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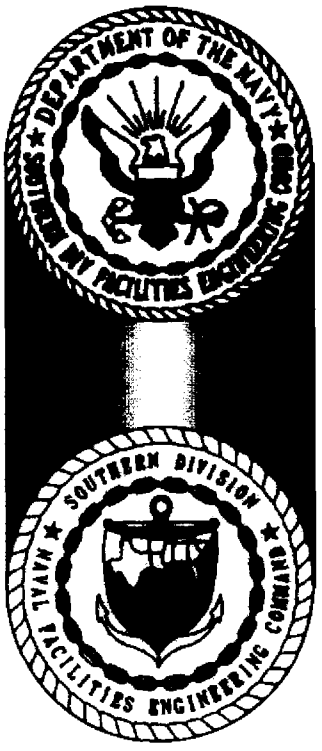
RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT ADDENDUM CORRECTIVE MEASURE STUDY WORK PLAN SOLID WASTE MANAGEMENT UNIT 102 (SWMU 102) AND AREA OF CONCERN 590 (AOC 590) ZONE E CNC CHARLESTON SC

5/19/2003

CH2M HILL

RFI REPORT ADDENDUM

RFI Report Addendum and CMS Work Plan
SWMU 102 and AOC 590, Zone E



Charleston Naval Complex
North Charleston, South Carolina

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

CH2M-Jones

May 2003

Contract N62467-99-C-0960

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CH2MHILL

May 19, 2003

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

Re: RFI Report Addendum and CMS Work Plan (Revision 1) and Response to Comments – SWMU 102 and AOC 590, Zone E

Dear Mr. Scaturo:

Enclosed please find four copies of the RFI Report Addendum and CMS Work Plan (Revision 1) and Response to Comments for SWMU 102 and AOC 590 in Zone E of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

The principal author of this document is Sam Naik. Please contact him at 770/604-9182, ext. 255, if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

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

THE ATTACHED PAGES SHOULD BE INSERTED AS REPLACEMENTS IN THE RFI REPORT ADDENDUM AND CMS WORK PLAN, SWMU 102 AND AOC 590, ZONE E, REVISION 0 SUBMITTAL:

- REVISED TABLE OF CONTENTS PG. V
- REVISED PGS. 5-3 TO 5-7

EPA Specific Comments

Comment:

1. Section 5.2.2, Page 5-3, Line 7.

This line states that the site average subsurface soil concentration for arsenic was calculated to be 18.43 mg/kg. However, it is unclear as to which sampling events and samples were used to calculate the average value. The calculations for this average value should be described in the report.

CH2M-Jones Response:

The subsurface sample IDs and associated concentrations of arsenic used to calculate the average subsurface soil arsenic concentration are included in Table 5-1 on Page 5-10 of the report. The samples were collected during the initial RFI in 1996, as indicated under the "Date Collected" column of the table. The text will be revised to clarify these calculations further.

Comment:

2. Section 5.2.4, Page 5-4, Line 8.

The sampling events and the samples used to calculate the site average value and a description of that calculation for surface soil lead concentration should be provided in the report.

CH2M-Jones Response:

The surface sample IDs and associated concentrations of lead used to calculate the average surface soil lead concentration are included in Table 5-1 on Pages 5-12 and 5-13 of the report. The samples were collected during the initial RFI in 1996, and the additional delineation sampling was conducted by CH2M-Jones during August 2002, as indicated under the "Date Collected" column of the table. The text will be revised to clarify these calculations further.

Comment:

3. Section 5.2.4, Page 5-4, Line 10.

The sampling events and the samples used to calculate the site average value and a description of that calculation for subsurface soil lead concentration should be provided in the report.

CH2M-Jones Response:

The subsurface sample IDs and associated concentrations of lead used to calculate the average subsurface soil lead concentration are included in Table 5-1 on Pages 5-13 and 5-14 of the report. The samples were collected during the initial RFI in 1996, and the additional delineation sampling was conducted by CH2M-Jones during August 2002, as indicated under the "Date Collected" column of the table. The text will be revised to clarify these calculations further.

Comment:

4. Section 5.2.5, Page 5-5, Line 18.

A description of the calculation for mean mercury concentration in surface soil and the average subsurface soil concentration should be provided in the report.

CH2M-Jones Response:

The subsurface sample IDs and associated concentrations of mercury used to calculate the average surface soil mercury concentration and the (arithmetic) mean of the subsurface soil mercury are included in Table 5-1 on Pages 5-13 and 5-14 of the report. The samples were collected during the initial RFI in 1996, and the additional delineation sampling was conducted by CH2M-Jones during August 2002, as indicated under the "Date Collected" column of the table. The text will be revised to clarify these calculations further. Additional parameters pertaining to the calculation of the mean concentrations of mercury are included in Appendix G of the report.

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February 7, 2003

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

Re: RFI Report Addendum and CMS Work Plan (Revision 0) – SWMU 102 and AOC 590, Zone E

Dear Mr. Scaturo:

Enclosed please find four copies of the RFI Report Addendum and CMS Work Plan (Revision 0) for SWMU 102 and AOC 590 in Zone E of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

The principal author of this document is Sam Naik. Please contact him at 770/604-9182, ext. 255, if you have any questions or comments.

Sincerely,

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Gary Foster/CH2M HILL, w/att

RFI REPORT ADDENDUM

RFI Report Addendum and CMS Work Plan
SWMU 102 and AOC 590, Zone E

Charleston Naval Complex
North Charleston, South Carolina

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

PREPARED BY
CH2M-Jones

May 2003

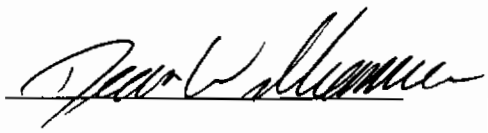
Revision 1
Contract N62467-99-C-0960
158814.ZE.PR.01

Certification Page for RFI Report Addendum and CMS Work Plan (Revision 1) — SWMU 102 and AOC 590, Zone E

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

South Carolina

P.E. No. 21428



Dean Williamson, P.E.

5/19/2003

Date

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Contents, Continued

Appendices

Acronyms and Abbreviations

ALM	Adult Lead Methodology
AOC	area of concern
AST	aboveground storage tank
BCT	BRAC Cleanup Team
BEHP	bis(2-ethylhexyl)phthalate
BRAC	Base Realignment and Closure Act
BRC	background reference concentration
BTEX	benzene, toluene, ethylbenzene, and xylene
CA	corrective action
cPAH	carcinogenic polyaromatic hydrocarbon
CMS	corrective measures study
CNC	Charleston Naval Complex
COC	chemical of concern
COPC	chemical of potential concern
DAF	dilution attenuation factor
DET	Environmental Detachment Charleston
DPT	direct push technology
EnSafe	EnSafe Inc.
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
FRE	fixed-point risk evaluation
HHRA	human health risk assessment
HI	hazard index

Acronyms and Abbreviations, Continued

ILCR	incremental lifetime cancer risk
IM	interim measure
LUC	land use control
µg/L	micrograms per liter
µg/kg	micrograms per kilogram
mg/kg	milligram per kilogram
mg/m^3	milligrams per cubic meter
MCL	maximum contaminant level
MCS	media cleanup standards
ng/kg	nanograms per kilograms
NAVBASE	Naval Base
NFI	no further investigation
OWS	oil/water separator
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
QC	quality control
RAO	remedial action objectives
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RGO	remedial goal options
RI	remedial investigation

Acronyms and Abbreviations, Continued

SAP	sampling and analysis plan
SCDHEC	South Carolina Department of Health and Environmental Control
SPLP	Synthetic Precipitation Leaching Procedure
SSL	soil screening level
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TDS	total dissolved solids
TEQ	TCDD-equivalent
TPH-GRO	Total Petroleum Hydrocarbons – Gasoline Range Organics
TPH-DRO	Total Petroleum Hydrocarbons – Diesel Range Organics
TTAL	Treatment Technique Action Level
UST	underground storage tank
VOC	volatile organic compound
UCL_{95}	95-percent Upper Confidence Limit

Section 1.0

1.0 Introduction

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

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

In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation and remediation services at the CNC. This submittal has been prepared by CH2M-Jones to complete the RCRA Facility Investigation (RFI) for Area of Concern (AOC) 590 and Solid Waste Management Unit (SWMU) 102 in Zone E of the CNC. These two sites have been included together in this report due to their proximity to each other. The location of AOC 590 and SWMU 102 in Zone E is shown in Figure 1-1. Figure 1-2 shows an aerial photograph of the site.

1.1 Background

AOC 590 – Alley, Buildings 79 and 1760

AOC 590 comprises the alley between Buildings 79 and 1760. According to the *Final RCRA Facility Assessment Report* (EnSafe Inc. [EnSafe]/Allen & Hoshall, 1995), this alley was reported to have been the site of past releases of acetone and cutting oil. No information was found during the RFA regarding the specific locations, volumes, or duration of the waste discharge in this area. Currently, this alley is paved with asphalt.

As identified in RCRA Facility Assessment (RFA) documentation, the materials of concern for AOC 590 include heavy metals, benzene, toluene, ethylbenzene, and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), and petroleum hydrocarbons. The AOC 590 area is zoned M2 (marine industrial). The CNC RCRA Permit identified AOC 590 as requiring a CSI.

SWMU 102 – Mercury Spill, Building 79

Building 79 is a single-story concrete block structure with a concrete slab foundation that was constructed in 1943. The building previously housed the Ordnance Shop and then served as a dental clinic from 1966 until 1976. Currently, Building 79 is being used by the Neal Brothers Co. as a storage facility. This area is zoned for marine industrial use (M-2).

According to the RFA, several incidents involving hazardous material spills, as well as cleanup activities, have been documented since 1976. The most noteworthy was the 1969 discovery of a pool of mercury under the floor inside the central portion of Building 79. Mercury reportedly spilled and seeped under the floor, forming a pool approximately 10 feet in diameter.

According to the Environmental Baseline Survey conducted in 1994 at Building 79 (EnSafe, 1996), the 1970 Incident Report #CNS-12-70 reported that five pounds of mercury were recovered by a vacuum cleaner and disposed of properly. The exposed area was scrubbed with HgX to remove any traces of remaining mercury, and the floor was replaced. The mercury was reportedly used in gyroscopes before World War II.

As identified in RFA documentation, the materials of concern for SWMU 102 include mercury, silver and other metals, VOCs, and petroleum hydrocarbons. The CNC RCRA Permit identified SWMU 102 as requiring a CSI.

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

1.2 Purpose of the RFI Report Addendum

This submittal has been prepared by CH2M-Jones to complete the RFI for SWMU 102 and AOC 590 in Zone E of the CNC. This RFI Report Addendum includes a summary of previous RFI investigations and conclusions, as well as additional investigations conducted at AOC 590 and SWMU 102 by CH2M-Jones during 2002. This RFI Report Addendum also discusses various closeout issues and the findings of previous investigations, existing site conditions, and surrounding area land use.

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

- Status of the RFI

- Presence of metals (inorganics) in groundwater
- Potential linkage to SWMU 37, Investigated Sanitary Sewers at the CNC
- Potential linkage to AOC 699, Investigated Storm Sewers at the CNC
- Potential linkage of AOC 504, Investigated Railroad Lines at the CNC
- Potential linkage to surface water bodies (Zone J)
- Potential contamination associated with oil/water separators (OWSs)
- Relevance or need for land use controls (LUCs) at the site

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

1.3 Report Organization

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

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

2.0 Summary of RFI Conclusions for AOC 590 and SWMU 102 – Summarizes the conclusions from the RFI investigations and risk evaluations for AOC 590 and SWMU 102 as presented in the RFI report.

3.0 Summary of Interim Measures and UST/AST Removals at AOC 590 and SWMU 102 – Provides information regarding any interim measures (IMs) or tank removal activities performed at the site.

4.0 Summary of Additional Investigations – Summarizes information, if any, collected after completion of the RFI report.

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

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

7.0 Recommendations – Provides recommendations for proceeding with site closure.

8.0 CMS Work Plan – Presents a focused Corrective Measures Study (CMS) Work Plan.

9.0 References – Lists the references used in this document.

Appendix A – Contains excerpts from the RFI report, including a summary of chemical detections and a groundwater flow map for the site vicinity.

Appendix B – Contains responses to SCDHEC comments for AOC 590 and SWMU 102 from the RFI report.

Appendix C – Contains a copy of the Public Works Map dated November 3, 1955, showing historical railroad lines in the SWMU 102 area.

Appendix D – Contains analytical results summary for additional soil samples.

Appendix E – Contains data validation summary.

Appendix F – Contains copies of Figures 4 and 4A from the *Interim Measure Completion Report for AOC 699, Storm Drain Cleaning* (Environmental Detachment Charleston [DET], 1999).

Appendix G – Contains 95-percent Upper Confidence Limit (UCL_{95}) summaries.

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

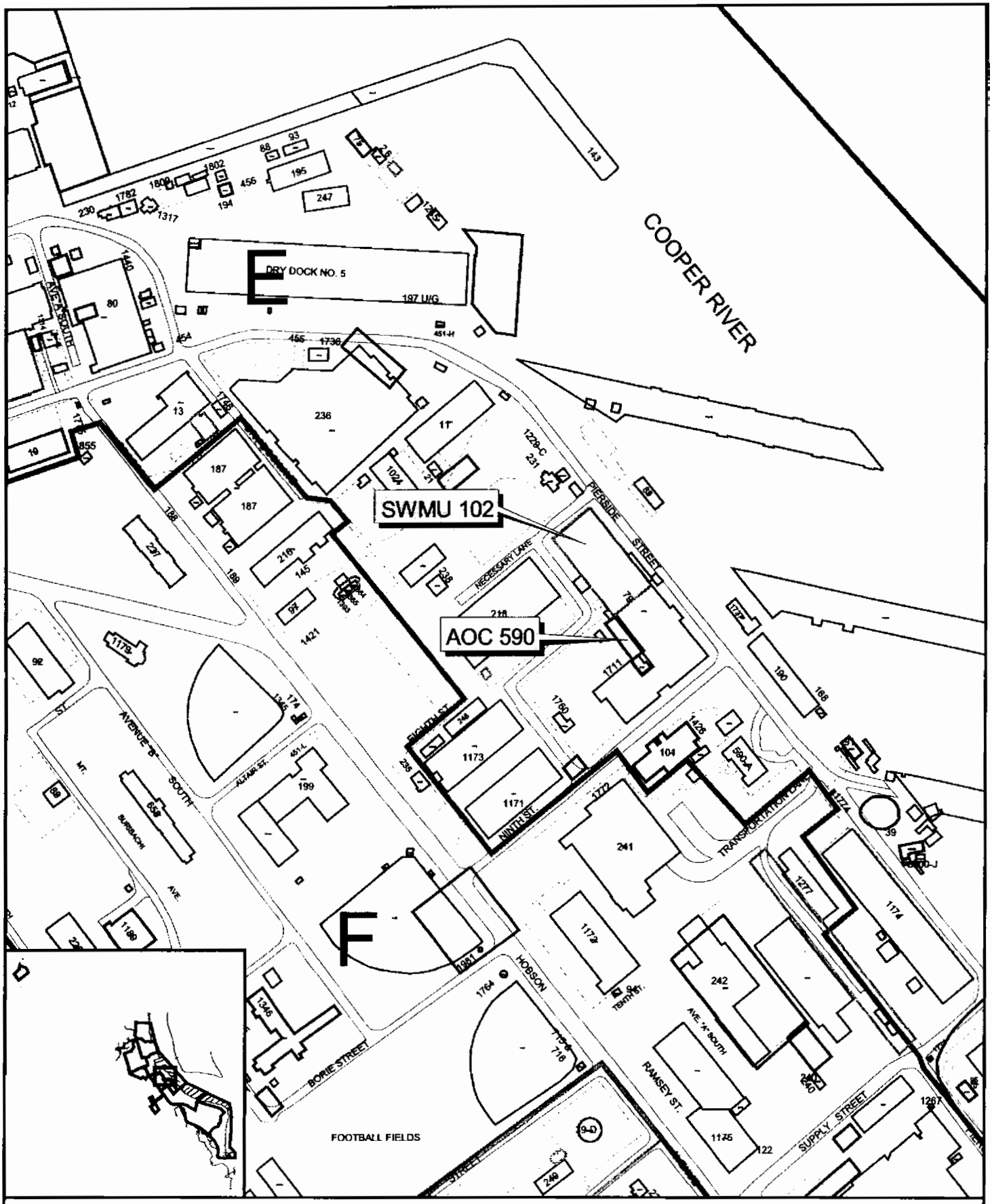

Figure 1-1
Location of AOC 590 and SWMU 102 in Zone E
Charleston Naval Complex

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NOTE: Aerial Photo Date is 1997

Fence
Railroads
Roads
AOC/SWMU Boundary
Buildings
Zone Boundary

N

0 60 120 Feet

1 inch = 75 feet

Figure 1-2
Site Map
SWMU 102 and AOC 590, Zone E
Charleston Naval Complex

CH2MHILL

File Path: C:\18gis\Projects\Zone_E\SWMU102\swmu102.apr, Date: 10 Jan 2002 6:36, User: NMOUDRY, Figure 1-2 Site Map

Section 2.0

2.0 Summary of RFI Conclusions for AOC 590 and SWMU 102

As part of the Zone E RFI, soil, groundwater, sediment and air investigations were conducted at AOC 590 and SWMU 102 during 1996 through 1997. The *Zone E RFI Report, Revision 0* (EnSafe, 1997) presented the results of these investigations and conclusions concerning contamination and risk, as summarized in the following sections. A further evaluation of COCs at these sites is provided in Section 5.0. Figure 2-1 shows RFI soil, groundwater, and sediment sampling locations.

2.1 Soil Sampling and Analysis

As part of the RFI field investigation for AOC 590, surface soil samples (0 to 1 foot below land surface [ft bls]) and co-located subsurface soil samples (3 to 5 ft bls) were collected in two sampling events. Figure 2-1 presents the historical sample locations. Samples from the first sampling event were analyzed for VOCs, semivolatile organic compounds (SVOCs), and metals. Samples from the second sampling event were analyzed for SVOCs and metals. No duplicate samples were collected at AOC 590. RFI activities at this site are described in the RFI report.

As part of the RFI field investigation for SWMU 102, surface and co-located subsurface soil samples were collected in three sampling events (see Figure 2-1 for historical sample locations). Samples from the first sampling event were analyzed for VOCs, SVOCs, metals and cyanide. One surface soil sample was selected as a duplicate and analyzed for VOCs, SVOCs, and metals, as well as herbicides, organophosphorous pesticides, hexavalent chromium, mercury, and dioxins. Samples from the second and third sampling events were analyzed for mercury. One surface soil sample was selected as a duplicate during each of the second and third sampling events and analyzed for VOCs, SVOCs, and metals, as well as pesticides and cyanide. One surface soil sample and one subsurface soil sample were sampled for Total Petroleum Hydrocarbons – Gasoline Range Organics (TPH-GRO) and Total Petroleum Hydrocarbons – Diesel Range Organics (TPH-DRO). RFI activities at this site are described in the RFI report.

2.1.1 Surface Soil

During the RFI at AOC 590 and SWMU 102, surface soil detections of organic compounds were evaluated against the U.S. Environmental Protection Agency (EPA) Region III industrial risk-based concentrations (RBCs) (with a hazard index [HI] = 0.1 for noncarcinogens). Surface soil detections of inorganic compounds were evaluated against the EPA Region III industrial RBCs (HI = 0.1 for noncarcinogens) and the Zone E background reference concentrations (BRCs).

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

VOCs: No VOCs exceeded the screening criteria in surface soil at either site.

SVOCs: Among detected SVOC compounds, the following analytes exceeded their respective screening criteria.

- At AOC 590, the calculated BEQs at concentrations of 2,865 micrograms per kilogram (µg/kg) and 1,445 µg/kg at E590SB001 and E590SB002, respectively, exceeded the benzo(a)pyrene industrial RBC of 780 µg/kg.
- At SWMU 102, BEQs at 12 locations, with concentrations ranging from 1,028 µg/kg to 17,500 µg/kg, exceeded the benzo(a)pyrene industrial RBC of 780 µg/kg.

Inorganics: No inorganic detections exceeded the screening criteria in surface soils at AOC 590. At SWMU 102, arsenic, at concentrations of 25.0 milligrams per kilogram (mg/kg), 27.2 mg/kg, and 27.8 mg/kg at locations E102SB036, E102SB038, and E102SB034, respectively, exceeded both its industrial RBC of 3.8 mg/kg and surface soil BRC of 23.9 mg/kg.

Pesticides/PCBs: Surface soil samples from AOC 590 were not analyzed for pesticides/PCBs. At SWMU 102, pesticides did not exceed the screening criteria in surface soil. No PCBs were detected in soil samples collected from SWMU 102.

Dioxins: At AOC 590, surface soil samples were not analyzed for dioxins. At SWMU 102, dioxins did not exceed the screening criteria of 1,000 nanograms per kilograms (ng/kg) of TCDD-equivalents (TEQs) used in the RFI.

TPH: Surface soil samples from AOC 590 were not analyzed for TPH. At SWMU 102, TPH-GRO was detected in one surface soil sample at 0.0428 mg/kg. No industrial RBC exists for TPH-GRO.

2.1.2 Subsurface Soil

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

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

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

VOCs: No VOCs exceeded the screening criteria in subsurface soil.

SVOCs: No SVOCs exceeded the screening criteria in subsurface soil at AOC 590. Among detected SVOC compounds at SWMU 102, two analytes exceeded their respective screening criteria.

- Benzo(a)anthracene, at concentrations of 1,600 µg/kg, 2,200 µg/kg, and 1,800 µg/kg at locations E102SB001, E102SB002, and E102SB004, respectively, exceeded its SSL of 700 µg/kg.
- Chrysene, at concentrations of 2,000 µg/kg at locations E102SB001, E102SB002, and E102SB004, exceeded its SSL of 1,000 µg/kg.

Inorganics: At AOC 590, one inorganic detection exceeded the screening criteria.

- Arsenic, at concentrations of 21.4 mg/kg and 22 mg/kg at locations E590SB003 and E590SB005, respectively, exceeded both its SSL of 15 mg/kg and its subsurface soil BRC of 19.9 mg/kg.

At SWMU 102, two metals exceeded their respective screening criteria.

- Arsenic, at concentrations ranging from 22.2 mg/kg to 64 mg/kg at six locations exceeded both its SSL of 15 mg/kg and its subsurface soil BRC of 19.9 mg/kg.
- Barium, at concentrations of 109 mg/kg, 141 mg/kg, and 262 mg/kg, at locations E102SB003, E102SB008, and E102SB036, respectively, exceeded both its SSL of 32 mg/kg and its subsurface soil BRC of 94.1 mg/kg.

Pesticides/PCBs: Subsurface soil samples from AOC 590 were not analyzed for pesticides/PCBs. At SWMU 102, among detected pesticides, one pesticide exceeded its respective screening criteria.

- Dieldrin, at concentrations of 7 µg/kg and 15 µg/kg at locations E102SB036 and E102SB037, respectively, exceeded its SSL of 1 µg/kg.

No PCBs were detected in subsurface soil samples collected from SWMU 102.

TPH: Subsurface soil samples from AOC 590 were not analyzed for TPH. At SWMU 102, TPH was not detected in subsurface soil samples.

2.2 Groundwater Sampling and Analysis

At AOC 590, one shallow monitoring well and one deep monitoring well were installed and sampled as part of the RFI. Figure 2-2 presents the locations of these wells. Groundwater was sampled during four sampling events. During the first sampling event, samples were analyzed for VOCs, SVOCs, metals, chlorides, sulfates, and total dissolved solids (TDS). During the second, third, and fourth sampling events, samples were analyzed for metals only. Detections in groundwater samples were compared with the EPA Region III tap water RBCs, maximum contaminant levels (MCLs), and the Zone E BRCs for shallow aquifers.

At SWMU 102, one shallow monitoring well was installed and sampled as part of the RFI (see Figure 2-2). The groundwater samples were analyzed for VOCs, SVOCs, metals, pesticides/polychlorinated biphenyls (PCBs), cyanide, chlorides, sulfates, TDS, and organotins. Groundwater was sampled during four sampling events. During the first sampling event, samples were analyzed for VOCs, SVOCs, metals, cyanide, chlorides, sulfates, TPH, and TDS. During the second sampling event, samples were analyzed for SVOCs, metals, and organotins. During the third and fourth sampling events, samples were analyzed for metals. Detections in groundwater samples were compared with the EPA Region III tap water RBCs, MCLs, and the Zone E BRCs for shallow aquifers.

2.2.1 Shallow Groundwater

Analyte concentrations in shallow groundwater samples were detected as follows:

VOCs: There were no VOCs detected above laboratory detection limits in shallow groundwater samples collected at AOC 590 and SWMU 102.

SVOCs: There were no SVOCs detected above laboratory detection limits in shallow groundwater samples collected at AOC 590. There were no detections of SVOC concentrations above screening criteria in groundwater samples collected at SWMU 102.

Inorganics: Among detected inorganics, two metals exceeded their respective screening criteria.

- Arsenic, at a concentration of 19.9 micrograms per liter (µg/L) at location E590GW001, exceeded both its tap water RBC of 0.045 µg/L and its shallow groundwater BRC 18.7 of 340 µg/L. However, the detection did not exceed the MCL of 50 µg/L.
- Iron, at a concentration of 18,800 µg/L at location E590GW001, exceeded its tap water RBC of 1,100 µg/L. There is no primary MCL established for groundwater.

There were no detections of inorganic concentrations above screening criteria from shallow groundwater samples from SWMU 102.

Pesticides/PCBs: Shallow groundwater samples from AOC 590 were not analyzed for PCBs or pesticides. No pesticides/PCBs were detected above laboratory detection limits in shallow groundwater samples from SWMU 102.

Organotins: Shallow groundwater samples from AOC 590 were not analyzed for organotins. No organotins were detected above laboratory detection limits in shallow groundwater samples from SWMU 102.

2.2.2 Deep Groundwater

Analyte concentrations in the groundwater samples from deep monitoring well E590GW01D at AOC 590 were detected as follows:

VOCs: There was only one VOC, acetone, detected below screening criteria in the deep well at AOC 590.

SVOCs: There were no SVOCs detected above laboratory detection limits in shallow groundwater samples collected at AOC 590.

Inorganics: Among detected inorganics, two metals exceeded their respective screening criteria.

- Barium, at a concentration of 281 µg/L, exceeded both its tap water RBC of 260 µg/L and its deep groundwater BRC of 218 µg/L. However, the detection did not exceed the MCL of 2,000 µg/L.
- Beryllium, at a concentration of 1.30 µg/L, exceeded its tap water RBC of 0.0160 µg/L (at the time the RFI report was prepared).

2.3 Sediment Sampling and Analysis

One sediment sample was collected and sampled as part of the RFI investigation. The sediment sample was collected from what appears to be a drop culvert catch basin and was analyzed for VOCs, SVOCs, and metals. The location of this catch basin is shown in Appendix G, which includes copies of Figures 4 and 4A from the *IM Completion Report for AOC 699, Storm Drain Cleaning* (DET, 1999). Detections in sediment samples were evaluated during the RFI against the EPA Region III industrial RBCs for soil (with a HI = 0.1 for noncarcinogens). No sediment samples were collected as duplicates at this site.

Detected concentrations of organic and inorganic compounds from sediment samples are as follows:

VOCs: No VOC detections exceeded the screening criteria in sediment samples.

SVOCs: The RFI reported that among detected SVOC compounds, the calculated BEQ concentration exceeded the industrial RBC of 780 µg/kg for benzo(a)pyrene, at a concentration of 147,000 µg /kg at E590M0001. BEQ calculations were performed using the method adopted by the BCT at the time of writing of the RFI report.

Inorganics: No inorganic detections exceeded the screening criteria in sediment samples.

Subsequent to the RFI field investigation, the sediments that were present in catch basins at AOC 590 were addressed in the IM for AOC 699 conducted by the DET in 1999. As a result, these sediments are no longer present at this site.

2.4 Air Sampling and Analysis

Mercury vapor was analyzed during the RFI at 46 locations beneath the intermediate wood flooring of Building 79. Seven vapor samples were collected from beneath the concrete sub-floor of Building 79. Sample locations were determined in the field and were biased in an attempt to identify the worst case situations. Mercury vapor was detected in 29 of 46 samples collected beneath the intermediate wood floor, with concentrations ranging from 0.001 milligrams per cubic meter (mg/m^3) to 0.074 mg/m^3; and in 3 of 7 samples collected from beneath the concrete sub-floor, with concentrations ranging from 0.007 mg/m^3 to 0.061 mg/m^3.

2.5 RFI Human Health Risk Assessment (HHRA)

The RFI report used a fixed-point risk evaluation (FRE) approach at these sites. The FRE included site resident and site worker exposure scenarios. The detailed risk assessment for AOC 590 is presented in Section 10.43.8 and for SWMU 102 in Section 10.14.8 of the RFI report.

2.5.1 Soils

AOC 590. Antimony, chromium, lead, mercury, and BEQs were retained as surface soil COCs for the residential land use scenario. Arsenic and BEQs were identified as surface soil COCs for the industrial land use scenario.

SWMU 102. Arsenic, lead, mercury, and BEQs were retained as surface soil COCs based on exceedances of the screening criteria for the residential land use scenario. Arsenic and BEQs were retained as COCs in surface soil for the industrial land use scenario.

2.5.2 Groundwater

AOC 590. Arsenic was retained as a shallow groundwater COC and beryllium was retained as a deep groundwater COC.

SWMU 102. No COCs were identified for groundwater at the SWMU 102 site.

2.6 RFI Conclusions and Recommendations

The RFI report recommended that a CMS be conducted at AOC 590 for surface soil and shallow and deep groundwater and at SWMU 102 for surface soil to address the analytes identified as COCs in the previous sections.

