from bottom to top with Type 1 Portland Cement
15	Second Sample Interval Formation too tight for to collect groundwater, Dry		
	Bottom of Sampling Interval		
	End of Boring		
20			
25			
30			