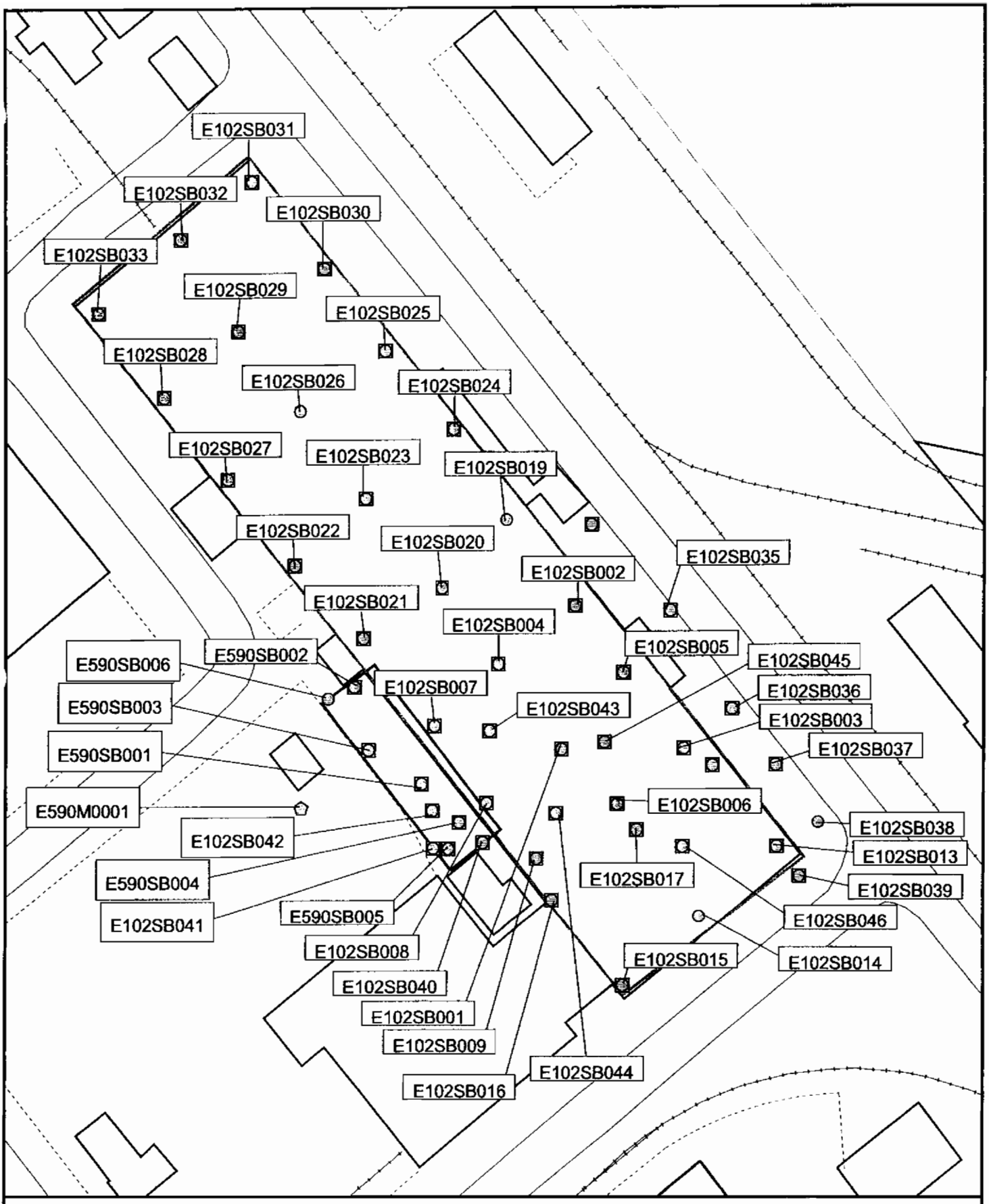

Figure 2-1
RFI Soil and Sediment Sampling Locations
SWMU 102 and AOC 590, Zone E
Charleston Naval Complex

CH2MHILL

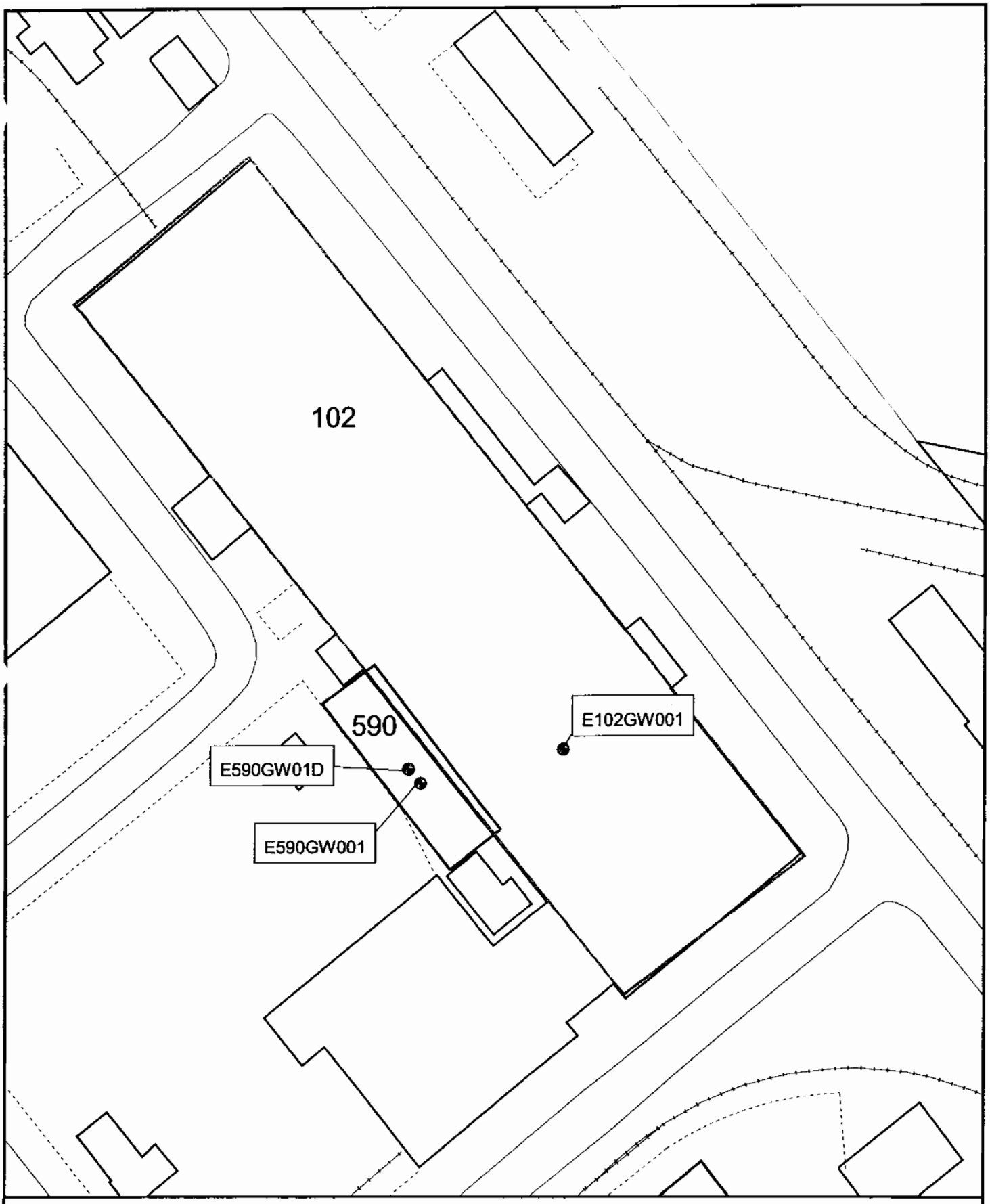

Figure 2-2
RFI Groundwater Sample Locations
SWMU 102 and AOC 590, Zone E
Charleston Naval Complex

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Section 3.0

3.0 Summary of Interim Measures and UST/AST Removals at AOC 590 and SWMU 102

3.1 UST/AST Removals

According to the Environmental Baseline Survey (EnSafe, 1996), an underground storage tank (UST) of unknown capacity associated with Building 79 was removed during 1986. This tank was reportedly used to store wastewater from a laundry where contaminated clothing was washed. No additional information confirming the UST's capacity or removal has been found at the time of writing this report.

3.2 Interim Measures

In 1998, the DET conducted an IM to remove sediments present in the storm drains and associated piping at the CNC. As a result, the sediments that were present in the storm drain catch basin at AOC 590 are no longer present at this site.

The IM activities are documented in the *Interim Measure Completion Report for AOC 699 Storm Drain Cleaning* (DET, 1999). Copies of Figures 4 and 4A from the DET report are included in Appendix G and show the location of the storm drain at AOC 590 which underwent cleaning as part of this IM.

Section 4.0

4.0 Summary of Additional Investigations

This section summarizes the results and conclusions from the additional soil investigation conducted at SWMU 102 and AOC 590 by CH2M-Jones during August 2002 to further delineate the nature and extent of antimony, lead, mercury, and BEQs in surface soil and lead and mercury in subsurface soil.

A sampling and analysis plan (SAP) for SWMU 102 and AOC 590 was prepared by CH2M-Jones and submitted to SCDHEC. The soil sampling was conducted during August 2002. Copies of analytical results and data validation summaries are included in Appendix D and E, respectively, of this report.

4.1 Soil Sampling and Analysis

Ten RFI soil boring locations, which showed elevated antimony, lead, mercury, and BEQ concentrations in soil, were resampled during August 2002 to verify these elevated concentrations. In addition, 14 new soil samples were collected to further delineate BEQs, antimony, lead, and mercury. At these sampling locations, surface and subsurface samples were collected from the 0 to 1 ft bls and the 3 to 5 ft bls depth interval. Figures 4-1 shows RFI sampling locations and Figure 4-2 shows August 2002 soil sampling locations.

4.1.1 Surface Soil

Surface soil detections of inorganic compounds were evaluated against the EPA Region III residential and industrial RBCs (HI = 0.1 for noncarcinogens) and the range of Zone E background concentrations from grid samples. Surface soil detections of SVOCs were evaluated against the EPA Region III residential and industrial RBCs (HI = 0.1 for noncarcinogens). BEQs were evaluated against the CNC BEQ sitewide reference concentration for surface soil of 1,304 μg/kg. Surface soil detections of lead were also compared with the EPA target cleanup goal for industrial use of 1,218 mg/kg, based on the EPA's Adult Lead Methodology (ALM). A technical memorandum describing the ALM was approved by the BCT.

Detected concentrations of analytes from surface soil samples exceeding their respective COPC screening criteria are as follows:

SVOCs:

- BEQs at concentrations of 2,657 µg/kg and 2,804 µg/kg at locations E102SB063 and E102SB069, respectively, exceeded both the benzo(a)pyrene residential RBC of 88 µg/kg, the benzo(a)pyrene industrial RBC of 780 µg/kg, and the CNC surface soil BEQ sitewide reference concentration of 1,304 µg/kg.

Inorganics:

- Lead at concentrations of 920 mg/kg, 1,400 mg/kg, and 1,710 mg/kg at locations E102SB064, E102SB060, and E102SB053, respectively, exceeded the EPA target cleanup goal for unrestricted land use of 400 mg/kg and the maximum Zone E surface soil background concentration for lead of 400 mg/kg. Two of these values exceeded the ALM target cleanup goal for industrial land use of 1,218 mg/kg.
- Mercury at concentrations ranging from 2.55 mg/kg to 57.8 mg/kg at eight locations exceeded both the mercury residential RBC of 2.3 mg/kg and the maximum Zone E surface soil background concentration for mercury of 2.7 mg/kg, but were below the industrial RBC (HI = 0.1) of 61 mg/kg.

Surface soil detections from the August 2002 sampling event are shown in Table 4-1.

4.1.2 Subsurface Soil

Subsurface soil detections were compared with generic soil screening levels (SSLs) (using a dilution attenuation factor [DAF]=10). Subsurface soil detections of inorganic compounds were also compared with the range of concentrations in Zone E grid samples.

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

Inorganics:

- Lead at concentrations of 1,320 mg/kg and 2,150 mg/kg at locations E102SB050 and E102SB053 exceeded both its SSL of 400 mg/kg and the maximum Zone E subsurface soil background concentration for lead of 322 mg/kg.
- Mercury at concentrations ranging from 1.01 mg/kg to 47.7 mg/kg at 11 locations exceeded both its SSL of 1 mg/kg and the maximum Zone E subsurface soil background concentration for mercury of 0.90 mg/kg.

Subsurface soil detections from the August 2002 sampling event are shown in Table 4-1.

4.2 COPC Summary

Based on a comparison with COPC screening criteria adopted by the CNC BCT, the following COPCs have been identified from the analytical results of the August 2002 soil sampling effort:

Surface Soil:

- For the unrestricted land use scenario: BEQs, lead, and mercury.
- For the industrial land use scenario: BEQs.

Subsurface Soil: For the unrestricted and industrial land use scenario, lead and mercury, based on exceedances of SSL and maximum Zone E background concentrations.

TABLE 4-1
Detected Concentrations of Antimony, Lead, Mercury, and BEQs in Soil, August 2002
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result	Qualifier	Date Collected	EPA Region III Resid. RBC	EPA Region III Indust. RBC	SSL	Zone E Bkgd. Range of Conc.
Antimony	**Surface Soil**		**(mg/kg)**			3.1	82	2.5	0.50 – 7.4
	E102SB055	102SB05501	0.744	J	08/13/2002				
	E102SB070	102SB07001	0.509	U	08/21/2002				
Lead	**Surface Soil**		**(mg/kg)**			400	1,218*	400	1 – 400
	E102SB048	102SB04801	147	=	08/13/2002				
	E102SB049	102SB04901	63.2	=	08/13/2002				
	E102SB050	102SB05001	4.39	=	08/13/2002				
	E102SB051	102SB05101	7.47	=	08/13/2002				
	E102SB052	102SB05201	195	=	08/13/2002				
	E102SB053	102SB05301	**1,710**	=	08/13/2002				
	E102SB054	102SB05401	264	=	08/13/2002				
	E102SB055	102SB05501	334	=	08/13/2002				
	E102SB060	102SB06001	**1,400**	J	08/13/2002				
	E102SB061	102SB06101	51.6	J	08/13/2002				
	E102SB064	102SB06401	**920**	J	08/13/2002				
	E102SB070	102SB07001	4.18	=	08/21/2002				
	Subsurface Soil		**(mg/kg)**			NA	NA	400	1.8 – 322
	E102SB050	102SB05002	**1,320**	=	08/13/2002				
	E102SB051	102SB05102	330	=	08/13/2002				
	E102SB052	102SB05202	4.61	=	08/13/2002				
	E102SB053	102SB05302	**2,150**	=	08/13/2002				
	E102SB060	102SB06002	18.2	J	08/13/2002				
	E102SB061	102SB06102	33.3	J	08/13/2002				
Mercury	**Surface Soil**		**(mg/kg)**			2.3	61	1	0.03 – 2.7
	E102SB047	102SB04701	0.047	J	08/13/2002				
	E102SB049	102SB04901	0.27	=	08/13/2002				
	E102SB050	102SB05001	0.03	J	08/13/2002				
	E102SB051	102SB05101	0.934	=	08/13/2002				
	E102SB052	102SB05201	1.24	=	08/13/2002				
	E102SB056	102SB05601	**2.55**	=	08/13/2002				
	E102SB057	102SB05701	0.938	=	08/13/2002				
	E102SB058	102SB05801	1.87	=	08/13/2002				
	E102SB059	102SB05901	**57.8**	=	08/13/2002				
	E102SB060	102SB06001	**35.3**	=	08/13/2002				
	E102SB061	102SB06101	0.14	=	08/13/2002				
	E102SB062	102SB06201	0.689	=	08/13/2002				
	E102SB065	102SB06501	**15.9**	=	08/14/2002				
	E102SB066	102SB06601	**46.8**	=	08/14/2002				
	E102SB067	102SB06701	**11.9**	J	08/14/2002				
	E102SB068	102SB06801	**7.62**	J	08/14/2002				
	E102SB069	102SB06901	**34**	=	08/14/2002				

TABLE 4-1
Detected Concentrations of Antimony, Lead, Mercury, and BEQs in Soil, August 2002
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result	Qualifier	Date Collected	EPA Region III Resid. RBC	EPA Region III Indust. RBC	SSL	Zone E Bkgd. Range of Conc.
Mercury	**Subsurface Soil**		**(mg/kg)**			NA	NA	1	0.04 – 0.90
	E102SB047	102SB04702	0.739	=	08/13/2002				
	E102SB049	102SB04902	0.047	J	08/13/2002				
	E102SB050	102SB05002	**7.7**	=	08/13/2002				
	E102SB051	102SB05102	**1.01**	=	08/13/2002				
	E102SB052	102SB05202	0.072	J	08/13/2002				
	E102SB058	102SB05802	**2.22**	=	08/13/2002				
	E102SB059	102SB05902	**18.1**	=	08/13/2002				
	E102SB060	102SB06002	**3.54**	J	08/13/2002				
	E102SB061	102SB06102	0.034	J	08/13/2002				
	E102SB062	102SB06202	**1.44**	=	08/13/2002				
	E102SB065	102SB06502	**40.4**	=	08/14/2002				
	E102SB066	102SB06602	**10.2**	J	08/14/2002				
	E102SB067	102SB06702	**12.6**	J	08/14/2002				
	E102SB068	102SB06802	**10.8**	J	08/14/2002				
	E102SB069	102SB06902	**47.7**	=	08/14/2002				
BEQs	**Surface Soil**		**(µg/kg)**			88	780	NA	1,304
	E102SB057	102SB05701	414	=	08/13/2002				
	E102SB063	102SB06301	**2,657**	=	08/13/2002				
	E102SB066	102SB06601	374	=	08/14/2002				
	E102SB069	102SB06901	**2,804**	=	08/14/2002				

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

* EPA target cleanup goal for industrial land use based on the Adult Lead Methodology (CH2M-Jones, 2001a).

a SSLs with DAF=10.

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

U Indicates that the concentration was not detected.

NA Screening criteria not available for the referenced compound.

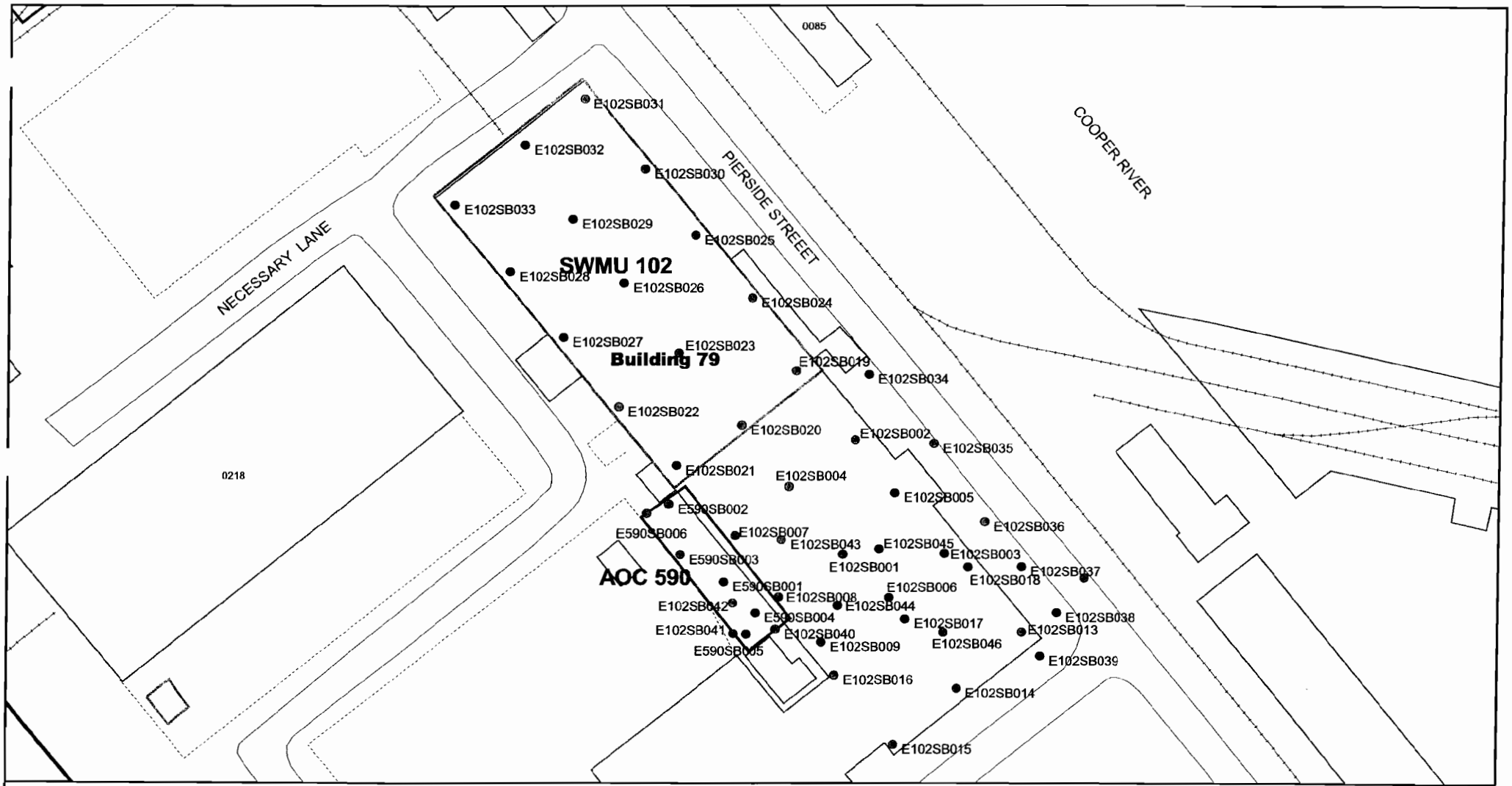

Figure 4-1
RFI Soil Sampling Locations
AOC 590 and SWMU 102, Zone E
Charleston Naval Complex

File Path: c:\18gis\cncfstatbasis.apr, Date: 15 Jan 2003 13:50, User: SNAIK1

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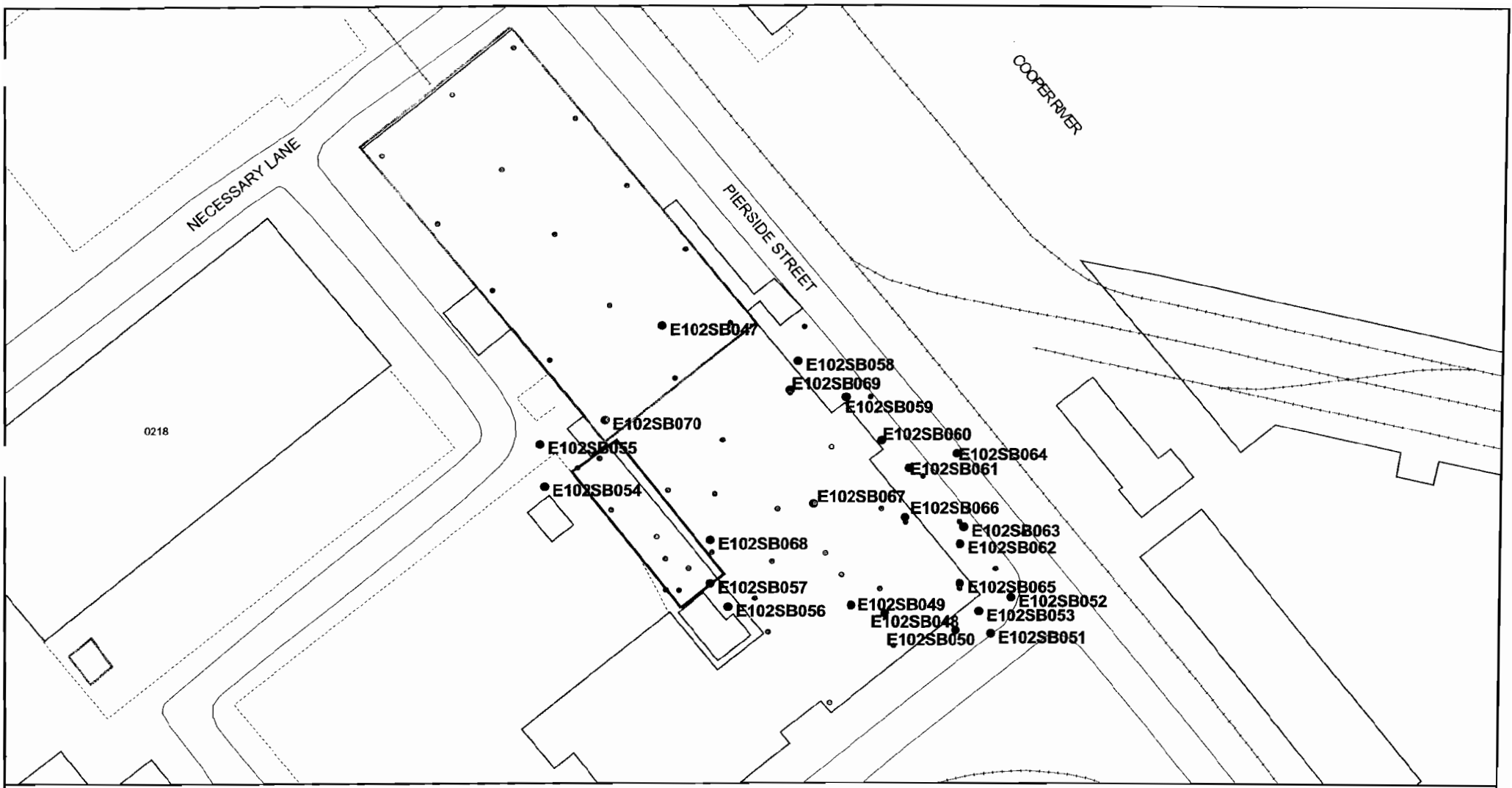

Figure 4-2
August 2002 Soil Sampling Locations
AOC 590 and SWMU 102, Zone E
Charleston Naval Complex

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Section 5.0

5.0 COPC/COC Refinement

For SWMU 102 and AOC 590, the *Zone E RFI Report, Revision 0* (EnSafe, 1997) identified antimony, arsenic, chromium, lead, mercury, and BEQs in surface soil as COCs for the unrestricted (i.e., residential) land use scenario; arsenic and BEQs in surface soil as COCs for the industrial land use scenario; arsenic as a shallow groundwater COC; and beryllium as a deep groundwater COC.

The additional soil sampling and analyses described in Section 4.0 identified the following COCs:

- **Surface soil** - BEQs, lead, and mercury for the unrestricted land use scenario and BEQs for the industrial land use scenario.
- **Subsurface soil** - Lead and mercury for the unrestricted and industrial land use scenario.

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

The nature of occurrence and the relevance of these chemicals at these sites are further discussed below.

5.1 Soil VOC Screening using SSL at DAF=1

VOCs acetone, carbon disulfide, methyl ethyl ketone, toluene, and xylenes (total) were detected in soil samples at SWMU 102 and AOC 590. Tables 5-2 and 5-3 summarize the detections of VOCs in SWMU 102 and AOC 590 samples for surface and subsurface soil, respectively.

No VOC analytes were detected above their respective generic SSLs (DAF=1) in soil.

5.2 COCs in Soil

5.2.1 Antimony

During the initial RFI, antimony was detected in 18 of the 28 surface soil samples collected from SWMU 102 and AOC 590, with concentrations ranging from 0.54 mg/kg to

11.6 mg/kg. Only one detection, at a concentration of 11.6 mg/kg at E590SB002, exceeded the residential RBC of 3.1 mg/kg (with a HI=0.1) and the Zone E maximum background surface soil antimony concentration of 7.4 mg/kg, but was below the industrial RBC of 82 mg/kg (with a HI = 0.1). There were no other exceedances in surface soil samples of the COPC screening criteria.

During the August 2002 sampling event, two surface soil samples were collected northwest of location E590SB002. Both samples had antimony detections that were below the residential RBC, as shown in Table 5-1.

A UCL_{95} exposure point concentration (EPC) of 2.24 mg/kg was calculated for surface soil antimony concentrations. This value is below the residential RBC of 3.1 (HI = 0.1). The UCL_{95} EPC calculations are included in Appendix G.

One detection of antimony in the subsurface soil sample from E102SB036 at 10.3 mg/kg exceeded the SSL for antimony of 2.5 mg/kg. The site average subsurface antimony concentration was calculated to be 1.44 mg/kg, which is below the SSL of 2.5 mg/kg. Additionally, antimony was not detected in groundwater above its MCL during four RFI sampling events. For this reason, it is not a leachability concern at these sites. Based on these observations, antimony is not considered a COC for soil at SWMU 102 and AOC 590 under either the unrestricted or industrial land use scenario.

5.2.2 Arsenic

Arsenic was detected in all 28 surface soil samples collected from SWMU 102 and AOC 590, with concentrations ranging from 2.6 mg/kg to 27.8 mg/kg. All of these values exceed the EPA region III residential RBC of 0.43 mg/kg (with a HI = 1.0). Arsenic concentrations in 26 samples were equal to or greater than the industrial RBC of 3.8 mg/kg (with a HI = 1.0). However, none of the samples had an arsenic concentration that exceeded the Zone E maximum background surface soil arsenic concentration of 68 mg/kg. Table 5-1 lists detected arsenic concentrations in surface soil.

A UCL_{95} EPC of 14.8 mg/kg was calculated for surface soil arsenic concentrations.

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

For sites where background arsenic levels exceed RBCs, EPA Region IV typically considers arsenic concentrations in surface soil of up to 20 mg/kg and 270 mg/kg for unrestricted and industrial land use, respectively, as acceptable (EPA, 2001). Based on these criteria and the

UCL_{95} exposure concentration estimate of 14.8 mg/kg for surface soil samples from these sites, arsenic in surface soil would not be considered a COC for SWMU 102 and AOC 590 under either the unrestricted or industrial land use scenario.

Arsenic concentrations in several subsurface soil samples exceed the generic SSL(with a DAF=10) of 14.5 mg/kg, as shown in Table 5-1. Arsenic concentrations in three subsurface soil samples—E102SB036 at 64.1 mg/kg, E102SB07 at 38.3 mg/kg, and E102SB041 at 47 mg/kg—exceed the maximum Zone E subsurface soil arsenic concentration of 26 mg/kg. The site average subsurface soil concentration for arsenic was calculated from the RFI soil sampling results shown in Table 5-1, to be 18.43 mg/kg. This value exceeds the SSL of 14.5 mg/kg.

However, arsenic was not detected in groundwater above its MCL during four RFI sampling events, indicating that it is not a leaching concern. For this reason, it is not a leachability concern at these sites. Based on these observations, arsenic is not considered a COC for subsurface soil at SWMU 102 and AOC 590.

5.2.3 Chromium

Chromium was detected in all 28 surface soil samples collected from SWMU 102 and AOC 590, with concentrations ranging from 4.5 mg/kg to 140 mg/kg. Thirteen of these values exceed the EPA region III residential RBC of 23 mg/kg (with a HI = 0.1). However, none of the samples had a chromium concentration that exceeded the industrial RBC of 610 mg/kg (with a HI = 0.1) or the Zone E maximum background surface soil chromium concentration of 567 mg/kg. Table 5-1 lists detected chromium concentrations in surface soil.

No subsurface soil samples collected from SWMU 102 and AOC 590 had detections that exceed the Zone E maximum background subsurface soil chromium concentration of 75 mg/kg. The site average subsurface soil chromium concentration was calculated to be 30.44 mg/kg, which is above the SSL of 19 mg/kg, but below the Zone E maximum background subsurface soil chromium concentration of 75 mg/kg. Table 5-1 lists detected chromium concentrations in subsurface soil.

Chromium was not detected in groundwater above its MCL during four RFI sampling events. For this reason, it does not appear to be a leachability concern at these sites. Based on these observations, chromium is not considered a COC for soil at SWMU 102 and AOC 590 under either the unrestricted or industrial land use scenario.

5.2.4 Lead

Lead was detected in all 28 surface soil samples collected from SWMU 102 and AOC 590, with concentrations ranging from 5.7 mg/kg to 1,710 mg/kg. Seven of these values exceed the EPA target cleanup goal of 400 mg/kg for unrestricted land use and the Zone E maximum background surface soil lead concentration of 400 mg/kg. None of the samples had lead concentrations that exceeded the EPA target cleanup goal for industrial use of 1,880 mg/kg. Table 5-1 lists detected lead concentrations in surface soil.

Three subsurface soil samples collected from SWMU 102 and AOC 590 had detections ranging from 809 mg/kg to 9,930 mg/kg, which exceed the SSL of 400 mg/kg and the Zone E maximum background subsurface soil lead concentration of 322 mg/kg.

A site average of 196 mg/kg was calculated for surface soil lead detections from the RFI soil sampling events, which are shown in Table 5-1. This value is below the EPA target cleanup goal of 400 mg/kg for unrestricted land use.

A site average of 617 mg/kg was calculated for subsurface soil lead detections from the RFI soil sampling events, shown in Table 5-1. This value exceeds the SSL for lead of 400 mg/kg and the Zone E maximum background subsurface soil lead concentration of 322 mg/kg. A site-specific SSL was estimated based on previous Synthetic Precipitation Leaching Procedure (SPLP) leaching analyses for lead- impacted soil samples at the CNC from sites with lead-impacted soil that, like AOC 590 and SWMU 102, were not impacted by lead acid battery handling. Based on site-specific SSLs from these sites, an SSL value of 1,427 mg/kg was selected as representative of site conditions at AOC 590 and SWMU 102. The site average subsurface soil lead concentration of 617 mg/kg is below this SSL.

Lead was not detected in groundwater above its MCL during four RFI sampling events. For this reason, it is does not appear to be a leachability concern at these sites.

Based on these observations, lead is not considered a COC in soil at SWMU 102 and AOC 590.

5.2.5 Mercury

During the initial RFI sampling, mercury was detected in 42 of the 49 surface soil samples collected from SWMU 102 and AOC 590, with concentrations ranging from 0.05 mg/kg to 27.3 mg/kg. Twelve soil samples had mercury concentrations that exceeded the residential RBC of 2.3 mg/kg (with a HI = 0.1) and the maximum Zone E surface soil background concentration of 2.7 mg/kg. None of the detections exceed the industrial RBC for mercury of 61 mg/kg (with a HI = 0.1).

In subsurface soil samples collected during the initial RFI, mercury was detected in 40 of 44 subsurface soil samples, with concentrations ranging from 0.7 mg/kg to 11.7 mg/kg. Thirteen subsurface soil samples had mercury concentrations that exceeded the SSL of 1 mg/kg and the maximum Zone E subsurface soil mercury concentration of 0.90 mg/kg.

During the August 2002 soil sampling event, 17 surface soil and 15 subsurface soil samples were collected and analyzed for mercury. Mercury was detected in all 17 surface soil samples analyzed for mercury, at concentrations ranging from 0.14 mg/kg to 57.8 mg/kg. Detections in eight of these surface soil samples exceed the residential RBC. None of the detections exceed the industrial RBC of 61 mg/kg. Mercury was detected in all 15 subsurface soil samples, at concentrations ranging from 0.034 mg/kg to 47.7 mg/kg. Detections in 11 of these subsurface soil samples exceed the SSL for mercury of 1.0 mg/kg. Table 5-1 lists detected mercury concentrations in surface and subsurface soils.

A UCL_{95} EPC of 7.2 mg/kg was calculated for mercury in surface soil at this combined site, as shown in Appendix G. This value exceeds the residential RBC of 2.3 mg/kg (HI = 0.1), but not the industrial RBC of 61 mg/kg (HI = 0.1). Additionally, none of the individual detections of mercury in surface soil exceed the industrial RBC (HI = 0.1).

Because mercury is the only non-carcinogenic surface soil COPC (other than lead, for which a separate risk evaluation process is used), comparison of the EPC to the residential RBC based on an HI = 1.0 is appropriate. The EPC of 7.2 mg/kg is well below the residential RBC of 23 mg/kg (HI = 1.0). On this basis, mercury would not be considered a surface soil COC from a direct exposure pathway.

Using mercury concentrations detected during the initial RFI and the August 2002 delineation sampling (shown in Table 5-1), the mean mercury concentration in surface soil was calculated to be 5.9 mg/kg, which exceeds the SSL of 1 mg/kg (DAF = 10). The average subsurface soil concentration of mercury using the detections from the initial RFI and the August 2002 delineation sampling, was calculated to be 3.73 mg/kg, which also exceeds the SSL (DAF=10) for mercury of 1.0 mg/kg. Site-specific SSLs for mercury were calculated as shown in Table 5-5 and are 0.63 mg/kg for the paved scenario and 0.17 mg/kg for the unpaved scenario. The statistical parameters used in the calculation of the arithmetic mean of the subsurface soil mercury concentrations is included in Appendix G of the report.

Mercury is a volatile metal, and volatilization to ambient and indoor air is a potentially complete exposure pathway for future industrial land use, should the existing flooring in the building and pavement at the site be disturbed. Based on EPA's guidance on SSLs (EPA, 2001), the soil concentrations protective of indoor air for unrestricted (i.e., residential)

land use is up to 10 mg/kg. Although the maximum individual mercury concentration in surface soil is above 10 mg/kg, the UCL_{95} estimate of 7.2 mg/kg is below this residential RBC for air. In localized areas, mercury concentrations in soil exceed this RBC for the soil-to-air exposure pathway of 10 mg/kg for the unrestricted land use scenario. As a conservative measure, mercury will be included as a surface and subsurface soil COC for the leaching and inhalation exposure pathway and this exposure concern will be addressed in the CMS.

Mercury was detected in only 1 of 10 groundwater samples during four RFI sampling events. This detection, at a concentration of 0.1 µg/L, was below the MCL of 2 µg/L, indicating that mercury does not appear to be a leaching concern. However, based on exceedances of the SSLs in surface and subsurface soil samples, mercury is considered a COC in surface and subsurface soil at SWMU 102 and AOC 590.

5.2.6 BEQs

Table 5-1 lists detected BEQ concentrations in surface and subsurface soils from the RFI sampling. During the RFI, BEQ concentrations in surface soil exceeded the CNC BEQ surface soil sitewide reference concentration of 1,304 µg/kg at 10 locations, with concentrations ranging from 1,410 µg/kg to 17,501 µg/kg. During the August 2002 soil sampling event, BEQ concentrations at two locations, E102 SB063 (at 2,657 µg/kg) and E102SB069 (at 2,804 µg/kg), exceeded the CNC surface soil BEQ sitewide reference concentration of 1,304 µg/kg.

During the RFI, BEQs were detected in the subsurface soil above the CNC subsurface BEQ BRC of 1,400 µg/kg at five locations, with concentrations ranging from 1,502 µg/kg to 2,743 µg/kg, as shown in Table 5-1.

In both surface and subsurface soil samples, detected concentrations of the seven individual carcinogenic polyaromatic hydrocarbons (cPAHs) that are included in the calculated BEQ concentrations, did not exceed their respective SSLs. Additionally, BEQ compounds were not detected above laboratory detection limits in the wells adjacent to the soil sample locations that showed the highest BEQ detections. This indicates that the BEQs in soils do not pose a threat to groundwater via leaching. Based on these observations, BEQs are not considered a subsurface soil COC at SWMU 102 and AOC 590.

The presence of BEQs at these sites could also be attributed to the historical and current presence of railroad lines at the site. Figure C-1 includes a copy of the Public Works Map of the Charleston Naval Base dated November 3, 1955 which shows the presence of railroad lines entering Building 79 and running along the eastern side of Building 79.

Because the BEQ exceedances in soil are beneath pavement, they do not currently present a direct exposure concern. However, in the future, should site conditions change, potential exposure to BEQs in soil could be a concern. Based on exceedances in surface soil of the CNC BEQ surface soil sitewide reference concentration of 1,304 µg/kg, BEQs are considered a surface soil COC at SWMU 102 and AOC 590 under the unrestricted and industrial land use scenarios.

5.3 COCs in Groundwater

5.3.1 Arsenic

The RFI report considered arsenic to be a COC at AOC 590 based on its detection in one shallow groundwater sample, E590GW001, at a concentration of 19.9 µg/L, which exceeded the tap water RBC of 0.045 µg/L. However, this detection and arsenic detections during subsequent groundwater sampling events were below the South Carolina MCL of 50 µg/L and the maximum shallow background concentration of 316 µg/L, as shown in Table 5-4. Based on these observations, arsenic is not considered a shallow groundwater COC for AOC 590.

5.3.2 Beryllium

The RFI report considered beryllium to be a COC at AOC 590, based on its detection in one deep groundwater sample, E590GW01D, at a concentration of 1.3 µg/L, which exceeded both the tap water RBC and the maximum Zone E shallow groundwater background concentration for beryllium of 0.85 µg/L. However, the detection did not exceed the current MCL for beryllium of 4.0 µg/L, as shown in Table 5-4. Beryllium detections during subsequent groundwater sampling events were also below the MCL. Based on these observations, beryllium is not a groundwater COC for AOC 590.

5.4 COC Summary

COCs in surface soil identified for SWMU 102 and AOC 590 are BEQs and mercury for the unrestricted land use scenario and BEQs for the industrial land use scenario. Mercury is the only COC for subsurface soil. Mercury is identified as a soil COC for the potential leaching and inhalation exposure pathways. No other COCs for any media or land use scenario have been identified at SWMU 102 and AOC 590. These COCs in soil will be addressed in a focused CMS. Section 8.0 of this report includes a CMS Work Plan.

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TABLE 5-1

Detected Concentrations of Antimony, Arsenic, Chromium, Lead, Mercury, and BEQs in Soil
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result	Qualif.	Date Collected	EPA Region III Residential RBC	EPA Region III Industrial RBC	SSL	Zone E Range of Backgd. Conc.
Antimony	**Surface Soil**		**(mg/kg)**			3.1	82	2.5	0.50 – 7.4
	E102SB001	102SB00101	1.20	J	01/31/1996				
	E102SB002	102SB00201	1.60	J	02/01/1996				
	E102SB003	102SB00301	0.76	J	02/01/1996				
	E102SB004	102SB00401	0.81	J	01/31/1996				
	E102SB005	102SB00501	0.60	J	02/01/1996				
	E102SB006	102SB00601	0.50	UJ	01/31/1996				
	E102SB007	102SB00701	0.46	UJ	02/01/1996				
	E102SB008	102SB00801	0.93	J	01/31/1996				
	E102SB009	102SB00901	0.66	J	01/31/1996				
	E102SB034	102SB03401a	9.00	J	05/17/1996				
	E102SB035	102SB03501a	0.46	UJ	05/17/1996				
	E102SB036	102SB03601b	2.80	UJ	05/17/1996				
	E102SB037	102SB03701a	5.00	UJ	05/17/1996				
	E102SB038	102SB03801	2.40	UJ	05/17/1996				
	E102SB039	102SB03901	1.80	UJ	05/17/1996				
	E102SB040	102SB04001	1.50	UJ	05/20/1996				
	E102SB041	102SB04101a	0.59	UJ	05/20/1996				
	E102SB042	102SB04201	0.96	UJ	05/20/1996				
	E102SB043	102SB04301	1.00	J	05/21/1996				
	E102SB044	102SB04401	1.10	J	05/21/1996				
	E102SB045	102SB04501	1.00	J	05/21/1996				
	E102SB046	102SB04601	1.90	J	06/04/1996				
	E590SB001	590SB00101	0.63	J	01/04/1996				
	E590SB002	590SB00201	**11.60**	=	01/05/1996				
	E590SB003	590SB00301	0.73	J	01/05/1996				
	E590SB004	590SB00401	0.65	J	01/05/1996				
	E590SB005	590SB00501	0.54	J	01/05/1996				
	E590SB006	590SB00601	2.30	J	09/16/1996				
	E102SB055	102SB05501	0.744	J	08/13/2002				
	E102SB070	102SB07001	0.509	U	08/21/2002				
Antimony	**Subsurface Soil**		**(mg/kg)**			NA	NA	2.5	0.52 – 1.6
	E102SB001	102SB00102	0.90	J	01/31/1996				
	E102SB002	102SB00202	0.57	UJ	02/01/1996				
	E102SB003	102SB00302	1.50	J	02/01/1996				
	E102SB004	102SB00402	0.74	J	01/31/1996				
	E102SB005	102SB00502	1.00	J	02/01/1996				
	E102SB006	102SB00602	1.10	J	01/31/1996				
	E102SB007	102SB00702	1.10	J	02/01/1996				
	E102SB008	102SB00802	1.00	J	01/31/1996				

TABLE 5-1

Detected Concentrations of Antimony, Arsenic, Chromium, Lead, Mercury, and BEQs in Soil
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result	Qualif.	Date Collected	EPA Region III Residential RBC	EPA Region III Industrial RBC	SSL	Zone E Range of Backgd. Conc.
	E102SB009	102SB00902	1.00	J	01/31/1996				
	E102SB034	102SB03402	1.50	J	06/03/1996				
	E102SB035	102SB03502	1.00	J	06/03/1996				
	E102SB036	102SB03602	**10.30**	=	06/03/1996				
	E102SB037	102SB03702	2.40	J	06/03/1996				
	E102SB039	102SB03902	3.30	UJ	05/17/1996				
	E102SB040	102SB04002	1.70	UJ	05/20/1996				
	E102SB041	102SB04102a	1.10	UJ	05/20/1996				
	E102SB042	102SB04202	1.80	UJ	05/20/1996				
	E102SB043	102SB04302	1.50	J	05/21/1996				
	E102SB044	102SB04402	1.30	J	05/21/1996				
	E102SB045	102SB04502	0.94	J	05/21/1996				
	E102SB046	102SB04602	0.51	U	06/04/1996				
	E590SB001	590SB00102	0.89	UJ	01/04/1996				
	E590SB002	590SB00202	1.20	J	01/05/1996				
	E590SB003	590SB00302	1.40	J	01/05/1996				
	E590SB004	590SB00402	1.20	J	01/05/1996				
	E590SB005	590SB00502	1.40	J	01/05/1996				
Antimony	**Average Subsurface Soil Conc.**		**1.44**						
Arsenic	**Surface Soil**		**(mg/kg)**			0.43	3.8	14.5	0.95 – 68
	E102SB001	102SB00101	9.90	=	01/31/1996				
	E102SB002	102SB00201	14.30	=	02/01/1996				
	E102SB003	102SB00301	12.30	=	02/01/1996				
	E102SB004	102SB00401	8.10	=	01/31/1996				
	E102SB005	102SB00501	9.50	=	02/01/1996				
	E102SB006	102SB00601	6.50	=	01/31/1996				
	E102SB007	102SB00701	3.10	=	02/01/1996				
	E102SB008	102SB00801	13.40	=	01/31/1996				
	E102SB009	102SB00901	8.50	=	01/31/1996				
	E102SB034	102SB03401a	27.80	=	05/17/1996				
	E102SB035	102SB03501a	13.10	=	05/17/1996				
	E102SB036	102SB03601b	25.00	=	05/17/1996				
	E102SB037	102SB03701a	23.50	=	05/17/1996				
	E102SB038	102SB03801	27.20	=	05/17/1996				
	E102SB039	102SB03901	9.40	=	05/17/1996				
	E102SB040	102SB04001	10.60	=	05/20/1996				
	E102SB041	102SB04101a	2.60	J	05/20/1996				
	E102SB042	102SB04201	7.10	=	05/20/1996				
	E102SB043	102SB04301	9.00	=	05/21/1996				
	E102SB044	102SB04401	9.20	=	05/21/1996				
	E102SB045	102SB04501	10.60	=	05/21/1996				

TABLE 5-1

Detected Concentrations of Antimony, Arsenic, Chromium, Lead, Mercury, and BEQs in Soil
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result	Qualif.	Date Collected	EPA Region III Residential RBC	EPA Region III Industrial RBC	SSL	Zone E Range of Backgd. Conc.
	E102SB046	102SB04601	9.40	=	06/04/1996				
	E590SB001	590SB00101	6.20	=	01/04/1996				
	E590SB002	590SB00201	8.90	=	01/05/1996				
	E590SB003	590SB00301	10.50	=	01/05/1996				
	E590SB004	590SB00401	5.20	=	01/05/1996				
	E590SB005	590SB00501	4.00	=	01/05/1996				
	E590SB006	590SB00601	21.50	=	09/16/1996				
Arsenic	**Subsurface Soil**		**(mg/kg)**			NA	NA	14.5	0.83 – 26
	E102SB001	102SB00102	**19.80**	=	01/31/1996				
	E102SB002	102SB00202	7.80	=	02/01/1996				
	E102SB003	102SB00302	**19.00**	=	02/01/1996				
	E102SB004	102SB00402	13.90	=	01/31/1996				
	E102SB005	102SB00502	11.80	=	02/01/1996				
	E102SB006	102SB00602	11.50	=	01/31/1996				
	E102SB007	102SB00702	12.90	=	02/01/1996				
	E102SB008	102SB00802	**22.20**	=	01/31/1996				
	E102SB009	102SB00902	**23.60**	=	01/31/1996				
	E102SB034	102SB03402	6.80	=	06/03/1996				
	E102SB035	102SB03502	8.20	=	06/03/1996				
	E102SB036	102SB03602	**64.10**	=	06/03/1996				
	E102SB037	102SB03702	**38.30**	=	06/03/1996				
	E102SB039	102SB03902	12.10	=	05/17/1996				
	E102SB040	102SB04002	**23.00**	=	05/20/1996				
	E102SB041	102SB04102a	**47.00**	=	05/20/1996				
	E102SB042	102SB04202	**18.90**	=	05/20/1996				
	E102SB043	102SB04302	9.40	=	05/21/1996				
	E102SB044	102SB04402	10.10	=	05/21/1996				
	E102SB045	102SB04502	10.70	=	05/21/1996				
	E102SB046	102SB04602	3.20	=	06/04/1996				
	E590SB001	590SB00102	13.40	=	01/04/1996				
	E590SB002	590SB00202	13.20	=	01/05/1996				
	E590SB003	590SB00302	**21.40**	=	01/05/1996				
	E590SB004	590SB00402	**14.80**	=	01/05/1996				
	E590SB005	590SB00502	**22.00**	=	01/05/1996				
Arsenic	**Average Subsurface Soil Conc.**		**18.43**						
Chromium	**Surface Soil**		**(mg/kg)**			23	610	19	2.3 – 567
	E102SB001	102SB00101	19.00	=	01/31/1996				
	E102SB002	102SB00201	**26.30**	=	02/01/1996				
	E102SB003	102SB00301	21.40	=	02/01/1996				
	E102SB004	102SB00401	18.60	=	01/31/1996				

TABLE 5-1

Detected Concentrations of Antimony, Arsenic, Chromium, Lead, Mercury, and BEQs in Soil
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result	Qualif.	Date Collected	EPA Region III Residential RBC	EPA Region III Industrial RBC	SSL	Zone E Range of Backgd. Conc.
	E102SB005	102SB00501	18.00	=	02/01/1996				
	E102SB006	102SB00601	14.80	=	01/31/1996				
	E102SB007	102SB00701	6.60	=	02/01/1996	23		19	2.3 — 567
	E102SB008	102SB00801	**29.30**	=	01/31/1996				
	E102SB009	102SB00901	22.70	=	01/31/1996				
	E102SB034	102SB03401a	**34.60**	=	05/17/1996				
	E102SB035	102SB03501a	4.50	=	05/17/1996				
	E102SB036	102SB03601b	**23.90**	=	05/17/1996				
	E102SB037	102SB03701a	21.90	=	05/17/1996				
	E102SB038	102SB03801	20.20	=	05/17/1996				
	E102SB039	102SB03901	14.30	=	05/17/1996				
	E102SB040	102SB04001	**140.00**	=	05/20/1996				
	E102SB041	102SB04101a	**97.00**	J	05/20/1996				
	E102SB042	102SB04201	**90.10**	=	05/20/1996				
	E102SB043	102SB04301	**24.40**	J	05/21/1996				
	E102SB044	102SB04401	22.50	J	05/21/1996				
	E102SB045	102SB04501	17.90	J	05/21/1996				
	E102SB046	102SB04601	**25.40**	=	06/04/1996				
	E590SB001	590SB00101	17.10	=	01/04/1996				
	E590SB002	590SB00201	21.50	=	01/05/1996				
	E590SB003	590SB00301	**73.10**	=	01/05/1996				
	E590SB004	590SB00401	**31.10**	=	01/05/1996				
	E590SB005	590SB00501	**79.10**	=	01/05/1996				
	E590SB006	590SB00601	**91.20**	=	09/16/1996				
Chromium	**Subsurface Soil**		**(mg/kg)**			NA	NA	19	1.6 — 75
	E102SB001	102SB00102	37.30	=	01/31/1996				
	E102SB002	102SB00202	20.50	=	02/01/1996				
	E102SB003	102SB00302	27.80	=	02/01/1996				
	E102SB004	102SB00402	28.40	=	01/31/1996				
	E102SB005	102SB00502	22.10	=	02/01/1996				
	E102SB006	102SB00602	30.40	=	01/31/1996				
	E102SB007	102SB00702	27.00	=	02/01/1996				
	E102SB008	102SB00802	46.30	=	01/31/1996				
	E102SB009	102SB00902	48.50	=	01/31/1996				
	E102SB034	102SB03402	9.90	=	06/03/1996				
	E102SB035	102SB03502	3.10	=	06/03/1996				
	E102SB036	102SB03602	22.50	=	06/03/1996				
	E102SB037	102SB03702	3.50	=	06/03/1996				
	E102SB039	102SB03902	17.70	=	05/17/1996				
	E102SB040	102SB04002	40.20	=	05/20/1996				
	E102SB041	102SB04102a	40.20	=	05/20/1996				
	E102SB042	102SB04202	44.50	=	05/20/1996				

TABLE 5-1

Detected Concentrations of Antimony, Arsenic, Chromium, Lead, Mercury, and BEQs in Soil
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result	Qualif.	Date Collected	EPA Region III Residential RBC	EPA Region III Industrial RBC	SSL	Zone E Range of Backgd. Conc.
	E102SB043	102SB04302	24.80	J	05/21/1996				
	E102SB044	102SB04402	25.80	J	05/21/1996				
	E102SB045	102SB04502	20.60	J	05/21/1996				
	E102SB046	102SB04602	7.40	=	06/04/1996				
	E590SB001	590SB00102	52.20	=	01/04/1996				
	E590SB002	590SB00202	35.70	=	01/05/1996				
	E590SB003	590SB00302	55.40	=	01/05/1996				
	E590SB004	590SB00402	54.30	=	01/05/1996				
	E590SB005	590SB00502	45.30	=	01/05/1996				
Chromium	**Average Subsurface Soil Conc.**		**30.44**						
Lead	**Surface Soil**		**(mg/kg)**			400	1,888*	400	1 – 400
	E102SB001	102SB00101	387.00	J	01/31/1996				
	E102SB002	102SB00201	**434.00**	J	02/01/1996				
	E102SB003	102SB00301	**415.00**	J	02/01/1996				
	E102SB004	102SB00401	83.70	J	01/31/1996				
	E102SB005	102SB00501	229.00	J	02/01/1996				
	E102SB006	102SB00601	86.50	J	01/31/1996				
	E102SB007	102SB00701	5.70	J	02/01/1996				
	E102SB008	102SB00801	106.00	J	01/31/1996				
	E102SB009	102SB00901	60.20	J	01/31/1996				
	E102SB034	102SB03401a	260.00	=	05/17/1996				
	E102SB035	102SB03501a	31.40	=	05/17/1996				
	E102SB036	102SB03601b	242.00	=	05/17/1996				
	E102SB037	102SB03701a	190.00	=	05/17/1996				
	E102SB038	102SB03801	98.00	=	05/17/1996				
	E102SB039	102SB03901	919.00	=	05/17/1996				
	E102SB040	102SB04001	83.80	=	05/20/1996				
	E102SB041	102SB04101a	15.00	J	05/20/1996				
	E102SB042	102SB04201	33.20	J	05/20/1996				
	E102SB043	102SB04301	58.00	J	05/21/1996				
	E102SB044	102SB04401	36.90	J	05/21/1996				
	E102SB045	102SB04501	253.00	J	05/21/1996				
	E102SB046	102SB04601	**754.00**	=	06/04/1996				
	E590SB001	590SB00101	70.90	J	01/04/1996				
	E590SB002	590SB00201	133.00	=	01/05/1996				
	E590SB003	590SB00301	301.00	=	01/05/1996				
	E590SB004	590SB00401	77.10	=	01/05/1996				
	E590SB005	590SB00501	26.00	=	01/05/1996				
	E590SB006	590SB00601	**871.00**	=	09/16/1996				
	E102SB048	102SB04801	147	=	08/13/2002				
	E102SB049	102SB04901	63.2	=	08/13/2002				

TABLE 5-1

Detected Concentrations of Antimony, Arsenic, Chromium, Lead, Mercury, and BEQs in Soil
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result	Qualif.	Date Collected	EPA Region III Residential RBC	EPA Region III Industrial RBC	SSL	Zone E Range of Backgd. Conc.
	E102SB050	102SB05001	4.39	=	08/13/2002				
	E102SB051	102SB05101	7.47	=	08/13/2002				
	E102SB052	102SB05201	195	=	08/13/2002				
	E102SB053	102SB05301	**1,710**	=	08/13/2002				
	E102SB054	102SB05401	264	=	08/13/2002				
	E102SB055	102SB05501	334	=	08/13/2002				
	E102SB060	102SB06001	**1,400**	J	08/13/2002				
	E102SB061	102SB06101	51.6	J	08/13/2002				
	E102SB064	102SB06401	**920**	J	08/13/2002				
	E102SB070	102SB07001	4.18	=	08/21/2002				
	Surface Soil Average Conc.		**223.59**						
Lead	**Subsurface Soil**		**(mg/kg)**			NA	NA	400	1.8 – 322
	E102SB001	102SB00102	51.30	J	01/31/1996				
	E102SB002	102SB00202	110.00	J	02/01/1996				
	E102SB003	102SB00302	**809.00**	J	02/01/1996				
	E102SB004	102SB00402	114.00	J	01/31/1996				
	E102SB005	102SB00502	137.00	J	02/01/1996				
	E102SB006	102SB00602	53.70	J	01/31/1996				
	E102SB007	102SB00702	61.40	J	02/01/1996				
	E102SB008	102SB00802	121.00	J	01/31/1996				
	E102SB009	102SB00902	44.00	J	01/31/1996				
	E102SB034	102SB03402	43.00	=	06/03/1996				
	E102SB035	102SB03502	21.90	=	06/03/1996				
	E102SB036	102SB03602	**9,930.00**	=	06/03/1996				
	E102SB037	102SB03702	53.10	=	06/03/1996				
	E102SB039	102SB03902	**3,700.00**	=	05/17/1996				
	E102SB040	102SB04002	70.60	=	05/20/1996				
	E102SB041	102SB04102a	46.60	J	05/20/1996				
	E102SB042	102SB04202	43.40	J	05/20/1996				
	E102SB043	102SB04302	25.90	J	05/21/1996				
	E102SB044	102SB04402	39.70	J	05/21/1996				
	E102SB045	102SB04502	35.00	J	05/21/1996				
	E102SB046	102SB04602	6.40	U	06/04/1996				
	E590SB001	590SB00102	46.00	J	01/04/1996				
	E590SB002	590SB00202	159.00	=	01/05/1996				
	E590SB003	590SB00302	99.50	=	01/05/1996				
	E590SB004	590SB00402	17.20	=	01/05/1996				
	E590SB005	590SB00502	52.50	=	01/05/1996				
	E102SB050	102SB05002	**1,320**	=	08/13/2002				
	E102SB051	102SB05102	330	=	08/13/2002				

TABLE 5-1

Detected Concentrations of Antimony, Arsenic, Chromium, Lead, Mercury, and BEQs in Soil
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result	Qualif.	Date Collected	EPA Region III Residential RBC	EPA Region III Industrial RBC	SSL	Zone E Range of Backgd. Conc.
	E102SB052	102SB05202	4.61	=	08/13/2002				
	E102SB053	102SB05302	**2,150**	=	08/13/2002				
	E102SB060	102SB06002	18.2	J	08/13/2002				
	E102SB061	102SB06102	33.3	J	08/13/2002				
Lead	**Subsurface Soil Average Conc.**		**617.10**						
Mercury	**Surface Soil**		**(mg/kg)**			2.3	61	1	0.030 – 2.7
	E102SB001	102SB00101	**4.60**	=	01/31/1996				
	E102SB002	102SB00201	**17.10**	=	02/01/1996				
	E102SB003	102SB00301	**11.10**	=	02/01/1996				
	E102SB004	102SB00401	1.20	=	01/31/1996				
	E102SB005	102SB00501	**9.60**	=	02/01/1996				
	E102SB006	102SB00601	1.20	=	01/31/1996				
	E102SB007	102SB00701	0.06	=	02/01/1996				
	E102SB008	102SB00801	**27.30**	=	01/31/1996				
	E102SB009	102SB00901	**2.70**	=	01/31/1996				
	E102SB013	102SB01301	**22.60**	J	03/01/1996				
	E102SB014	102SB01401	0.16	J	03/01/1996				
	E102SB015	102SB01501	0.18	J	03/01/1996				
	E102SB016	102SB01601	0.93	J	03/01/1996				
	E102SB017	102SB01701	0.93	J	03/01/1996				
	E102SB018	102SB01801	**18.60**	J	03/01/1996				
	E102SB019	102SB01901	0.28	J	03/01/1996				
	E102SB020	102SB02001	0.04	U	03/01/1996				
	E102SB021	102SB02101	0.05	J	03/01/1996				
	E102SB022	102SB02201	0.18	J	03/01/1996				
	E102SB023	102SB02301	0.04	U	02/29/1996				
	E102SB024	102SB02401	0.04	U	02/29/1996				
	E102SB025	102SB02501	0.16	=	02/29/1996				
	E102SB026	102SB02601	0.04	U	02/29/1996				
	E102SB027	102SB02701	0.07	=	02/29/1996				
	E102SB028	102SB02801	0.04	U	02/29/1996				
	E102SB029	102SB02901	0.04	U	02/29/1996				
	E102SB030	102SB03001	0.08	=	02/29/1996				
	E102SB031	102SB03101	0.04	U	02/29/1996				
	E102SB032	102SB03201	0.13	=	02/29/1996				
	E102SB033	102SB03301	0.06	=	02/29/1996				
	E102SB034	102SB03401a	0.38	J	05/17/1996				
	E102SB035	102SB03501a	0.06	J	05/17/1996				
	E102SB036	102SB03601b	1.80	J	05/17/1996				
	E102SB037	102SB03701a	0.49	J	05/17/1996				
	E102SB038	102SB03801	0.49	J	05/17/1996				

TABLE 5-1

Detected Concentrations of Antimony, Arsenic, Chromium, Lead, Mercury, and BEQs in Soil
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result	Qualif.	Date Collected	EPA Region III Residential RBC	EPA Region III Industrial RBC	SSL	Zone E Range of Backgd. Conc.
	E102SB039	102SB03901	2.00	J	05/17/1996				
	E102SB040	102SB04001	**5.90**	J	05/20/1996				
	E102SB041	102SB04101a	0.11	J	05/20/1996				
	E102SB042	102SB04201	0.31	J	05/20/1996				
	E102SB043	102SB04301	1.10	=	05/21/1996				
	E102SB044	102SB04401	1.30	=	05/21/1996				
	E102SB045	102SB04501	**21.50**	=	05/21/1996				
	E102SB046	102SB04601	**4.20**	=	06/04/1996				
	E590SB001	590SB00101	0.27	J	01/04/1996				
	E590SB002	590SB00201	0.51	=	01/05/1996				
	E590SB003	590SB00301	0.40	=	01/05/1996				
	E590SB004	590SB00401	**9.90**	=	01/05/1996				
	E590SB005	590SB00501	0.74	=	01/05/1996				
	E590SB006	590SB00601	1.50	=	09/16/1996				
	E102SB047	102SB04701	0.047	J	08/13/2002				
	E102SB049	102SB04901	0.27	=	08/13/2002				
	E102SB050	102SB05001	0.03	J	08/13/2002				
	E102SB051	102SB05101	0.934	=	08/13/2002				
	E102SB052	102SB05201	1.24	=	08/13/2002				
	E102SB056	102SB05601	**2.55**	=	08/13/2002				
	E102SB057	102SB05701	0.938	=	08/13/2002				
	E102SB058	102SB05801	1.87	=	08/13/2002				
	E102SB059	102SB05901	**57.8**	=	08/13/2002				
	E102SB060	102SB06001	**35.3**	=	08/13/2002				
	E102SB061	102SB06101	0.14	=	08/13/2002				
	E102SB062	102SB06201	0.689	=	08/13/2002				
	E102SB065	102SB06501	**15.9**	=	08/14/2002				
	E102SB066	102SB06601	**46.8**	=	08/14/2002				
	E102SB067	102SB06701	**11.9**	J	08/14/2002				
	E102SB068	102SB06801	**7.62**	J	08/14/2002				
	E102SB069	102SB06901	**34**	=	08/14/2002				
Mercury	**Subsurface Soil**		**(mg/kg)**			NA	NA	1	0.040 – 0.90
	E102SB001	102SB00102	**2.40**	=	01/31/1996				
	E102SB002	102SB00202	**6.40**	=	02/01/1996				
	E102SB003	102SB00302	**2.50**	=	02/01/1996				
	E102SB004	102SB00402	**1.10**	=	01/31/1996				
	E102SB005	102SB00502	**3.40**	=	02/01/1996				
	E102SB006	102SB00602	0.23	=	01/31/1996				
	E102SB007	102SB00702	0.18	=	02/01/1996				
	E102SB008	102SB00802	**8.10**	=	01/31/1996				
	E102SB009	102SB00902	**1.30**	=	01/31/1996				

TABLE 5-1

Detected Concentrations of Antimony, Arsenic, Chromium, Lead, Mercury, and BEQs in Soil
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result	Qualif.	Date Collected	EPA Region III Residential RBC	EPA Region III Industrial RBC	SSL	Zone E Range of Backgd. Conc.
	E102SB013	102SB01302	**1.90**	J	03/01/1996				
	E102SB015	102SB01502	0.04	U	03/01/1996				
	E102SB016	102SB01602	0.12	J	03/01/1996				
	E102SB017	102SB01702	**1.60**	J	03/01/1996				
	E102SB018	102SB01802	**11.70**	J	03/01/1996				
	E102SB020	102SB02002	0.26	J	03/01/1996				
	E102SB021	102SB02102	0.22	J	03/01/1996				
	E102SB022	102SB02202	0.17	J	03/01/1996				
	E102SB023	102SB02302	0.17	=	02/29/1996				
	E102SB024	102SB02402	0.47	=	02/29/1996				
	E102SB025	102SB02502	0.65	=	02/29/1996				
	E102SB027	102SB02702	0.06	U	02/29/1996				
	E102SB028	102SB02802	0.05	U	02/29/1996				
	E102SB029	102SB02902	0.07	=	02/29/1996				
	E102SB030	102SB03002	0.09	=	02/29/1996				
	E102SB031	102SB03102	0.69	=	02/29/1996				
	E102SB032	102SB03202	0.05	=	02/29/1996				
	E102SB033	102SB03302	0.06	=	02/29/1996				
	E102SB034	102SB03402	0.49	=	06/03/1996				
	E102SB035	102SB03502	0.15	=	06/03/1996				
	E102SB036	102SB03602	0.83	=	06/03/1996				
	E102SB037	102SB03702	0.32	=	06/03/1996				
	E102SB039	102SB03902	**4.80**	J	05/17/1996				
	E102SB040	102SB04002	0.28	J	05/20/1996				
	E102SB041	102SB04102a	0.11	J	05/20/1996				
	E102SB042	102SB04202	0.64	J	05/20/1996				
	E102SB043	102SB04302	0.19	=	05/21/1996				
	E102SB044	102SB04402	**6.20**	=	05/21/1996				
	E102SB045	102SB04502	0.29	=	05/21/1996				
	E102SB046	102SB04602	0.04	U	06/04/1996				
	E590SB001	590SB00102	0.16	J	01/04/1996				
	E590SB002	590SB00202	0.87	=	01/05/1996				
	E590SB003	590SB00302	0.28	=	01/05/1996				
	E590SB004	590SB00402	**3.20**	=	01/05/1996				
	E590SB005	590SB00502	0.50	=	01/05/1996				
	E102SB047	102SB04702	0.739	=	08/13/2002				
	E102SB049	102SB04902	0.047	J	08/13/2002				
	E102SB050	102SB05002	**7.7**	=	08/13/2002				
	E102SB051	102SB05102	**1.01**	=	08/13/2002				
	E102SB052	102SB05202	0.072	J	08/13/2002				
	E102SB058	102SB05802	**2.22**	=	08/13/2002				
	E102SB059	102SB05902	**18.1**	=	08/13/2002				

TABLE 5-1

Detected Concentrations of Antimony, Arsenic, Chromium, Lead, Mercury, and BEQs in Soil
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result	Qualif.	Date Collected	EPA Region III Residential RBC	EPA Region III Industrial RBC	SSL	Zone E Range of Backgd. Conc.
	E102SB060	102SB06002	**3.54**	J	08/13/2002				
	E102SB061	102SB06102	0.034	J	08/13/2002				
	E102SB062	102SB06202	**1.44**	=	08/13/2002				
	E102SB065	102SB06502	**40.4**	=	08/14/2002				
	E102SB066	102SB06602	**10.2**	J	08/14/2002				
	E102SB067	102SB06702	**12.6**	J	08/14/2002				
	E102SB068	102SB06802	**10.8**	J	08/14/2002				
	E102SB069	102SB06902	**47.7**	=	08/14/2002				
Mercury	**Average Subsurface Soil Conc.**		**3.73**						
BEQs	**Surface Soil**		**(µg/kg)**			0.088	0.78	NA	1.304
	E102SB002	102SB00201	**1,998**	=	02/01/1996				
	E102SB003	102SB00301	**2,150**	=	02/01/1996				
	E102SB004	102SB00401	828	=	01/31/1996				
	E102SB005	102SB00501	**1,410**	=	02/01/1996				
	E102SB007	102SB00701	89	U	02/01/1996				
	E102SB034	102SB03401a	**1,912**	=	05/17/1996				
	E102SB035	102SB03501a	831	U	05/17/1996				
	E102SB036	102SB03601b	**5,192**	=	05/17/1996				
	E102SB037	102SB03701a	**17,501**	=	05/17/1996				
	E102SB038	102SB03801	**5,404**	=	05/17/1996				
	E102SB039	102SB03901	916	=	05/17/1996				
	E102SB040	102SB04001	**8,149**	=	05/20/1996				
	E102SB041	102SB04101a	259	=	05/20/1996				
	E102SB046	102SB04601	379	=	06/04/1996				
	E590SB001	590SB00101	**2,865**	=	01/04/1996				
	E590SB002	590SB00201	**1,445**	=	01/05/1996				
	E590SB003	590SB00301	937	=	01/05/1996				
	E590SB004	590SB00401	570	=	01/05/1996				
	E590SB005	590SB00501	904	=	01/05/1996				
	E590SB006	590SB00601	448	=	09/16/1996				
	E102SB057	102SB05701	414	=	08/13/2002				
	E102SB063	102SB06301	**2,657**	=	08/13/2002				
	E102SB066	102SB06601	374	=	08/14/2002				
	E102SB069	102SB06901	**2,804**	=	08/14/2002				
BEQs	**Subsurface Soil**		**(µg/kg)**			NA	NA	NA	1,400
	E102SB001	102SB00102	**2,010**	=	01/31/1996				
	E102SB002	102SB00202	**2,743**	=	02/01/1996				
	E102SB003	102SB00302	1,271	U	02/01/1996				
	E102SB004	102SB00402	**2,140**	=	01/31/1996				

TABLE 5-1

Detected Concentrations of Antimony, Arsenic, Chromium, Lead, Mercury, and BEQs in Soil
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Parameter	Station ID	Sample ID	Result	Qualif.	Date Collected	EPA Region III Residential RBC	EPA Region III Industrial RBC	SSL	Zone E Range of Backgd. Conc.
	E102SB005	102SB00502	1,156	U	02/01/1996				
	E102SB006	102SB00602	1,156	U	01/31/1996				
	E102SB007	102SB00702	738	=	02/01/1996				
	E102SB008	102SB00802	812	=	01/31/1996				
	E102SB034	102SB03402	288	=	06/03/1996				
	E102SB035	102SB03502	**2,682**	=	06/03/1996				
	E102SB036	102SB03602	136	=	06/03/1996				
	E102SB037	102SB03702	61	=	06/03/1996				
	E102SB039	102SB03902	905	=	05/17/1996				
	E102SB040	102SB04002	504	=	05/20/1996				
	E102SB041	102SB04102a	867	U	05/20/1996				
	E102SB042	102SB04202	454	=	05/20/1996				
	E102SB044	102SB04402	374	=	05/21/1996				
	E102SB045	102SB04502	636	U	05/21/1996				
	E102SB046	102SB04602	485	U	06/04/1996				
	E590SB001	590SB00102	**1,733**	U	01/04/1996				
	E590SB002	590SB00202	1,214	=	01/05/1996				
	E590SB003	590SB00302	**1,545**	=	01/05/1996				
	E590SB004	590SB00402	**1,502**	U	01/05/1996				
	E590SB005	590SB00502	**1,618**	U	01/05/1996				

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

* EPA target cleanup goal for industrial land use based on the ALM calculations.

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

U Indicates that the concentration was not detected.

TABLE 5-2
Volatile Organic Compounds Detected in Surface Soil
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Compound	Station ID	Sample ID	Date Collected	Concentration (mg/kg)	Qualifier	$SSL_{generic}$ (DAF=1)
Acetone	E102SB046	102SB04601	06/04/1996	0.059	J	0.8
	E590SB002	590SB00201	01/05/1996	0.091	=	
	E590SB001	590SB00101	01/04/1996	0.160	J	
	E590SB003	590SB00301	01/05/1996	0.058	=	
	E590SB004	590SB00401	01/05/1996	0.057	=	
	E590SB005	590SB00501	01/05/1996	0.200	=	
Carbon Disulfide	E590SB004	590SB00401	01/05/1996	0.001	J	2
	E590SB003	590SB00301	01/05/1996	0.002	J	
Toluene	E590SB004	590SB00401	01/05/1996	0.001	J	0.6
Methyl ethyl ketone (2-Butanone)	E102SB005	102SB00501	02/01/1996	0.008	J	4,700*
	E590SB001	590SB00101	01/04/1996	0.014	J	
	E590SB002	590SB00201	01/05/1996	0.015	=	
	E590SB003	590SB00301	01/05/1996	0.008	J	
	E590SB004	590SB00401	01/05/1996	0.008	J	
Xylenes, Total	E590SB001	590SB00101	01/04/1996	0.002	J	9
	E590SB004	590SB00401	01/05/1996	0.002	J	

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

* Region III Residential RBC

J indicates that the compound was detected, the reported concentration is estimated.

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

1

1

TABLE 5-3
Volatile Organic Compounds Detected in Subsurface Soil
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Compound	Station ID	Sample ID	Date Collected	Concentration (mg/kg)	Qualifier	$SSL_{generic}$ (DAF=1)
Acetone	E590SB002	590SB00202	01/05/1996	0.140	=	0.8
	E590SB004	590SB00402	01/05/1996	0.052	=	
	E590SB001	590SB00102	01/04/1996	0.440	J	
	E590SB003	590SB00302	01/05/1996	0.027	=	
	E590SB005	590SB00502	01/05/1996	0.100	=	
Methyl Ethyl Ketone	E102SB007	102SB00702	02/01/1996	0.025	=	4,700*
	E102SB003	102SB00302	02/01/1996	0.021	=	
	E102SB008	102SB00802	01/31/1996	0.012	J	
	E102SB001	102SB00102	01/31/1996	0.024	=	
	E102SB009	102SB00902	01/31/1996	0.022	=	
	E590SB002	590SB00202	01/05/1996	0.040	=	
	E590SB001	590SB00102	01/04/1996	0.032	J	
	E590SB005	590SB00502	01/05/1996	0.020	J	

* Region III Residential RBC

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

J indicates that the compound was detected, the reported concentration is estimated.

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

2

1

TABLE 5-4
Arsenic, Beryllium, and Thallium in Groundwater
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

Location	Sample Collection Date	Arsenic Concentration (µg/L)	Arsenic Qualif.	Beryllium Concentration (µg/L)	Beryllium Qualif.	Thallium Concentration (µg/L)	Thallium Qualif.
MCL		50		4		2	
EPA Region III Tap Water RBC (HI=0.1)		0.045		7.3		0.26	
Zone E Shallow Mean Background Reference Concentration[a]		36		0.4		4	
Zone E Shallow Background Range Concentration[a]		2.6 - 316		0.3 – 0.9		3 – 6	
Zone E Deep Mean Background Reference Concentration[a]		21		0.6		5	
Zone E Deep Background Range Concentration[a]		3 - 132		0.2 – 1.3		3 – 7	
E102GW001	03/22/1996	5.10	J	1.00	U	5.0	U
E102GW001	07/19/1996	5.40	J	0.62	U	2.7	U
E102GW001	11/04/1996	8.40	J	0.30	UJ	3.1	J
E102GW001	01/15/1997	2.50	UJ	0.30	U	2.7	U
E590GW001	03/25/1996	19.90	=	1.00	U	5.0	U
E590GW001	07/09/1996	37.60	=	0.30	U	2.7	UJ
E590GW001	11/01/1996	25.40	=	0.30	UJ	2.7	UJ
E590GW001	01/14/1997	28.50	=	0.30	U	4.5	J
E590GW01D	03/25/1996	5.00	U	1.30	J	5.0	UJ
E590GW01D	07/09/1996	2.50	U	0.70	J	2.7	UJ
E590GW01D	11/01/1996	3.80	J	0.57	J	3.1	J
E590GW01D	01/14/1997	3.80	J	1.20	U	5.2	J

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

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

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

µg/L micrograms per liter

U Indicates analyte not detected above laboratory detection limit.

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

TABLE 5-5
Soil Screening Level (SSL) Calculation
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 590, Zone E, Charleston Naval Complex

						Parameter	Mercury
Chemical Specific Input Parameters							
Cw	=	Target groundwater concentration MCL (mg/L)					**2.00E-03**
H	=	Henry's Law Constant, dimensionless					**4.67E-01**
Kd	=	Soil-water sorption coefficient (cm3 water / g soil = L/kg) = Koc x foc where					5.20E+01
		koc = organic carbon-water sorption coefficient, (cm3 (ml) water) / (g soluble organic carbon)					**NA**
		foc = Fraction of organic content, dimensionless				**0.037**	
Site Specific Input Parameters							
Sw	=	Width of Source Parallel to Groundwater Flow Direction	(impacted soil zone)	**38.1** m	125 ft		
da	=	Aquifer Thickness		**10.4** m	34.0 ft		
d	=	Groundwater Mixing Zone thickness	(paved)	**5.0** m	16.3 ft		
			(unpaved)	**10.4** m	34.0 ft		
i	=	Groundwater Gradient		**2.0E-03**	(unitless)		
Ks	=	Saturated Hydraulic Conductivity		**166.9** m/yr	547.5 ft/yr		
θw	=	Volumetric Water Content of Soil Pore Space		**0.3** cm^3_{vapor}/cm^3_{soil}	0.3 in^3_{vapor}/in^3_{soil}		
θv	=	Volumetric Vapor Content of Soil Pore Space		**0.15** cm^3_{vapor}/cm^3_{soil}	0.15 in^3_{vapor}/in^3_{soil}		
ρs	=	Soil Bulk Density		**1.5** g/cm^3	93.64 lb_m/ft^3		
qi	=	Water Infiltration Rate	(paved)	**0.0086** m/yr	0.0283 ft/yr		
			(unpaved)	**0.1372** m/yr	0.4500 ft/yr		
		Partition Term, Csoil/Cw, (L/kg)			$\frac{C_{soil}}{C_w} = \left(\frac{\theta_w + K_d\rho_s + H\theta_v}{\rho_s}\right)\left(\frac{K_s i d + q_i S_w}{q_i S_w}\right)$		5.22E+01
		Dilution Term, dimensionless	(paved)				6.04E+00
			(unpaved)				1.66E+00
		Csoil/Cw =Partition term * Dilution term (mg/kg / mg/L) = L/kg	(paved)				3.16E+02
			(unpaved)				8.68E+01
		Calculated Site Specific Target Level for Soil					
		C_{soil} calculated source soil concentration (SSL, mg/kg) Cw*(partion term)*(dilution term)				(paved)	**0.53**
						(unpaved)	**0.17**

Cwt is the MCL from EPA National Drinking Water Standards (March 2001).
H is assumed to be zero as recommended in the Soil Screening Guidance; User's Guide (EPA, 1996, except Hg whose H is from Table 36).
Kd for Hg is from Table C-4, Soil Screening Guidance; User's Guide (EPA, 1996); for Pb from Table 5.9, Understanding Variation in Partition Coefficient, Kd, Values (EPA
koc is not applicable to inorganoc compounds, Soil Screening Guidance; Technical Background Document (EPA, 1996).
foc Mean of Zone E TOC measurements converted to g/g.
Sw Estimated as dimension of SWMU 102 along gw flow direction (125 ft).
d is calculated as $M = (0.0112\ L^2)^{0.5} + da\{1 - e^{[-L\ qi/Ks\ del]}\}$ or da, whichever is less.
da is based on water level elevation (4 ft msl, GIS) - the top of the Ashley formation (-30 ft msl, GIS).
i is estimated from groundwater data in the GIS ([6-4]/1080 ~ 0.002, CH2MHill, 2001)
Ks Based on CH2MHill's hydraulic conductivity theme in the GIS (1.5 ft/d).
θw is the default value presented in the Soil Screening Guidance: User's Guide (EPA, 1996)
θv is calculated as total porosity (0.45, assumed) - θw (0.3) = 0.15.
ρs is the default value presented in the Soil Screening Guidance: User's Guide (EPA, 1996)
qi derived values (5.4 in/yr, unpaved and 0.34 in/ yr, paved) based on annual precipitation, evapo-transportation, and runoff coefficient values for the Charleston area.

Section 6.0

6.0 Summary of Information Related to Site Closeout Issues

6.1 RFI Status

The *Zone E RFI Report, Revision 0* (EnSafe, 1997) addressed SWMUs and AOCs within Zone E of the CNC, including SWMU 102 and AOC 590.

In accordance with the RFI completion process, if a determination of No Further Investigation (NFI) is made upon completion of the RFI, then a site may proceed to either No Further Action status or to a CMS. The RFI for SWMU 102 and AOC 590 identified COCs for surface soil and shallow and deep groundwater. Based on the discussion presented in Section 5.0, BEQs and mercury in soil are considered COCs at SWMU 102 and AOC 590.

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

6.2 Presence of Inorganics in Groundwater

For the purpose of site closeout documentation, the inorganics in groundwater issue refers to the occasional or intermittent detection of several metals (primarily arsenic, thallium, and antimony) in groundwater at concentrations above the applicable MCL, preceded or followed by detections of these same metals below the MCL or below the practicable quantitation limit. Antimony was not detected above laboratory detection limits in shallow and deep groundwater samples at SWMU 102 and AOC 590. No arsenic detections in groundwater samples at SWMU 102 and AOC 590 exceeded the South Carolina MCL of 50 µg/L. There were two thallium detections in shallow groundwater, at concentrations of 3.1 µg/L and 4.5 µg/L, at locations E102GW001 and E590GW001, respectively, that exceed the MCL of 2 µg/L. Two thallium detections in deep groundwater at concentrations of 3.1 µg/L and 5.2 µg/L, at location E590GW01D, also exceed the MCL. However, these detections were either preceded or followed by concentrations that were below laboratory detection limits during other sampling events. None of the thallium detections in shallow and deep groundwater exceeded the Zone E shallow and deep groundwater maximum

background concentrations of 6 µg/L and 7µg/L, respectively. Table 5-4 shows arsenic and thallium concentrations from the RFI groundwater sampling at SWMU 102 and AOC 590.

Intermittent detections of thallium in groundwater at the site above the MCL do not point to a site-specific source, but can be attributed to natural occurrence. These detections did not exceed the background concentration for thallium in groundwater. Further evaluation of this issue is not warranted.

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

There are no data suggesting that there was an impact to the sanitary sewers from this site. Figure 6-1 shows locations of four groundwater direct push technology (DPT) borings introduced as part of the SWMU 37 investigations, in the vicinity of the site. These samples were analyzed for VOCs, SVOCs and inorganics. In these groundwater samples, there were no detections of VOCs above laboratory detection limits; there was only one detection of bis(2-ethylhexyl)phthalate (BEHP), which is a common laboratory artifact, and elevated detections of several metals. Elevated detections of inorganic compounds in DPT samples from the sewer line investigations at CNC have been attributed to high turbidity in DPT samples and do not point to an impact from site-related activities. Therefore, further evaluation of this issue is not warranted.

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

Figure 6-1 shows one DPT groundwater sample location introduced in the vicinity of the site as part of the AOC 699 investigations. No detections above laboratory detection limits were found for VOCs or SVOCs in this sample.

One storm drain located near AOC 590 was cleaned out as part of an IM conducted by the DET in 1998. Appendix G includes Figures 4 and 4A from the *IM Completion Report for AOC 699, Storm Drain Cleaning* (DET, 1999). As a result of the IM, all sediments collected in this storm drain were removed and disposed of. Additionally, the storm drain and sewer line were pressure-washed, and no sediments remained in the storm drain after completion of the IM during 1998. There is no information to suggest a linkage to the investigated storm sewers from the site. Based on these observations, further evaluation of this issue is not warranted.

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

Railroad lines extend into the northern side of Building 79 and run along the eastern side of Building 79, as shown in Figure C-1 included in Appendix C. Elevated BEQ concentrations at the site could be a result of the presence of historical and existing railroad lines at the site as discussed in Section 5.2.6.

There is no other known linkage between AOC 590 and SWMU 102 and the investigated railroad lines of AOC 504, so further evaluation of this issue is not warranted.

6.6 Potential Migration Pathways to Surface Water Bodies at the CNC

The nearest surface water body to AOC 590 and SWMU 102 is the Cooper River, which lies approximately 200 feet northeast of the site. The only potential migration pathway from the site to surface water is via overland flow via stormwater runoff. The entire site is covered with pavement, which eliminates contact of surface soil with stormwater. Similarly, runoff directed to the storm sewer system, which discharges to the Cooper River, does not contact the soil. Further evaluation of this issue is not warranted.

6.7 Potential Contamination in Oil/Water Separators (OWSs)

There is no indication of the presence of an OWS at the site. Therefore, further evaluation of this issue is not warranted.

6.8 Land Use Control (LUC)

The CNC BCT has agreed that all of Zone E will have at least some LUCs and restrictions. At a minimum, these LUCs are likely to include restrictions against unrestricted land use. The specific type of LUCs to be applied at this site will be further evaluated as part of the CMS process.

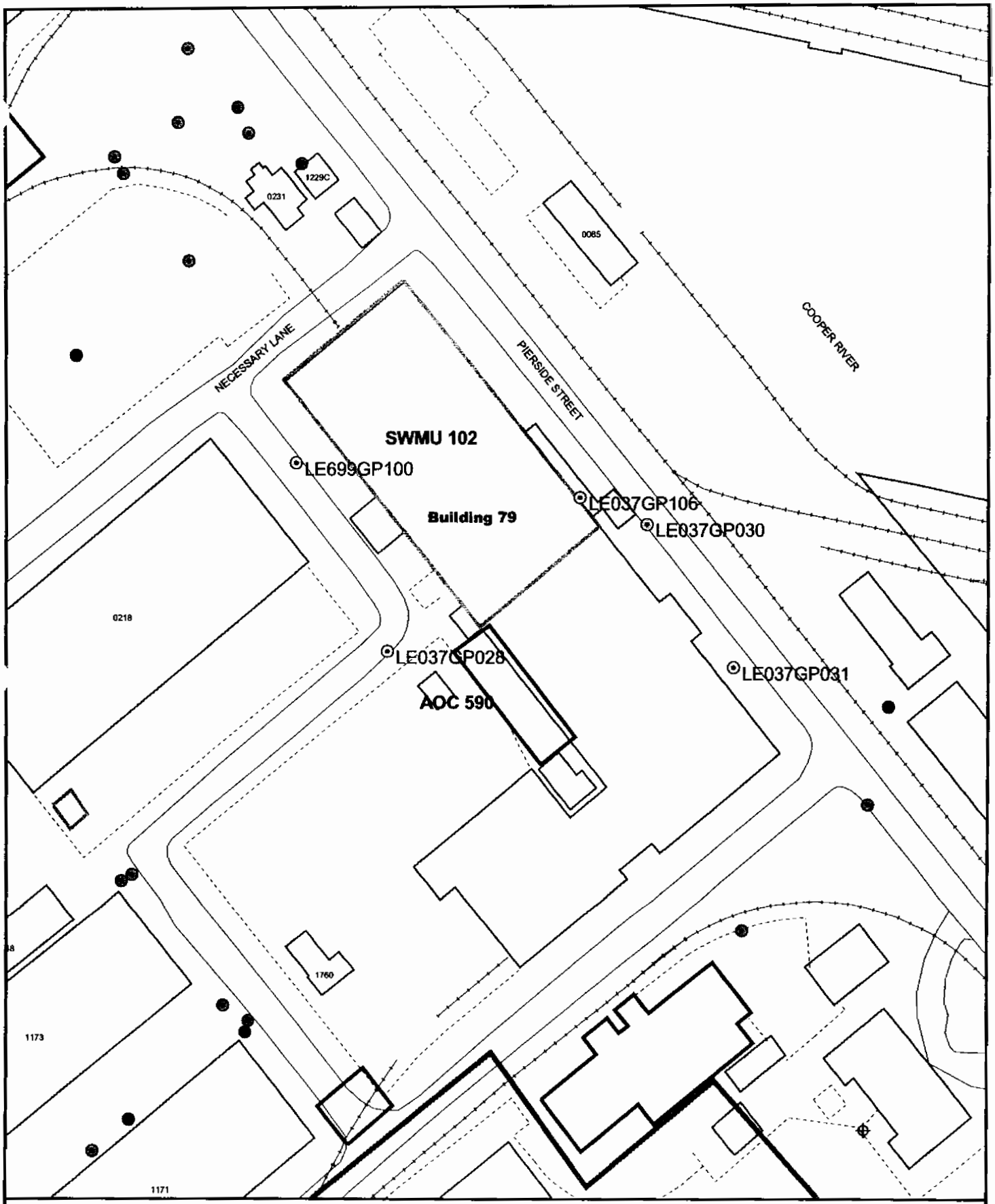

Figure 6-1
SWMU 37 Groundwater DPT Sample Locations
SWMU 102 and AOC 590 Area, Zone E
Charleston Naval Complex

CH2MHILL

Section 7.0

7.0 Recommendations

AOC 590 comprises the alley between Buildings 79 and 1760. This alley may have been the site of past releases of acetone and cutting oil. No information was found regarding the specific locations, volumes, or duration of the possibly discharged waste. Currently, the alley is paved with asphalt.

SWMU 102 comprises a mercury spill at Building 79. Several incidents involving hazardous material spills, as well as cleanup activities, have been documented since 1976. The most noteworthy was the discovery of a pool of mercury under the floor inside the central portion of the building. Mercury was reported to have been spilled and had seeped under the floor, forming an approximately 10-foot diameter pool. The mercury release was reportedly discovered in 1969. According to the 1970 Incident Report #CNS-12-70, five pounds of mercury was recovered by vacuum cleaner and disposed of properly. The exposed area was scrubbed with HgX to remove any traces of remaining mercury, and the floor was replaced. The mercury was reported as having been used in gyroscopes before World War II.

The RFI report identified antimony, arsenic, chromium, lead, mercury, BEQs in surface soil as COCs for the unrestricted (i.e., residential) land use scenario; arsenic and BEQs in surface soil as COCs for the industrial land use scenario; arsenic as a shallow groundwater COC, and beryllium as a deep groundwater COC for SWMU 102 and AOC 590.

Based on an evaluation of the data and site conditions as discussed herein, BEQs and mercury are identified as surface soil COCs for the unrestricted land use scenario; BEQs are identified as surface soil COCs for the industrial land use scenario, and mercury is identified as a subsurface soil COC. Mercury is a soil COC for the soil to air pathway.

A focused CMS should be performed to address these COCs. A CMS work plan which describes the steps for a focused CMS is provided in Section 8.0 of this report.

Section 8.0

8.0 CMS Work Plan

BEQs and mercury were identified as soil COCs at SWMU 102 and AOC 590. Mercury was identified as a soil COC for the inhalation exposure pathways. Currently there is no unacceptable exposure or risk from these COCs; however, it is feasible that in the future, should land use and/or site conditions change, some exposure could occur. Therefore, a CMS should be conducted to evaluate potential corrective measures and identify an appropriate remedy for the site.

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

8.1 Remedial Action Objectives

Remedial action objectives (RAOs) are medium-specific goals of remedial actions that are designed to protect human health and the environment by preventing or reducing exposures under current and future land use conditions. The RAO identified for soils at both SWMU 102 and AOC 590 is to prevent ingestion and direct/dermal contact with soil having unacceptable carcinogenic or noncarcinogenic risk.

8.2 Remedial Goal Options and Media Cleanup Standards

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

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

The contaminated media of concern for SWMU 102 and AOC 590 are surface soil contaminated with BEQs and mercury and subsurface soil contaminated with mercury. Because SWMU 102 and AOC 590 are located within a highly developed area of the CNC and there are no surface water bodies in the immediate vicinity of the site, ecological exposures were not considered applicable for evaluation.

BEQs and mercury were the only COCs identified for soil. BEQs were detected at concentrations ranging from 260 µg/kg to 17,501 µg/kg (surface soil) and 61 µg/kg to 2,743 µg/kg (subsurface soil). Mercury was detected at concentrations ranging from 0.03 mg/kg to 57.8 mg/kg in surface soil, and from 0.034 mg/kg to 40.4 mg/kg in subsurface soil. The MCS for BEQs is the CNC BEQ sitewide reference concentration 1,304 µg/kg for surface soil. The MCSs for mercury are the EPA Region III residential RBC of 2.3 mg/kg for surface soil and the SSL of 1 mg/kg for subsurface soil. For the soil-to-air exposure pathway for mercury, the EPA target goal of 10 mg/kg in soil is an acceptable MCS.

8.3 Potential Remedies to Evaluate

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

- Soil Excavation and disposal with LUCs
- LUCs with continued indoor air monitoring for mercury

8.4 Focused CMS Approach

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

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

8.5 Approach to Evaluating Corrective Measure Alternatives

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

1. Protecting human health and the environment.
2. Attaining media cleanup standards (RGOs).

3. Controlling the source of releases to minimize future releases that may pose a threat to human health and the environment.
4. Complying with applicable standards for the management of wastes generated by remedial activities.
5. Other factors include (a) long-term reliability and effectiveness; (b) reduction in toxicity, mobility, or volume of wastes; (c) short-term effectiveness; (d) implementability; and (e) cost.

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

1. **Protecting human health and the environment.** The alternatives will be evaluated on the basis of their ability to protect human health and the environment. The ability of an alternative to achieve this standard may or may not be independent of its ability to achieve the other four standards. For example, an alternative may be protective of human health, but may not be able to attain the MCSs if the MCSs are not directly tied to protecting human health.
2. **Attaining media cleanup standards (RGOs).** The alternatives will be evaluated on the basis of their ability to achieve the RGOs defined in this CMS Work Plan. Another aspect of this standard is the timeframe to achieve the RGOs. Estimates of the timeframe for the alternatives to achieve RGOs will be provided.
3. **Controlling the source of releases.** This standard deals with the control of releases of contamination from the source (the area in which the contamination originated).
4. **Complying with applicable standards for management of wastes.** This standard deals with the management of wastes derived from implementing the alternatives, for example, treatment or disposal of excavated material. The soil removal alternative will be designed to comply with all applicable standards for management of remediation wastes. Consequently, this standard will not be explicitly included in the detailed evaluation presented in the CMS but will be part of a work plan specific to the removal action should a removal action become the chosen alternative.
5. **Other factors.** Five other factors are to be considered if an alternative is found to meet the four standards described above. These other factors are as follows:

    a. Long-term reliability and effectiveness

    The two alternatives will be evaluated on the basis of their reliability, and the potential impact should the chosen alternative fail. In other words, a qualitative

assessment will be made as to the chance of the alternative's failure and the consequences of that failure.

b. Reduction in the toxicity, mobility, or volume of wastes

Alternatives with technologies that reduce the toxicity, mobility, or volume of the contamination will be generally favored over those that do not. Consequently, a qualitative assessment of this factor will be performed for each alternative.

c. Short-term effectiveness

Alternatives will be evaluated on the basis of the risk they create during the implementation of the remedy. Factors that may be considered include fire, explosion, and exposure of workers to hazardous substances.

d. Implementability

The alternatives will be evaluated for their implementability by considering any difficulties associated with conducting the alternatives (such as the construction disturbances they may create), operation of the alternatives, and the availability of equipment and resources to implement the technologies comprising the alternatives.

e. Cost

A net present value of each alternative will be developed. These cost estimates will be used for the relative evaluation of the alternatives, not to bid or budget the work. The estimates will be based on information available at the time of the CMS and on a conceptual design of the alternative. They will be "order-of-magnitude" estimates with a generally expected accuracy of -50 percent to +50 percent for the scope of action described for each alternative. The estimates will be categorized into capital costs and operations and maintenance costs for each alternative.

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

8.6 Focused CMS Report

A focused CMS Report will be prepared to present the identification, development, and evaluation of potential corrective measures for AOC 590 and SWMU 102. A proposed outline of the report, as shown in Table 8-1, provides an example of the report format and content.

TABLE 8-1
Outline of Focused CMS Report for AOC 590 and SWMU 102
RFI Report Addendum & CMS Work Plan, AOC 590 and SWMU 102, Zone E, Charleston Naval Complex

Section No.	Section Title
1.0	**Introduction**
1.1	Corrective Measures Study Purpose and Scope
1.2	Report Organization
1.3	Background Information
1.3.1	Facility Description
1.3.2	Site History and Background
1.3.2.1	Nature and Extent of Contamination
1.3.2.2	Summary of Risk Assessment
2.0	**Remedial Goal Objectives**
3.0	**Detailed Analysis of Focused Alternatives**
3.1	Approach
3.2	Evaluation Criteria
3.3	Description of Alternatives
3.3.1	Alternative 1: Soil removal and Offsite Disposal with LUCs
3.3.2	Alternative 2: LUCs with Indoor Air Monitoring for Mercury
3.4	Detailed Analysis of Alternatives
3.4.1	Analysis of Alternative 1
3.4.2	Analysis of Alternative 2
3.5	Comparative Analysis of Alternatives
4.0	**Recommended Remedial Alternative**
5.0	**References**
Appendix A	**Corrective Measure Alternative Cost Estimates**[b]
List of Tables	
List of Figures	

[a] Additional alternatives will be analyzed as found necessary.

[b] Additional appendices will be added, if necessary.

1

Section 9.0

9.0 References

CH2M-Jones. *Technical Memorandum: Adult Lead Methodology (ALM) Derived Target Lead Concentrations for Industrial Land Use. CNC.* September 2001a.

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EnSafe Inc. *Zone E RFI Report, Revision 0, NAVBASE Charleston.* November 1997.

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Environmental Detachment Charleston (DET). *Interim Measure Completion Report for AOC 699 Storm Drain Cleaning.* March 1999.

U.S. Environmental Protection Agency (EPA). Memorandum from Dann Spariosu, EPA Region IV, to Mihir Mehta, SCDHEC, *Remedial Goals for Arsenic in Soil,* dated March 30, 2001, with attachment of memorandum from Ted Simon to Dann Spariosu, *Remediation Goals for Arsenic in Soil at DOD Facilities,* dated March 29, 2001.

U. S. Environmental Protection Agency (EPA). *Soil Screening Guidance: Technical Background Document.* 1996.

Appendix A

Chemicals Detected in Zone E Groundwater Samples
AOC 590

Name	Location	Round 1 Conc.	Round 2 Conc.	Round 3 Conc.	Round 4 Conc.	RBC THQ=.1)	UTL	MCL
Volatile Organic Compounds (ug/l)								
Acetone	590GW01D	16.00	ND	ND	ND	370.00	NA	NA
Other Compounds (mg/l)								
Chloride	590GW001	765.00	1220.00	2930.00	1660.00	NA	NA	NA
	590GW01D	11500.00	10500.00	10800.00	10300.00			
Sulfate	590GW001	ND	0.42	2.00	ND	NA	NA	NA
	590GW01D	100.00	59.10	55.80	53.50			
Total Dissolved Solids (TDS)	590GW001	1930.00	3100.00	6090.00	4000.00	NA	NA	NA
	590GW01D	20400.00	20700.00	20200.00	20200.00			
Inorganic Compounds (ug/l)								
Aluminum (Al)	590GW001	ND	43.90	153.00	50.60	73.00	7.90	200
Arsenic (As)	590GW001	19.90	37.60	25.40	28.50	0.05	18.70	50
	590GW01D	ND	ND	3.80	3.80			
Barium (Ba)	590GW001	ND	28.30	37.00	32.20	260.00	211.00	2000
	590GW01D	281.00	261.00	235.00	200.00			
Beryllium (Be)	590GW01D	1.30	0.70	0.57	ND	0.02	0.43	4
Calcium (Ca)	590GW001	97300.00	111000.00	132000.00	120000.00	NA	NA	NA
	590GW01D	224000.00	217000.00	252000.00	229000.00			
Chromium (Cr)	590GW001	ND	ND	3.10	ND	3700.00	12.30	100
	590GW01D	ND	ND	2.60	ND			
Iron (Fe)	590GW001	18800.00	20600.00	10700.00	16600.00	1100.00	NA	NA
Lead (Pb)	590GW001	ND	2.00	ND	ND	15.00	NA	15
Magnesium (Mg)	590GW001	49500.00	75500.00	182000.00	111000.00	NA	NA	NA
	590GW01D	730000.00	702000.00	695000.00	689000.00			
Manganese (Mn)	590GW001	730.00	757.00	646.00	635.00	84.00	2560.00	NA
	590GW01D	197.00	220.00	242.00	236.00			
Mercury (Hg)	590GW001	ND	ND	0.10	ND	1100.00	NA	0
Nickel (Ni)	590GW001	ND	1.20	1.70	ND	73.00	15.20	100
	590GW001	ND	ND	1.30	ND			
Potassium (K)	590GW001	41400.00	52100.00	88200.00	54200.00	NA	NA	NA
	590GW01D	282000.00	193000.00	187000.00	180000.00			
Sodium (Na)	590GW001	537000.00	449000.00	1830000.00	1110000.00	NA	NA	NA
	590GW01D	7260000.00	6390000.00	5690000.00	5630000.00			
Thallium (Tl)	590GW001	ND	ND	ND	4.50	0.29	5.40	2
	590GW01D	ND	ND	3.10	5.20			
Vanadium (V)	590GW001	2.30	ND	9.20	2.70	26.00	11.40	NA
	590GW01D	3.30	ND	3.20	1.20			
Zinc (Zn)	590GW001	8.50	ND	ND	ND	1100.00	27.30	NA

Notes:

ND: Not Detected

NS: No Sample Taken/Sample Not Analyzed

NA: Not Applicable

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

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

Chemicals Detected in Zone E Groundwater Samples
SWMU 102

Name	Location	Round 1 Conc.	Round 2 Conc.	Round 3 Conc.	Round 4 Conc.	RBC (THQ=.1)	UTL	MCL
Semi-volatile Compounds (ug/l)								
Benzoic acid	102GW001	3.00	ND	NS	NS	1500	NA	NA
bis(2-Ethylhexyl)phthalate (BEHP)	102GW001	3.00	ND	NS	NS	4.8	NA	6
Other Compounds (mg/l)								
Chloride	102GW001	ND	2220.00	2830.00	2470.00	NA	NA	NA
Sulfate	102GW001	ND	ND	0.20	6.40	NA	NA	NA
Total Dissolved Solids (TDS)	102GW001	ND	2540.00	5950.00	5790.00	NA	NA	NA
Inorganic Compounds (ug/l)								
Aluminum (Al)	102GW001	50.40	30.50	98.20	20.50	3700	7.9	200
Arsenic (As)	102GW001	5.10	5.40	8.40	ND	0.05	2810	NA
Barium (Ba)	102GW001	ND	ND	49.80	44.60	260	211	200
Calcium (Ca)	102GW001	ND	148000.00	157000.00	150000.00	NA	NA	NA
Chromium (Cr)	102GW001	1.40	1.20	2.60	1.90	3700	12.3	100
Copper (Cu)	102GW001	ND	ND	ND	1.30	150	2.7	1300
Iron (Fe)	102GW001	ND	8630.00	6880.00	7470.00	1100	NA	NA
Magnesium (Mg)	102GW001	ND	126000.00	177000.00	159000.00	NA	NA	NA
Manganese (Mn)	102GW001	ND	510.00	490.00	507.00	84	2560	NA
Nickel (Ni)	102GW001	ND	ND	1.50	1.60	73	15.2	100
Potassium (K)	102GW001	ND	84600.00	98800.00	82800.00	NA	NA	NA
Sodium (Na)	102GW001	ND	1260000.00	1710000.00	1550000.00	NA	NA	NA
Thallium (Tl)	102GW001	ND	ND	3.10	ND	0.29	5.4	2
Tin (Sn)	102GW001	ND	ND	2.80	ND	2200	NA	NA
Vanadium (V)	102GW001	4.60	ND	10.90	2.90	26	11.4	NA

Notes:
ND: Not Detected
NS: No Sample Taken/Sample Not Analyzed
NA: Not applicable
For compounds detected in both the primary and duplicate sample, the concentration for both detections are averaged and listed as one detection.
For compounds that were detected in only one of the primary or duplicate sample, the value of the detection was used.

Chemicals Detected in Zone E Soil Samples
AOC 590

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Volatile Organic Compounds (ug/kg)						
2-Butanone (MEK)	590SB001	14.00	32.00	4700000.00	NA	NA
	590SB002	15.00	40.00			
	590SB003	8.00	ND			
	590SB004	8.00	ND			
	590SB005	ND	20.00			
Acetone	590SB001	160.00	440.00	780000.00	NA	NA
	590SB002	91.00	140.00			
	590SB003	58.00	27.00			
	590SB004	57.00	52.00			
	590SB005	200.00	100.00			
Carbon disulfide	590SB003	2.00	ND	780000.00	NA	NA
	590SB004	1.00	ND			
Toluene	590SB004	1.00	ND	1600000.00	NA	NA
Xylene (Total)	590SB001	2.00	ND	16000000.00	NA	NA
	590SB004	2.00	ND			
Semi-volatile Compounds (ug/kg)						
2-Methylnaphthalene	590SB001	120.00	ND	NA	NA	NA
Acenaphthene	590SB001	950.00	ND	470000.00	NA	NA
	590SB002	110.00	1400.00			
	590SB003	350.00	ND			
	590SB006	63.00	NS			
Anthracene	590SB001	870.00	ND	23000000.00	NA	NA
	590SB002	260.00	ND			
	590SB003	430.00	ND			
	590SB006	120.00	NS			
Benzo(a)anthracene	590SB001	1800.00	ND	880.00	NA	NA
	590SB002	1000.00	180.00			
	590SB003	520.00	ND			
	590SB004	340.00	ND			
	590SB006	360.00	NS			
Benzo(a)pyrene	590SB001	1800.00	ND	88.00	NA	NA
	590SB002	930.00	ND			
	590SB003	430.00	ND			
	590SB004	360.00	ND			
	590SB006	300.00	NS			
Benzo(b)fluoranthene	590SB001	1700.00	ND	880.00	NA	NA
	590SB002	960.00	ND			
	590SB003	280.00	150.00			
	590SB004	410.00	ND			
	590SB005	86.00	ND			
	590SB006	360.00	NS			
Benzo(g,h,i)perylene	590SB001	1100.00	ND	310000.00	NA	NA
	590SB002	720.00	380.00			
	590SB003	360.00	1200.00			
	590SB004	310.00	ND			
	590SB006	180.00	NS			
Benzo(k)fluoranthene	590SB001	1400.00	ND	8800.00	NA	NA

Chemicals Detected in Zone E Soil Samples
AOC 590

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	590SB002	780.00	ND			
	590SB003	260.00	ND			
	590SB004	320.00	ND			
	590SB006	220.00	NS			
Benzoic acid	590SB003	ND	170.00	31000000.00	NA	NA
	590SB004	ND	150.00			
Chrysene	590SB001	1700.00	ND	88000.00	NA	NA
	590SB002	1300.00	460.00			
	590SB003	620.00	190.00			
	590SB004	490.00	ND			
	590SB006	430.00	NS			
Di-n-butylphthalate	590SB001	100.00	ND	7800000.00	NA	NA
Dibenz(a,h)anthracene	590SB001	600.00	ND	88000.00	NA	NA
	590SB002	220.00	ND			
	590SB004	93.00	ND			
	590SB006	55.00	NS			
Dibenzofuran	590SB001	260.00	ND	31000.00	NA	NA
Fluoranthene	590SB001	3800.00	220.00	3100000.00	NA	NA
	590SB002	2600.00	ND			
	590SB003	900.00	620.00			
	590SB004	760.00	ND			
	590SB005	130.00	ND			
	590SB006	870.00	NS			
Fluorene	590SB001	490.00	ND	310000.00	NA	NA
	590SB002	92.00	ND			
	590SB003	210.00	ND			
Indeno(1,2,3-cd)pyrene	590SB001	1000.00	ND	880.00	NA	NA
	590SB002	900.00	350.00			
	590SB003	340.00	530.00			
	590SB004	390.00	ND			
	590SB005	92.00	ND			
	590SB006	190.00	NS			
Naphthalene	590SB001	660.00	ND	310000.00	NA	NA
Phenanthrene	590SB001	3500.00	180.00	310000.00	NA	NA
	590SB002	1500.00	ND			
	590SB003	1000.00	ND			
	590SB004	330.00	ND			
	590SB006	280.00	NS			
Pyrene	590SB001	2600.00	220.00	230000.00	NA	NA
	590SB002	2200.00	ND			
	590SB003	1400.00	650.00			
	590SB004	620.00	ND			
	590SB005	130.00	ND			
	590SB006	740.00	NS			
bis(2-Ethylhexyl)phthalate (BEHP)	590SB001	180.00	ND	4600.00	NA	NA
	590SB001	170.00	ND			
	590SB002	ND	350.00			

Chemicals Detected in Zone E Soil Samples
AOC 590

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Inorganic Compounds (mg/kg)						
Aluminum (Al)	590SB001	9130.00	28100.00	7800.00	26000.00	41100.00
	590SB002	6810.00	17000.00			
	590SB003	15400.00	24400.00			
	590SB004	4490.00	11100.00			
	590SB005	6470.00	23700.00			
	590SB006	15500.00	NS			
Antimony (Sb)	590SB001	0.63	ND	3.10	1.77	1.60
	590SB002	11.60	1.20			
	590SB003	0.73	1.40			
	590SB004	0.65	1.20			
	590SB005	0.54	1.40			
	590SB006	2.30	NS			
Arsenic (As)	590SB001	6.20	13.40	0.43	23.90	19.90
	590SB002	8.90	13.20			
	590SB003	10.50	21.40			
	590SB004	5.20	14.80			
	590SB005	4.00	22.00			
	590SB006	21.50	NS			
Barium (Ba)	590SB001	19.50	37.90	550.00	130.00	94.10
	590SB002	31.40	53.70			
	590SB003	66.90	44.30			
	590SB004	15.70	21.70			
	590SB005	18.10	38.40			
	590SB006	133.00	NS			
Beryllium (Be)	590SB001	0.33	1.40	0.15	1.70	2.71
	590SB002	0.34	0.88			
	590SB003	0.83	1.20			
	590SB004	0.22	0.81			
	590SB005	0.25	1.30			
	590SB006	0.80	NS			
Cadmium (Cd)	590SB001	0.20	0.30	3.90	1.50	0.96
	590SB002	0.90	0.51			
	590SB003	0.49	0.43			
	590SB004	0.41	0.98			
	590SB005	0.15	0.43			
	590SB006	0.75	NS			
Calcium (Ca)	590SB001	15400.00	40000.00	NA	NA	NA
	590SB002	8860.00	60700.00			
	590SB003	61100.00	40500.00			
	590SB004	6730.00	146000.00			
	590SB005	10500.00	50900.00			
	590SB006	45500.00	NS			
Chromium (Cr)	590SB001	17.10	52.20	39.00	94.60	75.20
	590SB002	21.50	35.70			
	590SB003	73.10	55.40			
	590SB004	31.10	54.30			
	590SB005	79.10	45.30			
	590SB006	91.20	NS			

Chemicals Detected in Zone E Soil Samples
AOC 590

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Cobalt (Co)	590SB001	1.70	8.00	470.00	19.00	14.90
	590SB002	2.00	4.90			
	590SB003	9.90	9.10			
	590SB004	1.20	4.30			
	590SB005	2.50	8.80			
	590SB006	4.50	NS			
Copper (Cu)	590SB001	16.80	52.90	310.00	66.00	152.00
	590SB002	235.00	29.90			
	590SB003	30.70	39.50			
	590SB004	100.00	29.90			
	590SB005	98.20	43.60			
	590SB006	54.60	NS			
Iron (Fe)	590SB001	9380.00	33200.00	2300.00	NA	NA
	590SB002	9450.00	17700.00			
	590SB003	16100.00	27600.00			
	590SB004	5070.00	40500.00			
	590SB005	5890.00	32200.00			
	590SB006	18800.00	NS			
Lead (Pb)	590SB001	70.90	46.00	400.00	265.00	173.00
	590SB002	133.00	159.00			
	590SB003	301.00	99.50			
	590SB004	77.10	17.20			
	590SB005	26.00	52.50			
	590SB006	871.00	NS			
Magnesium (Mg)	590SB001	1620.00	5990.00	NA	NA	NA
	590SB002	909.00	6580.00			
	590SB003	5080.00	5950.00			
	590SB004	1180.00	6440.00			
	590SB005	2830.00	6880.00			
	590SB006	5220.00	NS			
Manganese (Mn)	590SB001	106.00	316.00	180.00	302.00	881.00
	590SB002	97.60	207.00			
	590SB003	239.00	366.00			
	590SB004	52.40	2160.00			
	590SB005	65.00	605.00			
	590SB006	239.00	NS			
Mercury (Hg)	590SB001	0.27	0.16	2.30	2.60	1.59
	590SB002	0.51	0.87			
	590SB003	0.40	0.28			
	590SB004	9.90	3.20			
	590SB005	0.74	0.50			
	590SB006	1.50	NS			
Nickel (Ni)	590SB001	6.50	18.40	160.00	77.10	57.00
	590SB002	22.80	18.90			
	590SB003	16.80	19.90			
	590SB004	6.80	19.90			
	590SB005	6.70	19.20			
	590SB006	21.10	NS			
Potassium (K)	590SB001	831.00	3170.00	NA	NA	NA

Chemicals Detected in Zone E Soil Samples
AOC 590

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	590SB002	685.00	1940.00			
	590SB003	1720.00	3420.00			
	590SB004	538.00	2230.00			
	590SB005	513.00	3470.00			
	590SB006	1080.00	NS			
Selenium (Se)	590SB001	1.10	2.20	39.00	1.70	2.40
	590SB002	ND	1.90			
	590SB003	1.60	1.40			
	590SB004	ND	2.90			
	590SB005	ND	2.10			
	590SB006	0.55	NS			
Sodium (Na)	590SB001	131.00	777.00	NA	NA	NA
	590SB002	88.30	455.00			
	590SB003	374.00	1630.00			
	590SB004	138.00	1540.00			
	590SB005	83.90	1520.00			
	590SB006	472.00	NS			
Tin (Sn)	590SB006	6.00	NS	4700.00	59.40	9.23
Vanadium (V)	590SB001	21.00	73.30	55.00	94.30	155.00
	590SB002	19.70	46.20			
	590SB003	39.90	67.00			
	590SB004	9.70	54.80			
	590SB005	13.80	73.10			
	590SB006	38.10	NS			
Zinc (Zn)	590SB001	67.40	170.00	2300.00	827.00	886.00
	590SB002	352.00	179.00			
	590SB003	184.00	158.00			
	590SB004	106.00	118.00			
	590SB005	84.00	176.00			
	590SB006	429.00	NS			

Notes:
ND: Not Detected
NS: No Sample Taken/Sample Not Analyzed
NA: Not applicable
For compounds detected in both the primary and duplicate sample, the concentration for both detections are averaged and listed as one detection.
For compounds that were detected in only one of the primary or duplicate sample, the value of the detection was used.
* Surface soil samples will be used for human health risk assessment for the Zone E report.

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Volatile Organic Compounds (ug/kg)						
2-Butanone (MEK)	102SB001	ND	24.00	4700000	NA	NA
	102SB003	ND	21.00			
	102SB005	8.00	ND			
	102SB007	ND	25.00			
	102SB008	ND	12.00			
	102SB009	ND	22.00			
Acetone	102SB046	59.00	ND	780000	NA	NA
Semi-volatile Compounds (ug/kg)						
2-Methylnaphthalene	102SB001	260.00	ND	NA	NA	NA
	102SB003	190.00	ND			
	102SB006	100.00	ND			
	102SB008	300.00	ND			
	102SB034	170.00	ND			
	102SB037	220.00	150.00			
	102SB039	320.00	89.00			
	102SB040	290.00	ND			
	102SB044	67.00	ND			
Acenaphthene	102SB001	460.00	140.00	470000	NA	NA
	102SB002	140.00	170.00			
	102SB003	530.00	ND			
	102SB004	425.00	1600.00			
	102SB006	300.00	ND			
	102SB008	ND	150.00			
	102SB034	160.00	110.00			
	102SB037	550.00	ND			
	102SB040	620.00	ND			
	102SB042	810.00	ND			
	102SB043	89.00	300.00			
	102SB045	380.00	ND			
Acenaphthylene	102SB001	ND	260.00	310000	NA	NA
	102SB004	ND	110.00			
	102SB035	ND	170.00			
	102SB036	520.00	ND			
	102SB037	2300.00	ND			
	102SB038	520.00	NS			
	102SB045	140.00	ND			
Anthracene	102SB001	780.00	390.00	23000000	NA	NA
	102SB002	400.00	600.00			
	102SB003	700.00	ND			
	102SB004	440.00	1900.00			
	102SB005	230.00	ND			
	102SB006	580.00	ND			
	102SB008	2300.00	130.00			
	102SB034	290.00	180.00			
	102SB035	ND	240.00			
	102SB036	360.00	ND			
	102SB037	2300.00	ND			
	102SB038	310.00	NS			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB040	2600.00	ND			
	102SB042	820.00	ND			
	102SB043	260.00	90.00			
	102SB044	ND	53.00			
	102SB045	140.00	ND			
Benzo(a)anthracene	102SB001	580.00	1600.00	880	NA	NA
	102SB002	1400.00	2200.00			
	102SB003	1500.00	ND			
	102SB004	630.00	1800.00			
	102SB005	980.00	ND			
	102SB006	470.00	ND			
	102SB007	ND	120.00			
	102SB008	2400.00	210.00			
	102SB034	1200.00	280.00			
	102SB035	ND	660.00			
	102SB036	2000.00	99.00			
	102SB037	10000.00	ND			
	102SB038	1800.00	NS			
	102SB039	320.00	210.00			
	102SB040	6700.00	110.00			
	102SB041	48.00	ND			
	102SB042	1700.00	79.00			
	102SB043	500.00	200.00			
	102SB044	ND	110.00			
	102SB045	740.00	ND			
	102SB046	69.00	ND			
Benzo(a)pyrene	102SB001	500.00	1300.00	88	NA	NA
	102SB002	980.00	1800.00			
	102SB003	1300.00	ND			
	102SB004	620.00	1300.00			
	102SB005	890.00	ND			
	102SB006	520.00	ND			
	102SB007	ND	120.00			
	102SB008	1800.00	170.00			
	102SB034	1200.00	230.00			
	102SB035	ND	1900.00			
	102SB036	2800.00	110.00			
	102SB037	8200.00	ND			
	102SB038	3000.00	NS			
	102SB040	6100.00	150.00			
	102SB041	46.00	ND			
	102SB042	1700.00	100.00			
	102SB043	500.00	ND			
	102SB044	ND	90.00			
	102SB045	2100.00	ND			
	102SB046	66.00	ND			
Benzo(b)fluoranthene	102SB002	1100.00	ND	8800	NA	NA
	102SB003	1100.00	ND			
	102SB004	590.00	1100.00			
	102SB006	350.00	ND			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB008	1600.00	140.00			
	102SB034	1300.00	260.00			
	102SB035	ND	2600.00			
	102SB036	3900.00	140.00			
	102SB037	11000.00	390.00			
	102SB038	4200.00	NS			
	102SB040	6600.00	170.00			
	102SB041	51.00	ND			
	102SB042	1600.00	150.00			
	102SB043	460.00	ND			
	102SB044	ND	78.00			
	102SB045	1800.00	ND			
Benzo(g,h,i)perylene	102SB001	320.00	610.00	310000	NA	NA
	102SB002	960.00	1100.00			
	102SB003	1100.00	ND			
	102SB004	480.00	870.00			
	102SB005	710.00	ND			
	102SB006	420.00	ND			
	102SB007	ND	340.00			
	102SB008	1200.00	170.00			
	102SB034	890.00	ND			
	102SB035	ND	650.00			
	102SB036	2600.00	ND			
	102SB037	9400.00	ND			
	102SB038	3200.00	NS			
	102SB040	2000.00	ND			
	102SB042	500.00	ND			
	102SB043	450.00	ND			
	102SB045	1400.00	ND			
Benzo(k)fluoranthene	102SB001	490.00	1400.00	8800	NA	NA
	102SB002	680.00	2400.00			
	102SB003	1000.00	ND			
	102SB004	455.00	1300.00			
	102SB005	1200.00	ND			
	102SB006	610.00	ND			
	102SB008	1600.00	210.00			
	102SB034	1000.00	350.00			
	102SB035	ND	2700.00			
	102SB036	3550.00	210.00			
	102SB037	9300.00	ND			
	102SB038	3200.00	NS			
	102SB040	5200.00	140.00			
	102SB041	53.00	ND			
	102SB042	1700.00	110.00			
	102SB043	430.00	ND			
	102SB044	ND	100.00			
	102SB045	1700.00	ND			
	102SB046	77.00	ND			
Benzoic acid	102SB040	ND	120.00	31000000	NA	NA
	102SB041	39.00	130.00			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB042	46.00	110.00			
	102SB045	85.00	ND			
bis(2-Ethylhexyl)phthalate (BEHP)	102SB004	ND	220.00	4600	NA	NA
	102SB034	600.00	ND			
	102SB036	140.00	ND			
	102SB037	480.00	ND			
	102SB042	44.00	64.00			
Butylbenzylphthalate	102SB045	2100.00	170.00	1600000	NA	NA
Chrysene	102SB001	810.00	2000.00	88000	NA	NA
	102SB002	1200.00	2000.00			
	102SB003	1800.00	ND			
	102SB004	740.00	2000.00			
	102SB005	980.00	ND			
	102SB006	770.00	ND			
	102SB008	3000.00	380.00			
	102SB009	120.00	ND			
	102SB034	1400.00	380.00			
	102SB035	ND	1000.00			
	102SB036	2650.00	160.00			
	102SB037	8400.00	950.00			
	102SB038	2300.00	NS			
	102SB039	410.00	230.00			
	102SB040	7800.00	120.00			
	102SB041	50.00	ND			
	102SB042	1800.00	100.00			
	102SB043	620.00	230.00			
	102SB044	51.00	210.00			
	102SB045	840.00	ND			
	102SB046	90.00	ND			
Di-n-butylphthalate	102SB007	280.00	ND	7800000	NA	NA
	102SB044	59.00	ND			
	102SB045	ND	63.00			
Dibenz(a,h)anthracene	102SB001	100.00	380.00	88000	NA	NA
	102SB002	540.00	550.00			
	102SB003	500.00	ND			
	102SB004	140.00	460.00			
	102SB005	310.00	ND			
	102SB006	110.00	ND			
	102SB008	600.00	ND			
	102SB035	ND	360.00			
	102SB036	1180.00	ND			
	102SB037	6300.00	ND			
	102SB038	1500.00	NS			
	102SB040	430.00	ND			
	102SB042	140.00	ND			
	102SB045	560.00	ND			
Dibenzofuran	102SB001	540.00	140.00	31000	NA	NA
	102SB002	ND	130.00			
	102SB003	160.00	ND			
	102SB004	220.00	850.00			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB008	290.00	ND			
	102SB034	120.00	65.00			
	102SB035	ND	70.00			
	102SB037	520.00	ND			
	102SB039	99.00	ND			
	102SB042	180.00	ND			
	102SB045	110.00	ND			
Fluoranthene	102SB001	1300.00	2300.00	3100000	NA	NA
	102SB002	2500.00	3300.00			
	102SB003	2200.00	ND			
	102SB004	1800.00	6400.00			
	102SB005	1600.00	ND			
	102SB006	1300.00	ND			
	102SB007	ND	110.00			
	102SB008	7000.00	450.00			
	102SB009	230.00	ND			
	102SB034	2000.00	800.00			
	102SB035	ND	1800.00			
	102SB036	1950.00	120.00			
	102SB037	10000.00	ND			
	102SB038	1400.00	NS			
	102SB039	330.00	200.00			
	102SB040	16000.00	170.00			
	102SB041	78.00	79.00			
	102SB042	2400.00	190.00			
	102SB043	1100.00	780.00			
	102SB044	72.00	190.00			
	102SB045	640.00	120.00			
	102SB046	130.00	ND			
Fluorene	102SB001	750.00	270.00	310000	NA	NA
	102SB002	120.00	240.00			
	102SB003	470.00	ND			
	102SB004	335.00	1400.00			
	102SB005	100.00	ND			
	102SB006	170.00	ND			
	102SB008	1400.00	270.00			
	102SB009	ND	260.00			
	102SB034	200.00	99.00			
	102SB037	740.00	ND			
	102SB040	690.00	ND			
	102SB042	370.00	ND			
	102SB043	82.00	97.00			
Indeno(1,2,3-cd)pyrene	102SB001	320.00	540.00	880	NA	NA
	102SB002	2200.00	1000.00			
	102SB003	780.00	ND			
	102SB004	395.00	750.00			
	102SB005	540.00	ND			
	102SB006	310.00	ND			
	102SB008	1100.00	ND			
	102SB034	760.00	ND			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB035	ND	680.00			
	102SB036	2300.00	ND			
	102SB037	8000.00	ND			
	102SB038	2700.00	NS			
	102SB040	2300.00	ND			
	102SB042	600.00	ND			
	102SB043	310.00	ND			
	102SB045	1400.00	ND			
Naphthalene	102SB001	460.00	ND	310000	NA	NA
	102SB003	200.00	ND			
	102SB006	120.00	ND			
	102SB034	ND	51.00			
	102SB035	ND	83.00			
	102SB036	ND	48.00			
	102SB037	540.00	76.00			
	102SB039	210.00	ND			
	102SB041	190.00	ND			
	102SB042	84.00	ND			
	102SB043	99.00	ND			
	102SB045	140.00	ND			
Phenanthrene	102SB001	3200.00	1600.00	310000	NA	NA
	102SB002	2200.00	1900.00			
	102SB003	3000.00	ND			
	102SB004	1195.00	7400.00			
	102SB005	900.00	ND			
	102SB006	1600.00	ND			
	102SB008	7100.00	720.00			
	102SB009	300.00	230.00			
	102SB034	1900.00	310.00			
	102SB035	ND	170.00			
	102SB036	450.00	120.00			
	102SB037	7500.00	590.00			
	102SB038	330.00	NS			
	102SB039	410.00	180.00			
	102SB040	9600.00	60.00			
	102SB042	2500.00	110.00			
	102SB043	420.00	ND			
	102SB044	100.00	170.00			
	102SB045	240.00	63.00			
	102SB046	66.00	ND			
Pyrene	102SB001	1200.00	2900.00	230000	NA	NA
	102SB002	3000.00	4500.00			
	102SB003	5000.00	ND			
	102SB004	1650.00	5300.00			
	102SB005	1800.00	ND			
	102SB006	1600.00	ND			
	102SB007	ND	120.00			
	102SB008	5700.00	450.00			
	102SB009	220.00	ND			
	102SB034	2600.00	1200.00			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB035	ND	4300.00			
	102SB036	4650.00	210.00			
	102SB037	17000.00	370.00			
	102SB038	5100.00	NS			
	102SB039	590.00	390.00			
	102SB040	16000.00	230.00			
	102SB041	90.00	79.00			
	102SB042	3800.00	220.00			
	102SB043	2400.00	1600.00			
	102SB044	100.00	280.00			
	102SB045	2800.00	160.00			
	102SB046	120.00	ND			
Chlorinated Pesticides (ug/kg)						
4,4'-DDD	102SB034	87.00	9.40	2700	NA	NA
	102SB035	15.00	ND			
	102SB036	13.90	ND			
	102SB037	8.40	ND			
4,4'-DDE	102SB034	190.00	19.00	19000	NA	NA
	102SB035	35.00	ND			
	102SB036	27.50	ND			
	102SB037	31.00	ND			
	102SB038	32.00	NS			
4,4'-DDT	102SB034	220.00	25.00	1900	NA	NA
	102SB035	41.00	ND			
	102SB036	93.50	ND			
	102SB037	230.00	12.00			
	102SB038	130.00	NS			
	102SB039	12.00	ND			
	102SB043	8.50	ND			
alpha-Chlordane	102SB034	14.00	ND	490	NA	NA
	102SB036	5.00	ND			
delta-BHC	102SB001	13.00	22.00	350	NA	NA
Dieldrin	102SB034	5.40	ND	40	NA	NA
	102SB036	ND	7.00			
	102SB037	ND	15.00			
Endrin	102SB036	ND	6.20	23000	NA	NA
Endrin aldehyde	102SB037	3.40	ND	2300	NA	NA
Endrin ketone	102SB034	20.00	ND	2300	NA	NA
	102SB036	7.90	ND			
gamma-Chlordane	102SB034	53.00	ND	490	NA	NA
	102SB036	39.50	ND			
	102SB037	4.10	6.20			
	102SB038	11.00	NS			
Heptachlor	102SB034	2.40	ND	140	NA	NA
Heptachlor epoxide	102SB034	8.90	ND	70	NA	NA
	102SB036	2.30	ND			
Methoxychlor	102SB034	42.00	ND	390000	NA	NA
	102SB036	19.00	ND			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Dioxin/Dibenzofuran (ng/kg)						
1234678-HpCDD	102CB004	6.79	NS	NA	NA	NA
OCDD	102CB004	63.50	NS	NA	NA	NA
Total Hepta-Dioxins	102CB004	22.00	NS	NA	NA	NA
Total Hexa-Dioxins	102CB004	14.40	NS	NA	NA	NA
Inorganic Compounds (mg/kg)						
Cyanide (CN)	102SB036	1.15	0.36	73	0.5	NA
	102SB037	0.22	ND			
	102SB038	1.30	NS			
	102SB039	ND	0.29			
Aluminum (Al)	102SB001	6930.00	19000.00	7800	26000	41100
	102SB002	10500.00	7980.00			
	102SB003	8740.00	12200.00			
	102SB004	7325.00	13200.00			
	102SB005	7040.00	8710.00			
	102SB006	5910.00	14800.00			
	102SB007	2380.00	12200.00			
	102SB008	12500.00	20300.00			
	102SB009	9850.00	22000.00			
	102SB034	4320.00	4760.00			
	102SB035	2530.00	2190.00			
	102SB036	5975.00	2760.00			
	102SB037	3040.00	1110.00			
	102SB038	5650.00	NS			
	102SB039	6460.00	6540.00			
	102SB040	9590.00	20700.00			
	102SB041	5075.00	23000.00			
	102SB042	8180.00	21400.00			
	102SB043	9160.00	10600.00			
	102SB044	8370.00	11100.00			
	102SB045	6330.00	8320.00			
	102SB046	10500.00	3610.00			
Antimony (Sb)	102SB001	1.20	0.90	3.1	1.77	1.6
	102SB002	1.60	ND			
	102SB003	0.76	1.50			
	102SB004	0.73	0.74			
	102SB005	0.60	1.00			
	102SB006	ND	1.10			
	102SB007	ND	1.10			
	102SB008	0.93	1.00			
	102SB009	0.66	1.00			
	102SB034	9.00	1.50			
	102SB035	ND	1.00			
	102SB036	ND	10.30			
	102SB037	ND	2.40			
	102SB043	1.00	1.50			
	102SB044	1.10	1.30			
	102SB045	1.00	0.94			
	102SB046	1.90	ND			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Arsenic (As)	102SB001	9.90	19.80	0.43	23.9	19.9
	102SB002	14.30	7.80			
	102SB003	12.30	19.00			
	102SB004	8.35	13.90			
	102SB005	9.50	11.80			
	102SB006	6.50	11.50			
	102SB007	3.10	12.90			
	102SB008	13.40	22.20			
	102SB009	8.50	23.60			
	102SB034	27.80	6.80			
	102SB035	13.10	8.20			
	102SB036	25.80	64.10			
	102SB037	23.50	38.30			
	102SB038	27.20	NS			
	102SB039	9.40	12.10			
	102SB040	10.60	23.00			
	102SB041	1.95	47.00			
	102SB042	7.10	18.90			
	102SB043	9.00	9.40			
	102SB044	9.20	10.10			
	102SB045	10.60	10.70			
	102SB046	9.40	3.20			
Barium (Ba)	102SB001	34.60	37.00	550	130	94.1
	102SB002	78.50	29.10			
	102SB003	42.00	141.00			
	102SB004	22.80	38.30			
	102SB005	27.60	30.00			
	102SB006	22.40	36.60			
	102SB007	15.50	29.40			
	102SB008	38.50	109.00			
	102SB009	32.50	37.60			
	102SB034	ND	60.60			
	102SB035	ND	10.20			
	102SB036	ND	262.00			
	102SB037	ND	42.60			
	102SB043	25.90	28.40			
	102SB044	24.20	26.40			
	102SB045	23.90	21.90			
	102SB046	42.80	6.40			
Beryllium (Be)	102SB001	0.55	1.30	0.15	1.7	2.71
	102SB002	0.76	0.59			
	102SB003	0.69	1.10			
	102SB004	0.64	0.84			
	102SB005	0.60	0.74			
	102SB006	0.45	1.00			
	102SB007	0.31	1.00			
	102SB008	0.77	1.10			
	102SB009	0.66	1.20			
	102SB034	0.66	0.28			
	102SB036	0.47	0.51			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB037	0.52	0.54			
	102SB038	0.38	NS			
	102SB039	0.37	0.38			
	102SB040	0.39	1.40			
	102SB041	ND	1.30			
	102SB042	0.37	1.20			
	102SB043	0.81	0.92			
	102SB044	0.73	0.85			
	102SB045	0.65	0.90			
	102SB046	0.76	0.21			
Cadmium (Cd)	102SB001	1.30	0.90	3.9	1.5	0.96
	102SB002	1.20	0.43			
	102SB003	0.68	2.80			
	102SB004	0.34	0.45			
	102SB005	0.48	0.51			
	102SB006	0.34	0.41			
	102SB007	ND	0.28			
	102SB008	0.67	1.20			
	102SB009	0.44	0.99			
	102SB034	0.39	0.16			
	102SB036	0.66	1.40			
	102SB037	0.60	1.30			
	102SB038	0.44	NS			
	102SB039	0.91	1.70			
	102SB040	0.25	0.22			
	102SB042	0.14	0.24			
	102SB043	0.18	ND			
	102SB044	0.33	0.21			
	102SB045	1.10	ND			
	102SB046	0.51	ND			
Calcium (Ca)	102SB001	41700.00	20100.00	NA	NA	NA
	102SB002	42300.00	40400.00			
	102SB003	49600.00	23000.00			
	102SB004	42050.00	50000.00			
	102SB005	44600.00	50200.00			
	102SB006	29800.00	23100.00			
	102SB007	27700.00	20500.00			
	102SB008	48800.00	68100.00			
	102SB009	42100.00	38800.00			
	102SB034	27200.00	19900.00			
	102SB035	8060.00	957.00			
	102SB036	53550.00	13200.00			
	102SB037	79000.00	2730.00			
	102SB038	79400.00	NS			
	102SB039	18200.00	14700.00			
	102SB040	16400.00	20900.00			
	102SB041	4820.00	17600.00			
	102SB042	12100.00	53300.00			
	102SB043	52400.00	35400.00			
	102SB044	47700.00	41100.00			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB045	40800.00	22800.00			
	102SB046	40000.00	1310.00			
Chromium (Cr)	102SB001	19.00	37.30	39	94.6	75.2
	102SB002	26.30	20.50			
	102SB003	21.40	27.80			
	102SB004	18.50	28.40			
	102SB005	18.00	22.10			
	102SB006	14.80	30.40			
	102SB007	6.60	27.00			
	102SB008	29.30	46.30			
	102SB009	22.70	48.50			
	102SB034	34.60	9.90			
	102SB035	4.50	3.10			
	102SB036	22.15	22.50			
	102SB037	21.90	3.50			
	102SB038	20.20	NS			
	102SB039	14.30	17.70			
	102SB040	140.00	40.20			
	102SB041	147.00	40.20			
	102SB042	90.10	44.50			
	102SB043	24.40	24.80			
	102SB044	22.50	25.80			
	102SB045	17.90	20.60			
	102SB046	25.40	7.40			
Cobalt (Co)	102SB001	11.80	7.80	470	19	14.9
	102SB002	4.00	2.70			
	102SB003	3.30	7.90			
	102SB004	4.30	3.90			
	102SB005	2.70	3.50			
	102SB006	4.10	4.80			
	102SB007	5.50	6.00			
	102SB008	4.60	7.60			
	102SB009	3.10	6.50			
	102SB034	33.60	3.00			
	102SB035	554.00	0.46			
	102SB036	63.65	8.50			
	102SB037	61.30	3.30			
	102SB038	70.70	NS			
	102SB039	6.20	4.30			
	102SB040	9.30	8.70			
	102SB041	26.30	10.00			
	102SB042	48.80	8.20			
	102SB043	17.80	4.10			
	102SB044	7.20	3.90			
	102SB045	5.80	4.40			
	102SB046	263.00	1.60			
Copper (Cu)	102SB001	28.50	37.00	310	66	152
	102SB002	40.00	15.30			
	102SB003	30.20	306.00			
	102SB004	14.45	33.30			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB005	18.00	24.50			
	102SB006	14.60	30.20			
	102SB007	2.40	32.10			
	102SB008	25.10	38.50			
	102SB009	15.60	39.00			
	102SB034	197.00	24.60			
	102SB035	14.70	4.90			
	102SB036	74.75	121.00			
	102SB037	168.00	22.60			
	102SB038	54.80	NS			
	102SB039	73.20	548.00			
	102SB040	185.00	47.50			
	102SB041	4.30	48.70			
	102SB042	23.90	34.40			
	102SB043	18.00	19.80			
	102SB044	18.50	22.30			
	102SB045	20.00	20.40			
	102SB046	120.00	1.40			
Iron (Fe)	102SB001	17800.00	23200.00	2300	NA	NA
	102SB002	17400.00	10900.00			
	102SB003	14400.00	30600.00			
	102SB004	11200.00	15900.00			
	102SB005	12000.00	14200.00			
	102SB006	8120.00	20200.00			
	102SB007	4360.00	22100.00			
	102SB008	16800.00	27100.00			
	102SB009	12400.00	31600.00			
	102SB034	9370.00	5420.00			
	102SB035	2680.00	6670.00			
	102SB036	9360.00	56800.00			
	102SB037	11500.00	6240.00			
	102SB038	17900.00	NS			
	102SB039	11300.00	21500.00			
	102SB040	10100.00	28800.00			
	102SB041	3130.00	34500.00			
	102SB042	10500.00	31200.00			
	102SB043	10900.00	15400.00			
	102SB044	12800.00	15300.00			
	102SB045	10900.00	15200.00			
	102SB046	13800.00	4690.00			
Lead (Pb)	102SB001	387.00	51.30	400	265	173
	102SB002	434.00	110.00			
	102SB003	415.00	809.00			
	102SB004	61.10	114.00			
	102SB005	229.00	137.00			
	102SB006	86.50	53.70			
	102SB007	5.70	61.40			
	102SB008	106.00	121.00			
	102SB009	60.20	44.00			
	102SB034	260.00	43.00			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB035	31.40	21.90			
	102SB036	290.50	9930.00			
	102SB037	190.00	53.10			
	102SB038	98.00	NS			
	102SB039	919.00	3700.00			
	102SB040	83.80	70.60			
	102SB041	10.20	46.60			
	102SB042	33.20	43.40			
	102SB043	58.00	25.90			
	102SB044	36.90	39.70			
	102SB045	253.00	35.00			
	102SB046	754.00	ND			
Magnesium (Mg)	102SB001	3030.00	4550.00	NA	NA	NA
	102SB002	5020.00	3020.00			
	102SB003	3960.00	4490.00			
	102SB004	3455.00	4460.00			
	102SB005	3380.00	4060.00			
	102SB006	2640.00	4400.00			
	102SB007	488.00	4280.00			
	102SB008	4320.00	6930.00			
	102SB009	3020.00	5090.00			
	102SB034	1300.00	792.00			
	102SB035	ND	144.00			
	102SB036	1225.00	646.00			
	102SB037	1610.00	195.00			
	102SB038	1280.00	NS			
	102SB039	1520.00	1930.00			
	102SB040	4140.00	4930.00			
	102SB041	4680.00	4860.00			
	102SB042	3700.00	6620.00			
	102SB043	5150.00	3550.00			
	102SB044	4010.00	3730.00			
	102SB045	3360.00	3780.00			
	102SB046	4420.00	771.00			
Manganese (Mn)	102SB001	206.00	166.00	180	302	881
	102SB002	269.00	142.00			
	102SB003	214.00	291.00			
	102SB004	167.00	215.00			
	102SB005	387.00	213.00			
	102SB006	98.60	245.00			
	102SB007	37.40	138.00			
	102SB008	224.00	495.00			
	102SB009	152.00	716.00			
	102SB034	66.10	63.50			
	102SB035	27.80	32.80			
	102SB036	108.86	244.00			
	102SB037	138.00	30.20			
	102SB038	163.00	NS			
	102SB039	84.20	123.00			
	102SB040	77.60	330.00			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB041	26.10	517.00			
	102SB042	95.30	863.00			
	102SB043	212.00	217.00			
	102SB044	168.00	235.00			
	102SB045	190.00	169.00			
	102SB046	145.00	14.90			
Mercury (Hg)	102SB001	4.60	2.40	2.3	2.6	1.59
	102SB002	17.10	6.40			
	102SB003	11.10	2.50			
	102SB004	1.35	1.10			
	102SB005	9.60	3.40			
	102SB006	1.20	0.23			
	102SB007	0.06	0.18			
	102SB008	27.30	8.10			
	102SB009	2.70	1.30			
	102SB013	20.20	1.90			
	102SB014	0.16	NS			
	102SB015	0.18	ND			
	102SB016	0.93	0.11			
	102SB017	0.93	1.60			
	102SB018	18.60	11.70			
	102SB019	0.28	NS			
	102SB020	ND	0.26			
	102SB021	0.05	0.22			
	102SB022	0.18	0.17			
	102SB023	ND	0.17			
	102SB025	0.16	0.65			
	102SB027	0.07	ND			
	102SB029	ND	0.07			
	102SB030	0.08	0.09			
	102SB031	ND	0.69			
	102SB032	0.09	0.05			
	102SB033	0.06	0.15			
	102SB034	0.38	0.49			
	102SB035	0.06	0.15			
	102SB036	1.50	0.83			
	102SB037	0.49	0.32			
	102SB038	0.49	NS			
	102SB039	2.00	4.80			
	102SB040	5.90	0.28			
	102SB041	0.08	0.11			
	102SB042	0.31	0.64			
	102SB043	1.10	0.19			
	102SB044	1.30	6.20			
	102SB045	21.50	0.29			
	102SB046	4.20	ND			
Nickel (Ni)	102SB001	10.00	16.40	160	77.1	57
	102SB002	10.00	8.50			
	102SB003	10.30	14.80			
	102SB004	8.90	11.40			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB005	8.90	9.50			
	102SB006	7.50	12.10			
	102SB007	3.30	11.30			
	102SB008	12.40	18.00			
	102SB009	10.20	17.70			
	102SB034	33.70	4.70			
	102SB035	56.50	1.70			
	102SB036	20.25	15.50			
	102SB037	14.70	7.50			
	102SB038	17.80	NS			
	102SB039	7.80	10.50			
	102SB040	9.10	15.50			
	102SB041	4.50	13.50			
	102SB042	9.40	16.40			
	102SB043	12.00	9.40			
	102SB044	9.50	10.50			
	102SB045	9.60	8.70			
	102SB046	134.00	1.60			
Potassium (K)	102SB001	ND	3610.00	NA	NA	NA
	102SB003	ND	2920.00			
	102SB006	ND	2890.00			
	102SB008	ND	2950.00			
	102SB009	ND	3520.00			
	102SB034	ND	375.00			
	102SB036	ND	280.00			
	102SB040	ND	2150.00			
	102SB041	ND	2250.00			
	102SB043	1370.00	1350.00			
	102SB044	1160.00	1340.00			
	102SB045	1130.00	1770.00			
	102SB046	2030.00	601.00			
Selenium (Se)	102SB001	1.20	1.10	39	1.7	2.4
	102SB002	0.92	1.30			
	102SB003	0.86	1.80			
	102SB004	1.20	1.30			
	102SB005	ND	0.99			
	102SB006	0.73	1.40			
	102SB007	ND	1.10			
	102SB008	1.50	1.20			
	102SB009	1.10	1.60			
	102SB040	ND	1.50			
Silver (Ag)	102SB006	0.97	ND	39	NA	NA
	102SB007	1.40	ND			
	102SB034	0.25	ND			
	102SB035	11.00	ND			
	102SB036	1.03	ND			
	102SB037	0.40	ND			
	102SB038	0.36	NS			
Sodium (Na)	102SB001	1100.00	2260.00	NA	NA	NA
	102SB002	385.00	512.00			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB003	958.00	1400.00			
	102SB004	1175.00	1460.00			
	102SB005	356.00	479.00			
	102SB006	1290.00	2870.00			
	102SB007	300.00	327.00			
	102SB008	764.00	935.00			
	102SB009	643.00	782.00			
	102SB034	ND	392.00			
	102SB035	ND	188.00			
	102SB036	ND	327.00			
	102SB037	ND	271.00			
	102SB043	724.00	538.00			
	102SB044	1110.00	1130.00			
	102SB045	1550.00	2640.00			
	102SB046	1870.00	1050.00			
Thallium (Tl)	102SB036	ND	3.30	0.29	2.8	NA
Tin (Sn)	102SB034	43.20	ND	4700	59.4	9.23
	102SB036	7.45	26.60			
	102SB037	10.60	ND			
	102SB038	5.70	NS			
	102SB039	4.50	7.30			
	102SB040	2.60	ND			
Vanadium (V)	102SB001	21.40	66.00	55	94.3	155
	102SB002	30.80	21.20			
	102SB003	28.50	48.90			
	102SB004	24.00	36.00			
	102SB005	21.40	31.70			
	102SB006	17.60	47.70			
	102SB007	6.60	52.70			
	102SB008	35.20	62.10			
	102SB009	24.60	74.50			
	102SB034	14.10	10.00			
	102SB035	22.80	3.60			
	102SB036	17.35	12.80			
	102SB037	10.90	8.70			
	102SB038	14.30	NS			
	102SB039	16.70	16.30			
	102SB040	19.90	73.80			
	102SB041	8.00	76.00			
	102SB042	20.50	59.00			
	102SB043	27.10	35.50			
	102SB044	26.00	34.00			
	102SB045	23.40	34.10			
	102SB046	25.80	10.30			
Zinc (Zn)	102SB001	502.00	293.00	2300	827	886
	102SB002	1130.00	316.00			
	102SB003	391.00	2340.00			
	102SB004	94.35	147.00			
	102SB005	268.00	480.00			
	102SB006	78.30	122.00			

Chemicals Detected in Zone E Soil Samples
SWMU 102

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	102SB007	11.00	140.00			
	102SB008	291.00	514.00			
	102SB009	128.00	148.00			
	102SB034	573.00	71.00			
	102SB035	26.10	32.80			
	102SB036	268.50	1010.00			
	102SB037	295.00	322.00			
	102SB038	146.00	NS			
	102SB039	490.00	1010.00			
	102SB040	188.00	244.00			
	102SB041	ND	178.00			
	102SB042	69.80	139.00			
	102SB043	101.00	74.40			
	102SB044	275.00	256.00			
	102SB045	207.00	89.30			
	102SB046	330.00	9.70			

Notes:
ND: Not Detected
NS: No Sample Taken/Sample Not Analyzed
NA: Not applicable
For compounds detected in both the primary and duplicate sample, the concentration for both detections are averaged and listed as one detection.
For compounds that were detected in only one of the primary or duplicate sample, the value of the detection was used.
* Surface soil samples will be used for human health risk assessment for the Zone E report.

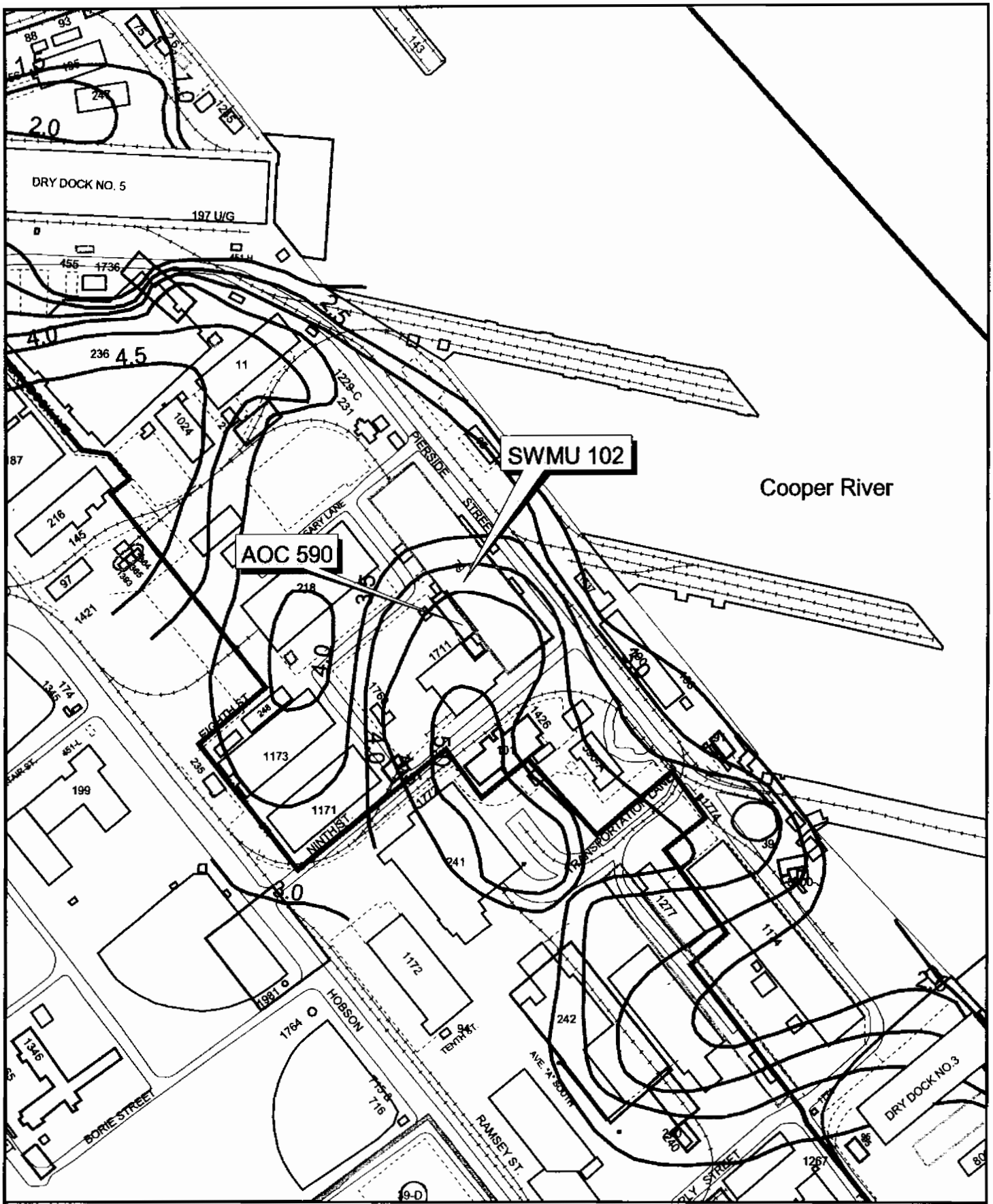

Figure A-1
Shallow Groundwater Contour Map, May 2002
SWMU 102 and AOC 590, Zone E
Charleston Naval Complex

CH2MHILL

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Appendix B

CHARLES B. WATSON COMMENTS

Comment 8:

The Navy should investigate the level of cleanup conducted in 1969 for the mercury spill. The information should assist with the determination of contamination and exact location of the spill.

Navy/EnSafe Response:

Intense scrutiny by the Project Team resulted in an expanded investigation of this site. All available records were researched and interviews of former employees were conducted in order to determine where the spill occurred. The area of investigation was expanded several times to cover the entire building area after the initial investigation revealed no source. All results were documented and reviewed by the Project Team for several consecutive months and it was agreed upon by the Team that all investigative efforts had been exhausted. The Final Zone E RFI Report will be revised to reflect the level of effort put forth to investigate this site.

CH2M-Jones Response:

No additional response.

Comment 9:

The report indicates that the mercury release was discovered inside the central portion of the building; however, samples 102SB0101 and 102SB011, and 102SB012 (located along southwest edge of building) were sampled for mercury vapor. The navy should sample in locations closer to the approximate release area. Also, the Navy must sample for mercury in the lower soil interval.

Navy/EnSafe Response:

Mercury vapor samples (see Section 10.14.5) were collected at each of the soil sample locations shown on Figure 10.14.1. Lower-interval soil samples were collected at 39 of the 46 proposed locations. These results are presented in Section 10.14.2.

CH2M-Jones Response:

No additional response.

Comment 24:

Section 10.43.7 reports "two storm sewer inlets" exists at the AOC. Only one sewer inlet was sampled for the investigation. Please verify the existence or absence of the other inlet. Also, has the Navy performed an interim measure on the sediment to date?

Navy/EnSafe Response:

Only one storm drain was present at the site during the investigation. It appeared that the other drain had been paved over, therefore a sample could not be collected. The existing catch basin was cleaned during interim measures conducted by the

Environmental Detachment Charleston. Details of the cleaning can be found in the Closure Report for AOC 699 Storm Drain Cleaning prepared on March 8, 1999.

CH2M-Jones Response:

No additional response.

ERIC F. CATHCART COMMENTS

Comment 26:

Page 10.14-13. Line 11 states "Gasoline (TPH-GRO) was detected." Additional samples should be collected in the effected well for petroleum constituents.

Navy/EnSafe Response:

TPH, as a single component, was not considered a COPC for two reasons: 1) the TPH analysis was used as a screening tool for subsequent specific analysis; and 2) because TPH did not have an RBC value specifically assigned to it. But because TPH is composed of numerous organic compounds, commonly called surrogate compounds, the toxicity of TPH can be evaluated when reviewing VOC and SVOC data. The SCDHEC Risk-Based Corrective Action For Petroleum Releases document (June 1995) has identified certain VOCs and SVOCs (Table 8; RBSLs for Ingestion or Dermal Contact with Surficial Soil) found in TPH which pose a toxicity risk. Specifically to Section 10.14.2, four of the SVOC compounds were identified as exceeding their respective RBC values. After evaluating the results, calculating the BEQs, and going through the toxicity assessment, BEQs were identified as both a Human Health Risk COPC and as a COC at SWMU 102 for surficial soil. BEQs were identified as needing further evaluation as part of the CMS process. Please refer to the memorandum attached to the Zone C CMS Work Plan entitled "Use of TPH and TIC Analytical Results for RFI Evaluation at CNC." The Navy feels that the specific components of TPH and their subsequent evaluation of them have been adequately addressed in the RFI report, therefore, no additional samples will be collected for TPH.

CH2M-Jones Response:

No additional response.

Comment 27:

Soil data for Arsenic on page 10.14-14 should be summarized in an isoconcentration map.

Navy/EnSafe Response:

There appears to be a sufficient number of sample points at this particular site, therefore, isoconcentration maps for arsenic will be presented in the Final Zone E RFI Report.

CH2M-Jones Response:

Isoconcentration maps for soil contaminants do not accurately represent soil contamination, since no plume is formed from inorganics in soil. Therefore, an isoconcentration map is not necessary to depict soil concentrations of arsenic.

Comment 28:

The reason for the particular well locations is not clear. The current locations may not be monitoring the area of mercury release. The Department recommends installation of additional wells.

Navy/EnSafe Response:

The Navy will collect additional soil samples at several locations which exceeded generic SSLs. These samples will be analyzed for the constituents which exceeded their respective SSLs according to the Synthetic Precipitation Leaching Procedure (SPLP), and for TOC content. Results will be reviewed and the need for additional monitoring wells will be determined.

CH2M-Jones Response:

Detections of soil COCs identified in the RFI Report Addendum and CMS Work Plan for SWMU 102 and AOC 590, Revision 0, *(BEQs, lead, and mercury) were not detected above groundwater screening criteria in the wells installed at AOC 590 and SWMU 102. No additional monitoring well installations appear to be warranted at this time.*

Comment 29:

Page 10.14-20 states "the current soil-groundwater equilibrium is protective of the surficial aquifer." The location of the well is not specific to the location of the contaminant. The Department recommends placing a well in the area of the maximum reported concentration.

Navy/EnSafe Response:

Please see response to Comment 28.

CH2M-Jones Response:

Please see CH2M-Jones' response to Comment 28.

Comment 30:

Page 10.14-23. The Navy has installed an inadequate number of wells to support the statement, "the current distribution of mercury concentration in soil appears to be protective of groundwater at the site".

Navy/EnSafe Response:

Please see response to Comment 28.

CH2M-Jones Response:

Please see CH2M-Jones' response to Comment 28.

Comment 31:

Page 10.14-36. Were the sample depths for 102CB004 and 102SB041 the same?

Navy/EnSafe Response:

Yes, surface soil samples were collected from the 0- to 1-foot interval at each location.

CH2M-Jones Response:

No additional response.

AOC 590

Comment 66:

Five soil samples were submitted to be analyzed for TPH due to elevated OVA readings and petroleum odor in samples. The Navy reported levels of TPH-gasoline detected in one upper-interval soil sample. Additional sampling should be conducted to identify the source of the gasoline.

Navy/EnSafe Response:

TPH, as a single component, was not considered a COPC for two reasons: 1) the TPH analysis was used as a screening tool for subsequent specific analysis; and 2) because TPH did not have an RBC value specifically assigned to it. But because TPH is composed of numerous organic compounds, commonly called surrogate compounds, the toxicity of TPH can be evaluated when reviewing VOC and SVOC data. The SCDHEC Risk-Based Corrective Action For Petroleum Releases document (June 1995) has identified certain VOCs and SVOCs (Table 8; RBSLs for Ingestion or Dermal Contact with Surficial Soil) found in TPH which pose a toxicity risk. Specifically to Section 10.14.2, four of the SVOC compounds were identified as exceeding their respective RBC values. After evaluating the results, calculating the BEQs, and going through the toxicity assessment, BEQs were identified as both a Human Health Risk COPC and as a COC at AOC 590 for surficial soil. BEQs were identified as needing further evaluation as part of the CMS process. Please refer to the memorandum attached to the Zone C CMS Work Plan entitled "Use of TPH and TIC Analytical Results for RFI Evaluation at CNC." The Navy feels that the specific components of TPH and their subsequent evaluation of them have been adequately addressed in the RFI report, therefore, no additional samples will be collected for TPH.

CH2M-Jones Response:

No additional response.

Comment 67:

The occurrence of lead in surface soil around 590SB006 should be delineated further in attempt to characterize the nature and extent of lead contamination.

Navy/EnSafe Response:

Additional soil samples will be collected to the north, south, and west of soil boring 590SB006 to delineate the extent of lead. The area to the east has been defined by soil boring 590SB002.

CH2M-Jones Response:

During the August 2002 sampling, two soil borings, E102SB054 and E102SB055, were advanced to the north and south of E590SB006 and surface samples were collected and analyzed for lead at these locations. Lead concentrations at these two locations are below the screening criteria, indicating that lead has been adequately delineated in surface soil at this location.

DYNAMAC / GANETT COMMENTS

Comment:

Section 10.14.4, Page 10.14-17, Line 8: The text states that no metal in shallow groundwater samples exceeded its respective tap-water RBC. This statement is incorrect. Arsenic (5.10 µg/L) exceeded its tap-water RBC (0.0450 µg/L), according to Table 10.14.4.2 (page 10.14-17). The text should be corrected.

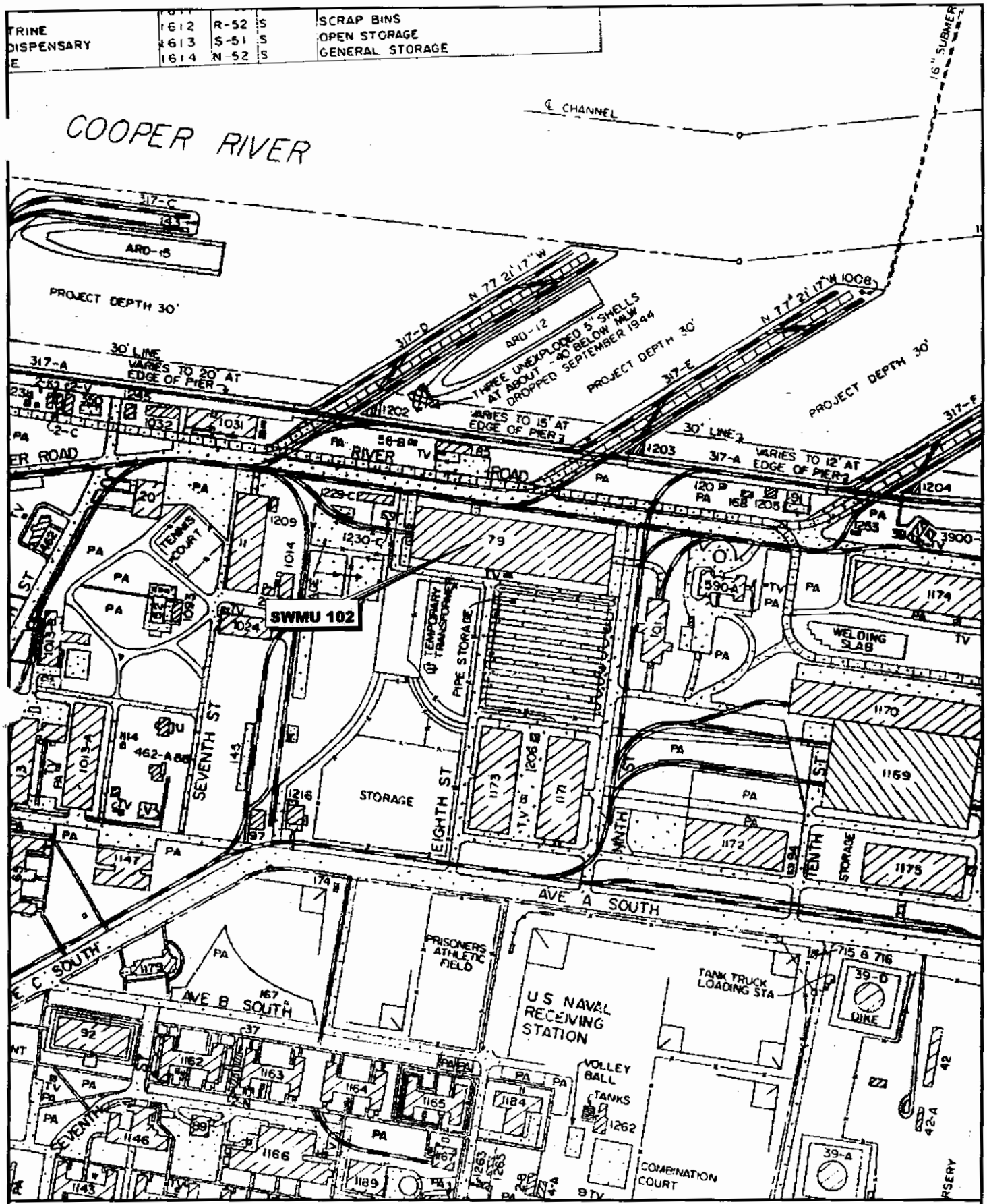
Navy/EnSafe Response:

The text will be revised to reflect this correction.

CH2M-Jones Response:

Section 5.3.1 of the RFI Report Addendum and CMS Work Plan for SWMU 102 and AOC 590, Revision 0, *discusses arsenic detections in groundwater at this site. There were no detections of arsenic above the South Carolina MCL of 50 µg/L, indicating that arsenic concentrations in groundwater do not pose a threat to groundwater quality at the site.*

Appendix C



Railroad Lines

N

Figure C-1
Historical Railroad Lines at SWMU 102 and AOC 590 Area
Public Works Map of Charleston Naval Base
Dated November 3, 1955

CH2MHILL

File Path: c:\18gis\cnc\statbasis.apr, Date: 16 Jan 2003 7:49, User: SNAIK1

Appendix D

Analytical Data Summary

	StationID	E102SB047	E102SB047	E102SB048	E102SB049	E102SB049	E102SB049
	SampleID	102SB04701 (0-1ft)	102SB04702 (3-5ft)	102SB04801 (0-1ft)	102SB04901 (0-1ft)	102SB04901 (0-1ft)	102SB04902 (3-5ft)
	DateCollected	8/13/2002	8/13/2002	8/13/2002	8/13/2002	8/13/2002	8/13/2002
	DateExtracted	8/19/2002	8/19/2002	8/15/2002	8/15/2002	8/19/2002	8/19/2002
	DateAnalyzed	8/20/2002	8/20/2002	8/25/2002	8/25/2002	8/20/2002	8/20/2002
	SDGNumber	65406	65406	65406	65406	65406	65406
Parameter	Units						
Antimony	mg/kg						
Lead	mg/kg			147 =	63.2 =		
Mercury	mg/kg	0.047 J	0.739 =			0.27 =	0.047 J

Analytical Data Summary

	StationID	E102SB050	E102SB050	E102SB050	E102SB050	E102SB051	E102SB051
	SampleID	102SB05001 (0-1ft)	102SB05001 (0-1ft)	102SB05002 (3-5ft)	102SB05002 (3-5ft)	102SB05101 (0-1ft)	102SB05101 (0-1ft)
	DateCollected	8/13/2002	8/13/2002	8/13/2002	8/13/2002	8/13/2002	8/13/2002
	DateExtracted	8/15/2002	8/19/2002	8/15/2002	8/19/2002	8/15/2002	8/19/2002
	DateAnalyzed	8/25/2002	8/20/2002	8/25/2002	8/20/2002	8/25/2002	8/20/2002
	SDGNumber	65406	65406	65406	65406	65406	65406
Parameter	Units						
Antimony	mg/kg						
Lead	mg/kg	4.39 =		1320 =		7.47 =	
Mercury	mg/kg		0.03 J		7.7 =		0.934 =

Analytical Data Summary

	StationID	E102SB051	E102SB051	E102SB052	E102SB052	E102SB052	E102SB052
	SampleID	102SB05102 (3-5ft)	102SB05102 (3-5ft)	102SB05201 (0-1ft)	102SB05201 (0-1ft)	102SB05202 (3-5ft)	102SB05202 (3-5ft)
	DateCollected	8/13/2002	8/13/2002	8/13/2002	8/13/2002	8/13/2002	8/13/2002
	DateExtracted	8/15/2002	8/19/2002	8/15/2002	8/19/2002	8/15/2002	8/19/2002
	DateAnalyzed	8/25/2002	8/20/2002	8/25/2002	8/20/2002	8/25/2002	8/20/2002
	SDGNumber	65406	65406	65406	65406	65406	65406
Parameter	Units						
Antimony	mg/kg						
Lead	mg/kg	330 =		195 =		4.61 =	
Mercury	mg/kg		1.01 =		1.24 =		0.072 J

Analytical Data Summary

	StationID	E102SB053		E102SB053		E102SB053		E102SB054		E102SB055		E102SB056	
	SampleID	102CB05301 (0-1ft)		102SB05301 (0-1ft)		102SB05302 (3-5ft)		102SB05401 (0-1ft)		102SB05501 (0-1ft)		102SB05601 (0-1ft)	
	DateCollected	8/13/2002		8/13/2002		8/13/2002		8/13/2002		8/13/2002		8/13/2002	
	DateExtracted	8/15/2002		8/15/2002		8/15/2002		8/15/2002		8/15/2002		8/19/2002	
	DateAnalyzed	8/25/2002		8/25/2002		8/25/2002		8/25/2002		8/25/2002		8/20/2002	
	SDGNumber	65406		65406		65406		65406		65406		65406	
Parameter	Units												
Antimony	mg/kg									0.744	J		
Lead	mg/kg	1500	=	1710	=	2150	=	264	=	334	=		
Mercury	mg/kg											2.55	=

Analytical Data Summary

	StationID	E102SB057	E102SB058	E102SB058	E102SB058	E102SB059	E102SB059
	SampleID	102SB05701 (0-1ft)	102CB05802 (3-5ft)	102SB05801 (0-1ft)	102SB05802 (3-5ft)	102SB05901 (0-1ft)	102SB05902 (3-5ft)
	DateCollected	8/13/2002	8/13/2002	8/13/2002	8/13/2002	8/13/2002	8/13/2002
	DateExtracted	8/19/2002	8/19/2002	8/19/2002	8/19/2002	8/19/2002	8/20/2002
	DateAnalyzed	8/20/2002	8/20/2002	8/20/2002	8/20/2002	8/20/2002	8/21/2002
	SDGNumber	65406	65411	65406	65406	65411	65412
Parameter	Units						
Antimony	mg/kg						
Lead	mg/kg						
Mercury	mg/kg	0.938 =	3.75 =	1.87 =	2.22 =	57.8 =	18.1 =

Analytical Data Summary

	StationID	E102SB060	E102SB060	E102SB060	E102SB060	E102SB061	E102SB061
	SampleID	102SB06001 (0-1ft)	102SB06001 (0-1ft)	102SB06002 (3-5ft)	102SB06002 (3-5ft)	102SB06101 (0-1ft)	102SB06101 (0-1ft)
	DateCollected	8/13/2002	8/13/2002	8/13/2002	8/13/2002	8/13/2002	8/13/2002
	DateExtracted	8/16/2002	8/20/2002	8/16/2002	8/20/2002	8/16/2002	8/20/2002
	DateAnalyzed	8/20/2002	8/21/2002	8/20/2002	8/21/2002	8/20/2002	8/21/2002
	SDGNumber	65412	65412	65412	65412	65412	65412
Parameter	Units						
Antimony	mg/kg						
Lead	mg/kg	1400 J		18.2 J		51.6 J	
Mercury	mg/kg		35.3 =		3.54 J		0.14 =

Analytical Data Summary

	StationID	E102SB061	E102SB061	E102SB062	E102SB062	E102SB064	E102SB065
	SampleID	102SB06102 (3-5ft)	102SB06102 (3-5ft)	102SB06201 (0-1ft)	102SB06202 (3-5ft)	102SB06401 (0-1ft)	102SB06501 (0-1ft)
	DateCollected	8/13/2002	8/13/2002	8/13/2002	8/13/2002	8/13/2002	8/14/2002
	DateExtracted	8/20/2002	8/20/2002	8/20/2002	8/20/2002	8/15/2002	8/20/2002
	DateAnalyzed	8/21/2002	8/25/2002	8/21/2002	8/21/2002	8/25/2002	8/21/2002
	SDGNumber	65412	65412	65412	65412	65412	65412
Parameter	Units						
Antimony	mg/kg						
Lead	mg/kg		33.3 J			920 J	
Mercury	mg/kg	0.034 J		0.689 =	1.44 =		15.9 =

Analytical Data Summary

	StationID	E102SB065	E102SB066	E102SB066	E102SB066	E102SB067	E102SB067
	SampleID	102SB06502 (3-5ft)	102CB06601 (0-1ft)	102SB06601 (0-1ft)	102SB06602 (3-5ft)	102SB06701 (0-1ft)	102SB06702 (3-5ft)
	DateCollected	8/14/2002	8/14/2002	8/14/2002	8/14/2002	8/14/2002	8/14/2002
	DateExtracted	8/20/2002	8/20/2002	8/20/2002	8/20/2002	8/20/2002	8/20/2002
	DateAnalyzed	8/21/2002	8/21/2002	8/21/2002	8/21/2002	8/21/2002	8/21/2002
	SDGNumber	65412	65412	65412	65412	65412	65412
Parameter	Units						
Antimony	mg/kg						
Lead	mg/kg						
Mercury	mg/kg	40.4 =	21.7 =	46.8 =	10.2 J	11.9 J	12.6 J

Analytical Data Summary

	StationID	E102SB068		E102SB068		E102SB069		E102SB069		E102SB070	
	SampleID	102SB06801 (0-1ft)		102SB06802 (3-5ft)		102SB06901 (0-1ft)		102SB06902 (3-5ft)		102SB07001 (0-1ft)	
	DateCollected	8/14/2002		8/14/2002		8/14/2002		8/14/2002		8/21/2002	
	DateExtracted	8/20/2002		8/20/2002		8/20/2002		8/20/2002		8/23/2002	
	DateAnalyzed	8/21/2002		8/21/2002		8/21/2002		8/21/2002		8/28/2002	
	SDGNumber	65412		65412		65412		65412		65784	
Parameter	Units										
Antimony	mg/kg									0.509	U
Lead	mg/kg									4.18	=
Mercury	mg/kg	7.62	J	10.8	J	34	=	47.7	=		

Analytical Data Summary

	StationID	E102SB057		E102SB063		E102SB066		E102SB066		E102SB069	
	SampleID	102SB05701 (0-1ft)		102SB06301 (0-1ft)		102CB06601 (0-1ft)		102SB06601 (0-1ft)		102SB06901 (0-1ft)	
	DateCollected	8/13/2002		8/13/2002		8/14/2002		8/14/2002		8/14/2002	
	DateExtracted	8/16/2002		8/15/2002		8/15/2002		8/15/2002		8/15/2002	
	DateAnalyzed	8/17/2002		8/15/2002		8/15/2002		8/15/2002		8/15/2002	
	SDGNumber	65406		65412		65412		65412		65412	
Parameter	**Units**										
Benzo(g,h,i)Perylene	µg/kg	183	U	1090	=	44.8	U	268	=	1530	=
Naphthalene	µg/kg	183	U	36.9	U	44.8	U	44.5	U	45.4	U
Acenaphthylene	µg/kg	183	U	265	=	182	=	185	=	190	=
Acenaphthene	µg/kg	183	U	143	=	44.8	U	44.5	U	242	=
Fluorene	µg/kg	34.9	J	8.6	J	44.8	U	8.9	J	115	=
Phenanthrene	µg/kg	150	J	237	=	176	=	194	=	1920	=
Anthracene	µg/kg	183	U	225	=	208	=	208	=	565	=
Fluoranthene	µg/kg	261	=	1690	=	210	=	248	=	4210	=
Pyrene	µg/kg	208	=	2180	J	260	J	315	J	4820	J
Benzo(a)Anthracene	µg/kg	109	J	1490	=	64.8	=	92	=	2530	=
Chrysene	µg/kg	106	J	2050	=	50.2	=	140	=	2180	=
Benzo(b)Fluoranthene	µg/kg	183	U	4370	=	255	=	335	=	2560	=
Benzo(k)Fluoranthene	µg/kg	183	U	36.9	U	36.3	J	44.5	U	1360	=
Benzo(a)Pyrene	µg/kg	179	J	1930	=	222	=	259	=	2100	=
Indeno(1,2,3-c,d)pyrene	µg/kg	205	=	1020	=	44.8	U	274	=	1340	=
Dibenz(a,h)anthracene	µg/kg	183	U	36.9	U	44.8	U	44.5	U	45.4	U

Analytical Data Summary

	StationID	E102SB057		E102SB063		E102SB066		E102SB066		E102SB069	
	SampleID	102SB05701 (0-1ft)		102SB06301 (0-1ft)		102CB06601 (0-1ft)		102SB06601 (0-1ft)		102SB06901 (0-1ft)	
	DateCollected	8/13/2002		8/13/2002		8/14/2002		8/14/2002		8/14/2002	
	DateExtracted	8/16/2002		8/15/2002		8/15/2002		8/15/2002		8/15/2002	
	DateAnalyzed	8/17/2002		8/15/2002		8/15/2002		8/15/2002		8/15/2002	
	SDGNumber	65406		65412		65412		65412		65412	
Parameter	**Units**										
Benzo(a)Anthracene	µg/kg	109	J	1490	=	64.8	=	92	=	2530	=
Chrysene	µg/kg	106	J	2050	=	50.2	=	140	=	2180	=
Benzo(b)Fluoranthene	µg/kg	183	U	4370	=	255	=	335	=	2560	=
Benzo(k)Fluoranthene	µg/kg	183	U	36.9	U	36.3	J	44.5	U	1360	=
Benzo(a)Pyrene	µg/kg	179	J	1930	=	222	=	259	=	2100	=
Indeno(1,2,3-c,d)pyrene	µg/kg	205	=	1020	=	44.8	U	274	=	1340	=
Dibenz(a,h)anthracene	µg/kg	183	U	36.9	U	44.8	U	44.5	U	45.4	U
Benzo(a)Anthracene	0.1	10.9		149		6.48		9.2		253	
Chrysene	0.001	0.106		2.05		0.0502		0.14		2.18	
Benzo(b)Fluoranthene	0.1	18.3		437		25.5		33.5		256	
Benzo(k)Fluoranthene	0.01	1.83		0.369		0.363		0.445		13.6	
Benzo(a)Pyrene	1	179		1930		222		259		2100	
Indeno(1,2,3-c,d)pyrene	0.1	20.5		102		4.48		27.4		134	
Dibenz(a,h)anthracene	1	183		36.9		44.8		44.5		45.4	
BEQ Concentration (µg/kg)		**414**		**2,657**		**304**		**374**		**2,804**	

Appendix E

Data Validation Summary - Charleston Naval Complex - Zone E, SWMU 102

TO: Sam Naik/CH2M HILL/ATL

FROM: Amy Juchem/CH2M HILL/GNA

Herb Kelly/CH2M HILL/GNA

DATE: January 16, 2003

The purpose of this memorandum is to present the results of the data validation process for the samples collected in Zone E, SWMU 102. The samples were collected between the dates of August 13 and 21, 2002.

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

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

Samples were submitted to General Engineering Laboratories, Inc., in Charleston, South Carolina, for the following analyses: SW-846 8270 Polyaromatic Hydrocarbons (PAHs) and 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

Code	Definition
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
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 509, Zone E

SDG	Station ID	Sample ID	Lab Sample ID	Matrix	Sample Type	LR Type	Upper Depth	Lower Depth	Date Collected	PAHs SW8270C	Metals SW6010B	Mercury SW7470A / SW7471A
65406	E102SB056	102SB05601	65406001	SO	N		0	1	08/13/02			X
65406	E102SB047	102SB04701	65406002	SO	N		0	1	08/13/02			X
65406	E102SB047	102SB04702	65406003	SO	N		3	5	08/13/02			X
65406	E102SB049	102SB04902	65406004	SO	N		3	5	08/13/02			X
65406	E102SB057	102SB05701	65406005	SO	N		0	1	08/13/02	X		X
65406	E102SB058	102SB05801	65406006	SO	N		0	1	08/13/02			X
65406	E102SB058	102SB05802	65406007	SO	N		3	5	08/13/02			X
65406	E102SB048	102SB04801	65406008	SO	N		0	1	08/13/02		X	
65406	E102SB053	102SB05301	65406009	SO	N		0	1	08/13/02		X	
65406	E102SB053	102CB05301	65406010	SO	FD		0	1	08/13/02		X	
65406	E102SB053	102SB05302	65406011	SO	N		3	5	08/13/02		X	
65406	E102SB054	102SB05401	65406012	SO	N		0	1	08/13/02		X	
65406	E102SB049	102SB04901	65406013	SO	N		0	1	08/13/02		X	X
65406	E102SB050	102SB05001	65406014	SO	N		0	1	08/13/02		X	X
65406	E102SB050	102SB05002	65406015	SO	N		3	5	08/13/02		X	X
65406	E102SB051	102SB05101	65406016	SO	N		0	1	08/13/02		X	X
65406	E102SB051	102SB05102	65406017	SO	N		3	5	08/13/02		X	X
65406	E102SB052	102SB05201	65406018	SO	N		0	1	08/13/02		X	X
65406	E102SB052	102SB05202	65406019	SO	N		3	5	08/13/02		X	X
65406	E102SB055	102SB05501	65406020	SO	N		0	1	08/13/02		X	
65406	LABQC	1200283742	1200283742	SQ	LB						X	
65406	E102SB048	102SB04801MS	1200283744	SO	MS		0	1	08/13/02		X	
65406	E102SB048	102SB04801SD	1200283745	SO	SD		0	1	08/13/02		X	
65406	LABQC	1200283746	1200283746	SQ	BS						X	
65406	LABQC	1200284445	1200284445	SQ	LB					X		

TABLE 1
Chemical Analytical Methods – Field and Quality Control Samples
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 509, Zone E

SDG	Station ID	Sample ID	Lab Sample ID	Matrix	Sample Type	LR Type	Upper Depth	Lower Depth	Date Collected	PAHs SW8270C	Metals SW6010B	Mercury SW7470A / SW7471A
65406	LABQC	1200284446	1200284446	SQ	BS					X		
65406	E102SB057	102SB05701MS	1200284447	SO	MS		0	1	08/13/02	X		
65406	E102SB057	102SB05701SD	1200284448	SO	SD		0	1	08/13/02	X		
65406	LABQC	1200286082	1200286082	SQ	LB							X
65406	E102SB056	102SB05601LR	1200286083	SO	LR	DL	0	1	08/13/02			X
65406	E102SB056	102SB05601MS	1200286084	SO	MS		0	1	08/13/02			X
65406	E102SB056	102SB05601SD	1200286085	SO	SD		0	1	08/13/02			X
65406	LABQC	1200286086	1200286086	SQ	BS							X
65411	E102SB058	102CB05802	65411001	SO	FD		3	5	08/13/02			X
65411	E102SB059	102SB05901	65411002	SO	N		0	1	08/13/02			X
65411	LABQC	1200286082	1200286082	SQ	LB							X
65411	LABQC	1200286086	1200286086	SQ	BS							X
65412	E102SB069	102SB06901	65412001	SO	N		0	1	08/14/02	X		X
65412	E102SB065	102SB06501	65412002	SO	N		0	1	08/14/02			X
65412	E102SB065	102SB06502	65412003	SO	N		3	5	08/14/02			X
65412	E102SB066	102SB06602	65412004	SO	N		3	5	08/14/02			X
65412	E102SB067	102SB06701	65412005	SO	N		0	1	08/14/02			X
65412	E102SB067	102SB06702	65412006	SO	N		3	5	08/14/02			X
65412	E102SB068	102SB06801	65412007	SO	N		0	1	08/14/02			X
65412	E102SB068	102SB06802	65412008	SO	N		3	5	08/14/02			X
65412	E102SB069	102SB06902	65412009	SO	N		3	5	08/14/02			X
65412	E102SB059	102SB05902	65412010	SO	N		3	5	08/13/02			X
65412	E102SB060	102SB06001	65412011	SO	N		0	1	08/13/02		X	X
65412	E102SB060	102SB06002	65412012	SO	N		3	5	08/13/02		X	X
65412	E102SB061	102SB06101	65412013	SO	N		0	1	08/13/02		X	X

TABLE 1
Chemical Analytical Methods – Field and Quality Control Samples
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 509, Zone E

SDG	Station ID	Sample ID	Lab Sample ID	Matrix	Sample Type	LR Type	Upper Depth	Lower Depth	Date Collected	PAHs SW8270C	Metals SW6010B	Mercury SW7470A / SW7471A
65412	E102SB061	102SB06102	65412014	SO	N		3	5	08/13/02		X	X
65412	E102SB062	102SB06201	65412015	SO	N		0	1	08/13/02			X
65412	E102SB062	102SB06202	65412016	SO	N		3	5	08/13/02			X
65412	E102SB066	102SB06601	65412017	SO	N		0	1	08/14/02	X		X
65412	E102SB066	102CB06601	65412018	SO	FD		0	1	08/14/02	X		X
65412	E102SB064	102SB06401	65412019	SO	N		0	1	08/13/02		X	
65412	E102SB063	102SB06301	65412020	SO	N		0	1	08/13/02	X		
65412	LABQC	1200283603	1200283603	SQ	LB					X		
65412	LABQC	1200283604	1200283604	SQ	BS					X		
65412	E102SB069	102SB06901MS	1200283605	SO	MS		0	1	08/14/02	X		
65412	E102SB069	102SB06901SD	1200283606	SO	SD		0	1	08/14/02	X		
65412	LABQC	1200283742	1200283742	SQ	LB						X	
65412	LABQC	1200283746	1200283746	SQ	BS						X	
65412	LABQC	1200285162	1200285162	SQ	LB						X	
65412	E102SB060	102SB06001MS	1200285164	SO	MS		0	1	08/13/02		X	
65412	E102SB060	102SB06001SD	1200285165	SO	SD		0	1	08/13/02		X	
65412	LABQC	1200285166	1200285166	SQ	BS						X	
65412	LABQC	1200286087	1200286087	SQ	LB							X
65412	LABQC	1200286088	1200286088	SQ	BS							X
65412	E102SB069	102SB06901MS	1200286089	SO	MS		0	1	08/14/02			X
65412	E102SB069	102SB06901SD	1200286090	SO	SD		0	1	08/14/02			X
65412	LABQC	1200287201	1200287201	SQ	LB						X	
65412	E102SB061	102SB06102MS	1200287203	SO	MS		3	5	08/13/02		X	
65412	E102SB061	102SB06102SD	1200287204	SO	SD		3	5	08/13/02		X	
65412	LABQC	1200287205	1200287205	SQ	BS						X	

TABLE 1
Chemical Analytical Methods – Field and Quality Control Samples
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 509, Zone E

SDG	Station ID	Sample ID	Lab Sample ID	Matrix	Sample Type	LR Type	Upper Depth	Lower Depth	Date Collected	PAHs SW8270C	Metals SW6010B	Mercury SW7470A / SW7471A
65413	FIELDQC	102EB047M1	65413001	WQ	EB				08/13/02	X	X	X
65413	FIELDQC	102EB048M2	65413002	WQ	EB				08/14/02	X		X
65413	LABQC	1200283466	1200283466	WQ	LB					X		
65413	LABQC	1200283467	1200283467	WQ	BS					X		
65413	LABQC	1200283752	1200283752	WQ	LB						X	
65413	LABQC	1200283756	1200283756	WQ	BS						X	
65413	LABQC	1200283962	1200283962	WQ	LB							X
65413	LABQC	1200283965	1200283965	WQ	BS							X
65784	E102SB070	102SB07001	65784001	SO	N		0	1	08/21/02		X	
65784	LABQC	1200288747	1200288747	SQ	LB						X	
65784	LABQC	1200288748	1200288748	SQ	BS						X	
65784	E102SB070	102SB07001MS	1200288749	SO	MS		0	1	08/21/02		X	
65784	E102SB070	102SB07001SD	1200288750	SO	SD		0	1	08/21/02		X	
65785	FIELDQC	102EB049M3	65785001	WQ	EB				08/21/02		X	
65785	LABQC	1200289516	1200289516	WQ	LB						X	
65785	LABQC	1200289520	1200289520	WQ	BS						X	

MATRIX CODE

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

SAMPLE TYPE CODE

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

LR TYPE CODE

DL - Dilution

ANALYSIS CODE

PAHs – Polyaromatic Hydrocarbons

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 and equipment blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Surrogate Recoveries** – Surrogate Compounds are added to each sample and the recoveries are used to monitor lab performance and possible matrix interference.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", either laboratory reagent water or Ottawa sand, in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **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.

Polyaromatic Hydrocarbons (PAHs) Analyses

The QA/QC parameters for the PAH 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 2 below. No flags are applied due to Field Duplicate precision.

TABLE 2
Field Duplicate RPDs Out of QC Limits: PAHs
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 509, Zone E

SDG	Sample	Parameter	Native Concentration	Field Duplicate Concentration	RPD	RPD Limits
65412	102SB06601 / 102CB06601	Indeno(1,2,3-cd)pyrene	274 ug/Kg	Non-detect	200*	35
		Benzo(g,h,i)perylene	268 ug/Kg	Non-detect	200*	35
* - 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: PAHs
Charleston Naval Complex, Zone E, SWMU 102, Charleston, SC

Instrument/ Calibration Date	Analyte	%Relative Standard Deviation or R^2 (ICAL)/ %Difference (CCAL)	Associated Samples
MSD4-CCAL-08/15/02, 0848	Pyrene	25.7% low	65412 - All
MSD5-CCAL-08/15/02, 1243	Pyrene	20.4% high	65413 – All (Field Blanks Only)

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.

Inorganic Parameters

Quality Control Review

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

- **Holding Times** – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- **Blank samples** – Sample preparation, initial calibration blanks/continuing calibration blanks, and equipment blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- **Lab Control Sample (LCS)** – This sample is a "controlled matrix", in which target parameters have been added prior to digestion/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- **Field Duplicate Samples** – These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- **Pre/Post Digestion Spike (MS/MSD)** – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- **ICP Interference Check Sample** – This sample verifies the lab's interelement and background correction factors.

- **Initial Calibration Verification** – This parameter ensures that the instrument is capable of producing acceptable quantitative data for the target analyte list to be measured.
- **Continuing Calibration Verification** – This one-point, mid-range parameter establishes that the initial calibration is still valid by checking the performance of the instrument on a continual basis.
- **ICP Serial Dilution** – The serial dilution of samples quantitated by ICP determines whether or not significant physical or chemical interferences exist due to the sample matrix.

Metals Analyses

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

Blanks

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

TABLE 4
Blank Contamination: Metals
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 509, Zone E

SDG	Lab Sample ID	Sample ID	Sample Type	Parameter	Lab Result	Units	Flag Concentrations less than the value listed below
65412	CCB		CCB	Lead	1.74	ug/L	0.435 mg/Kg
65784	CCB		CCB	Lead	1.47	ug/L	0.3675 mg/Kg
65785	CCB		CCB	Lead	1.47	ug/L	0.3675 mg/Kg

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

No results were qualified due to blank contamination.

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 5 below.

TABLE 5
MS/MSD, and LCS Recoveries Out of QC Limits: Metals
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 509, Zone E

SDG	Sample	Parameter	Recovery	Recovery Limits	Associated Samples	Flag
65406	102SB04801 MS/MSD	Antimony	40.9* / 32.8*	80-120	65406 - All	Detects-J, non-detects-UJ
65412	102SB06102 MS/MSD	Lead	11.3* / 8.8*	80-120	65412 - All	Detects-J, non-detects-R

* - out of control limits

Field Duplicate Samples

All Field Duplicate Samples were within acceptable quality control limits, except as noted in Table 6 below. No flags are applied due to Field Duplicate precision.

TABLE 6
Field Duplicate RPDs Out of QC Limits: Metals
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 509, Zone E

SDG	Sample	Parameter	Native Concentration	Field Duplicate Concentration	RPD	RPD Limits
65412	102SB06601 / 102CB06601	Mercury	46.8 mg/Kg	21.7 mg/Kg	73.3*	35

* - out of control limits

Rejected Data

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

Conclusion

A review of the analytical data submitted regarding the investigation of Zone E, SWMU 102 at the Charleston Naval Complex, Charleston, South Carolina by CH2M HILL has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed, and that the analytical results should be considered usable as qualified.

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

ATTACHMENT 1

Changed Qualifiers and Results Zone E, SWMU 102 - Data Validation

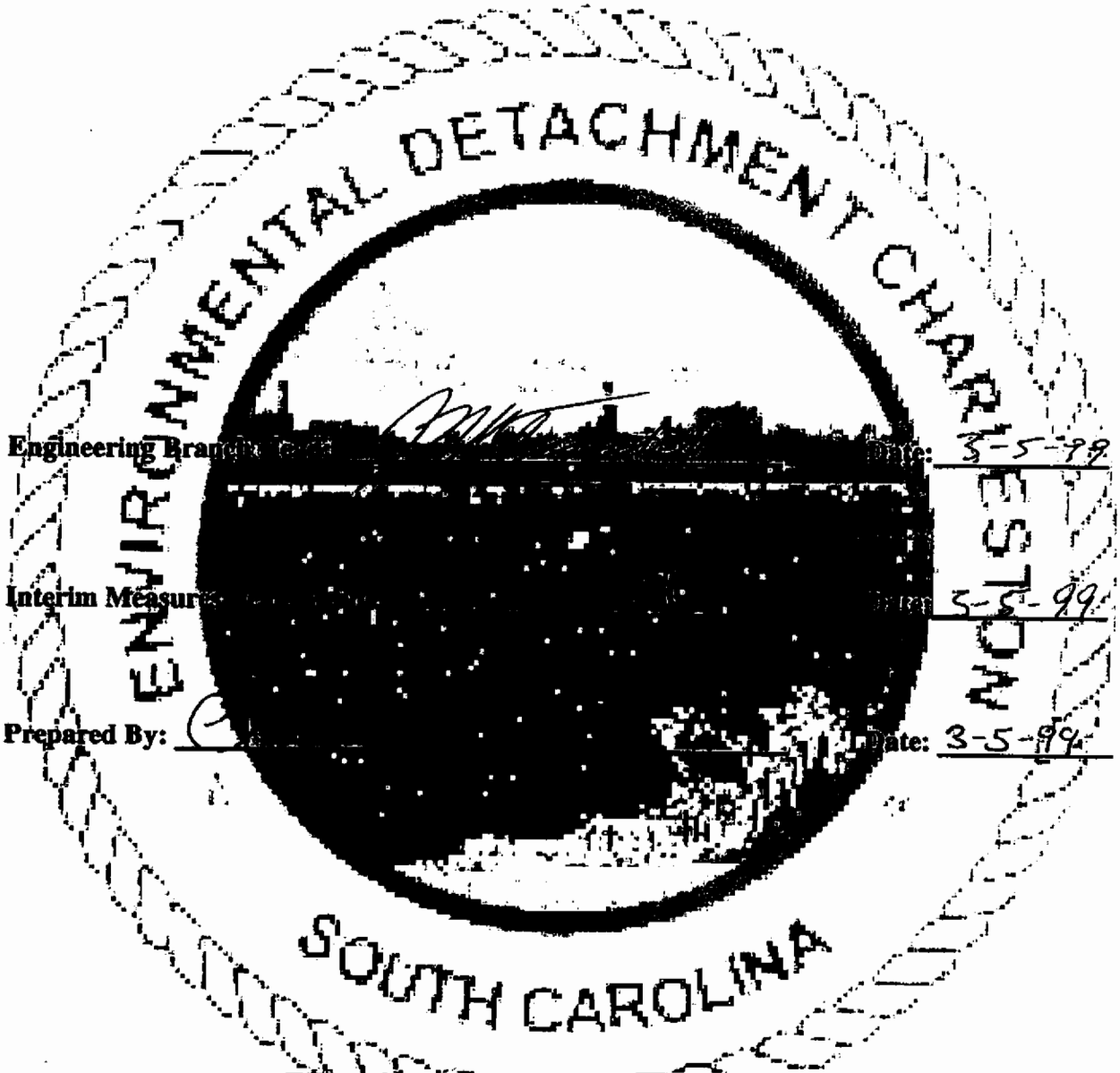
RFI Report Addendum and CMS Work Plan, SWMU 102 and AOC 509, Zone E, Charleston Naval Complex

Parameter Class	Analytical Method	Parameter	SDG	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
METAL	SW6010B	ANTIMONY	65406	102SB05501	65406020	SO	0.744	BN	0.744	J	mg/kg	MS
METAL	SW6010B	LEAD	65412	102SB06001	65412011	SO	1400	*	1400	J	mg/kg	MS
METAL	SW6010B	LEAD	65412	102SB06002	65412012	SO	18.2	*	18.2	J	mg/kg	MS
METAL	SW6010B	LEAD	65412	102SB06101	65412013	SO	51.6	*	51.6	J	mg/kg	MS
METAL	SW6010B	LEAD	65412	102SB06102	65412014	SO	33.3	N	33.3	J	mg/kg	MS
METAL	SW6010B	LEAD	65412	102SB06401	65412019	SO	920	=	920	J	mg/kg	MS
METAL	SW7471A	MERCURY	65406	102SB04701	65406002	SO	0.047	B*	0.047	J	mg/kg	IB
METAL	SW7471A	MERCURY	65406	102SB04902	65406004	SO	0.047	B*	0.047	J	mg/kg	IB
METAL	SW7471A	MERCURY	65406	102SB05001	65406014	SO	0.03	B*	0.03	J	mg/kg	IB
METAL	SW7471A	MERCURY	65406	102SB05202	65406019	SO	0.072	B*	0.072	J	mg/kg	IB
METAL	SW7471A	MERCURY	65412	102SB06602	65412004	SO	10.2	B*	10.2	J	mg/kg	IB
METAL	SW7471A	MERCURY	65412	102SB06701	65412005	SO	11.9	B*	11.9	J	mg/kg	IB
METAL	SW7471A	MERCURY	65412	102SB06702	65412006	SO	12.6	B*	12.6	J	mg/kg	IB
METAL	SW7471A	MERCURY	65412	102SB06801	65412007	SO	7.62	B*	7.62	J	mg/kg	IB
METAL	SW7471A	MERCURY	65412	102SB06802	65412008	SO	10.8	B*	10.8	J	mg/kg	IB
METAL	SW7471A	MERCURY	65412	102SB06002	65412012	SO	3.54	B*	3.54	J	mg/kg	IB
METAL	SW7471A	MERCURY	65412	102SB06102	65412014	SO	0.034	B*	0.034	J	mg/kg	IB
SVOA	SW8270C	PYRENE	65412	102SB06901	65412001	SO	4820	=	4820	J	ug/kg	CC
SVOA	SW8270C	PYRENE	65412	102SB06601	65412017	SO	315	=	315	J	ug/kg	CC
SVOA	SW8270C	PYRENE	65412	102CB06601	65412018	SO	260	=	260	J	ug/kg	CC
SVOA	SW8270C	PYRENE	65412	102SB06301	65412020	SO	2180	=	2180	J	ug/kg	CC

Appendix F

COMPETION REPORT

INTERIM MEASURE
FOR AOC 699 STORM DRAIN CLEANING
Naval Base Charleston
Charleston, South Carolina



Engineering Branch: [signature] Date: 3-5-99

Interim Measure: [signature] 5-5-99

Prepared By: [signature] Date: 3-5-99

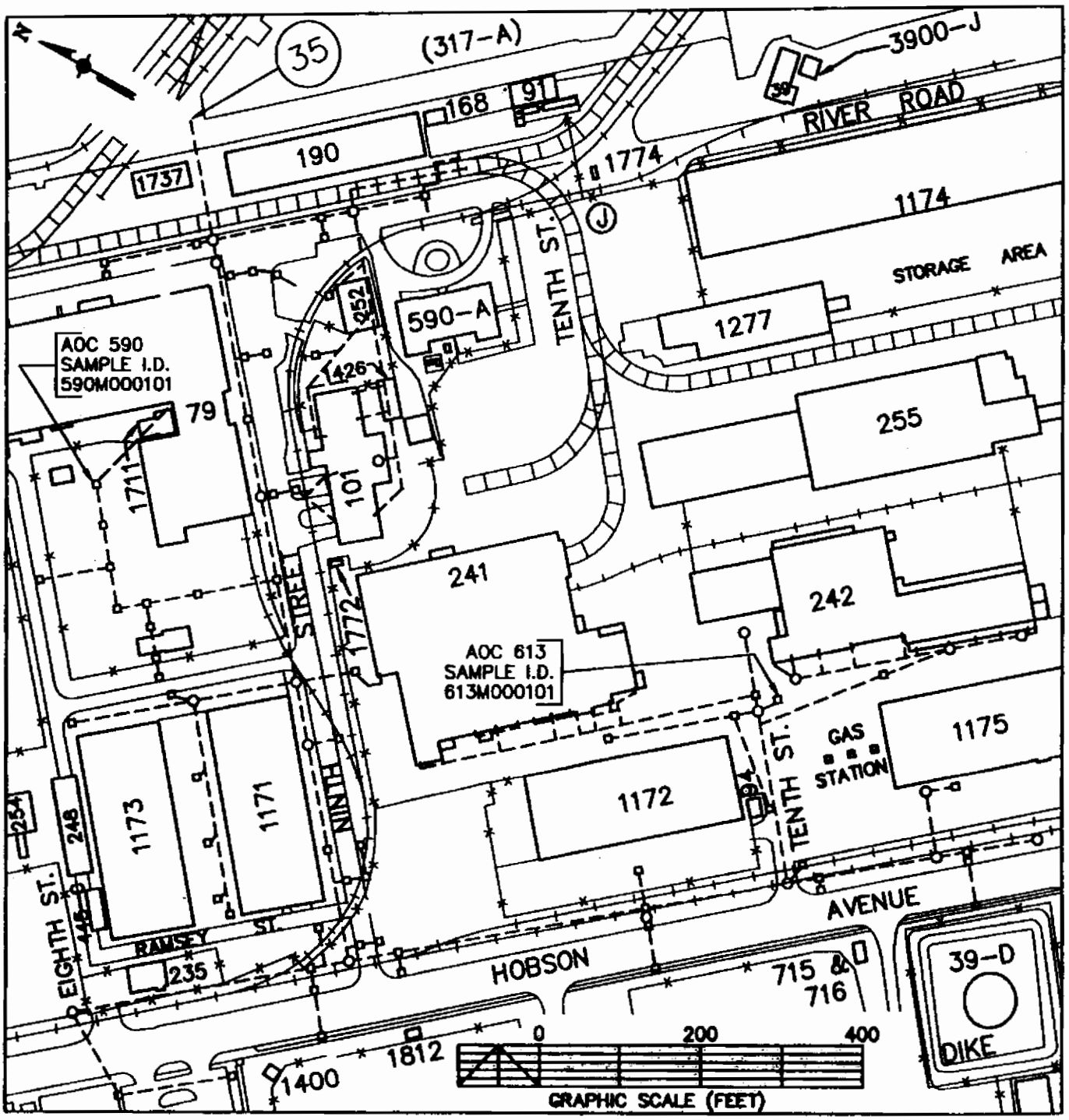
REPORT GENERATED BY:

ENVIRONMENTAL DETACHMENT CHARLESTON

1899 NORTH HOBSON AVENUE

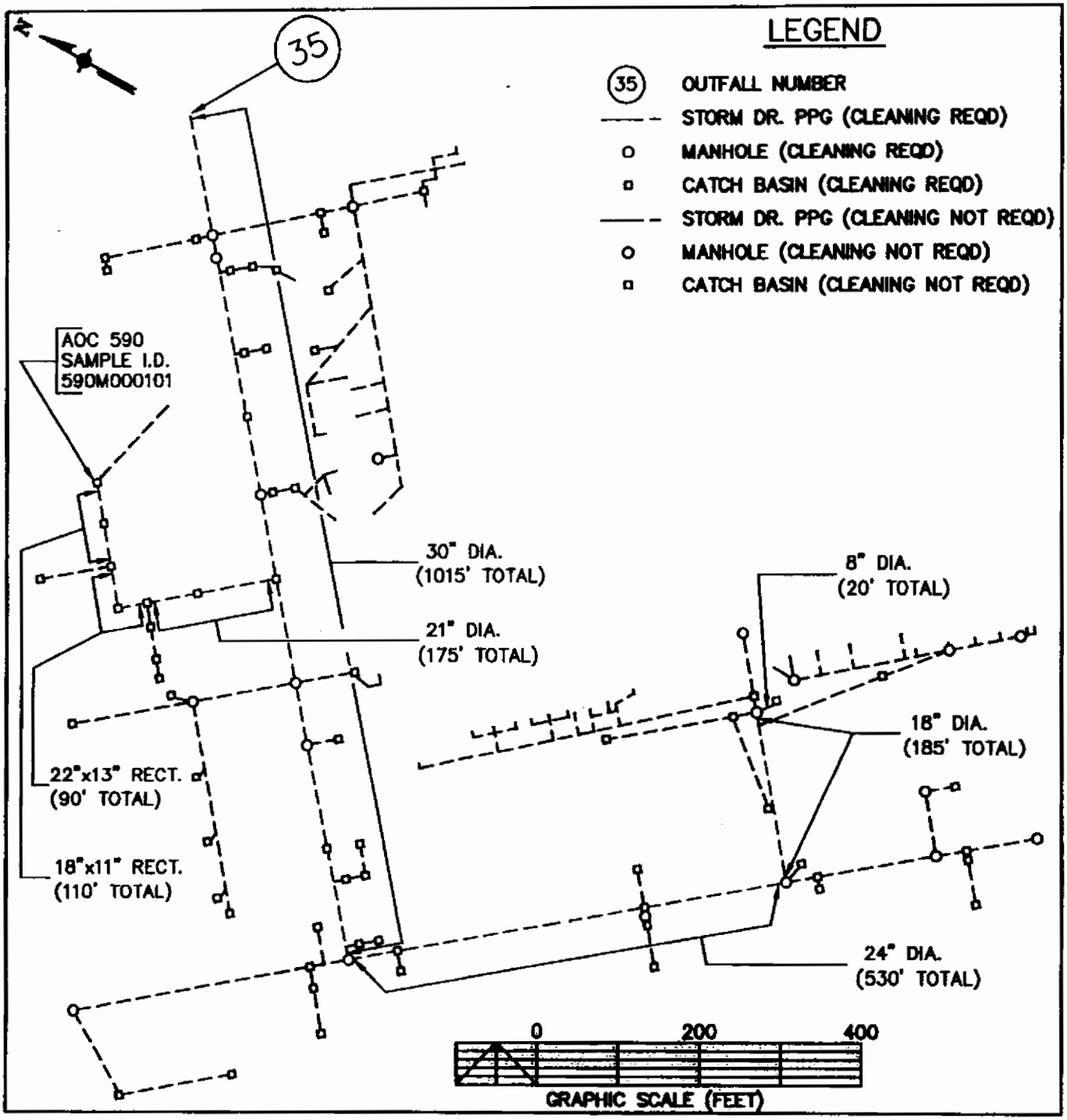
NORTH CHARLESTON, SC 29405

Figure 4



Appendix A

Figure 4A


LEGEND
35 OUTFALL NUMBER
STORM DR. PPG (CLEANING REQD)
MANHOLE (CLEANING REQD)
CATCH BASIN (CLEANING REQD)
STORM DR. PPG (CLEANING NOT REQD)
MANHOLE (CLEANING NOT REQD)
CATCH BASIN (CLEANING NOT REQD)
35
AOC 590
SAMPLE I.D.
590M000101
30" DIA.
(1015' TOTAL)
21" DIA.
(175' TOTAL)
8" DIA.
(20' TOTAL)
18" DIA.
(185' TOTAL)
22"x13" RECT.
(90' TOTAL)
18"x11" RECT.
(110' TOTAL)
24" DIA.
(530' TOTAL)
0
200
400
GRAPHIC SCALE (FEET)

Appendix G

Site: SWMU 102
Media: Surface and Subsurface Soil
Units: mg/kg

Chemical	Samples	Detects	FOD	Min Detect	Max Detect	Avg Detect	Mean*	W-Test	UCL95 log	UCL95 nonparm	UCL95 bootstrap
Surface Soil											
Antimony	30	19	63%	0.54	11.6	1.99	1.54	NONPARAMETRIC	2.1	0.6	**2.2**
Arsenic	28	28	100%	2.6	27.8	11.66	11.66	LOGNORMAL	**14.8**	8.5	13.8
Lead	40	32	80%	0.6	919	**196**	157	NONPARAMETRIC	4616.6	15.0	219
Mercury	65	58	89%	0.03	57.8	5.58	4.98	Unknown	21.7	1.2	**7.2**
Subsurface Soil											
Antimony	26	19	73%	0.74	10.3	1.71	**1.4**	NONPARAMETRIC	1.8	0.9	2.0
Arsenic	26	26	100%	3.2	64.1	18.43	**18.4**	LOGNORMAL	23.9	11.5	22.6
Lead	26	25	96%	17.2	9930	635.39	**611.1**	NONPARAMETRIC	790	43.4	1246
Mercury	54	50	93%	0.034	47.7	3.8	**3.5**	Unknown	9.1	1.01	5.5

Note:
Bolded are the values to be used for comparison with screening criteria in determining a COPC/COC for the site media.
* - Mean includes non-detects at half of the detection limit value

Site:	SWMU 102
Media:	Surface Soil
Units:	mg/kg
Chemical:	Antimony
CASRN:	

STATISTICS	
N	30
Detects	19
FOD	63%
Mean of Detect	1.99
Min of Detect	0.54
Max of Detect	11.60
Best Estimate of Mean (arithmetic)	2.2
Best Estimate of Mean (geometric)	0.9
Nondetects at 1/2 DL	YES

95% UPPER CONFIDENCE LIMITS FOR MEAN	
UCL95 Normal	2.3
t-statistic	1.70
UCL95 Lognormal	2.1
H-statistic	2.42
UCL95 Nonparametric	0.63
UCL95 Bootstrap	**2.24**

95% UPPER TOLERANCE INTERVAL	
UTL95 Normal	5.81
coverage	95%
UTL95 Lognormal	4.39
coverage	95%
UTL95 Nonparametric	11.60
coverage	97%

DISTRIBUTION TESTING	
Population is best described as:	NONPARAMETRIC
W_{normal}	0.482
W_{log}	0.909
$W_{\alpha = 0.05}$	0.927

Notes:

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

Site:	SWMU 102
Media:	Surface Soil
Units:	mg/kg
Chemical:	Arsenic
CASRN:	

STATISTICS	
N	28
Detects	28
FOD	100%
Mean of Detect	11.66
Min of Detect	2.60
Max of Detect	27.80
Best Estimate of Mean (arithmetic)	13.8
Best Estimate of Mean (geometric)	9.9
Nondetects at 1/2 DL	YES

95% UPPER CONFIDENCE LIMITS FOR MEAN	
UCL95 Normal	13.9
t-statistic	1.70
UCL95 Lognormal	**14.8**
H-statistic	1.97
UCL95 Nonparametric	8.5
UCL95 Bootstrap	13.78

95% UPPER TOLERANCE INTERVAL	
UTL95 Normal	23.81
coverage	95%
UTL95 Lognormal	27.81
coverage	95%
UTL95 Nonparametric	27.80
coverage	97%

DISTRIBUTION TESTING	
Population is best described as:	LOGNORMAL
W_{normal}	0.847
W_{log}	0.950
$W_{\alpha = 0.05}$	0.924

Notes:

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

Site:	SWMU 102
Media:	Surface Soil
Units:	mg/kg
Chemical:	Lead
CASRN:	

STATISTICS	
N	40
Detects	32
FOD	80%
Mean of Detect	**196**
Min of Detect	0.60
Max of Detect	919.00
Best Estimate of Mean (arithmetic)	219.0
Best Estimate of Mean (geometric)	26.9
Nondetects at 1/2 DL	YES

95% UPPER CONFIDENCE LIMITS FOR MEAN	
UCL95 Normal	219.9
t-statistic	1.70
UCL95 Lognormal	4616.6
H-statistic	4.39
UCL95 Nonparametric	15
UCL95 Bootstrap	219

95% UPPER TOLERANCE INTERVAL	
UTL95 Normal	559.89
coverage	95%
UTL95 Lognormal	2259.10
coverage	95%
UTL95 Nonparametric	919.00
coverage	98%

DISTRIBUTION TESTING	
Population is best described as:	NONPARAMETRIC
W_{normal}	0.690
W_{log}	0.894
$W_{\alpha = 0.05}$	0.940

Notes:

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

Site:	SWMU 102
Media:	Surface Soil
Units:	mg/kg
Chemical:	Mercury
CASRN:	

STATISTICS	
N	65
Detects	58
FOD	89%
Mean of Detect	5.58
Min of Detect	0.03
Max of Detect	57.80
Best Estimate of Mean (arithmetic)	7.2
Best Estimate of Mean (geometric)	0.7
Nondetects at 1/2 DL	YES

95% UPPER CONFIDENCE LIMITS FOR MEAN	
UCL95 Normal	7.2
t-statistic	1.66
UCL95 Lognormal	21.7
H-statistic	3.36
UCL95 Nonparametric	1.24
UCL95 Bootstrap	**7.21**

DISTRIBUTION TESTING	
Population is best described as:	Unknown (N > 50), nonparametric value is
W_{normal}	-- applicable
W_{log}	--
$W_{\alpha = 0.05}$	--

Notes:

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

Site:	SWMU 102
Media:	Subsurface Soil
Units:	mg/kg
Chemical:	Antimony
CASRN:	

STATISTICS	
N	26
Detects	19
FOD	73%
Mean of Detect	1.71
Min of Detect	0.74
Max of Detect	10.30
Best Estimate of Mean (arithmetic)	2.0
Best Estimate of Mean (geometric)	1.1
Nondetects at 1/2 DL	YES

95% UPPER CONFIDENCE LIMITS FOR MEAN	
UCL95 Normal	2.1
t-statistic	1.71
UCL95 Lognormal	1.8
H-statistic	2.05
UCL95 Nonparametric	0.9
UCL95 Bootstrap	**2.01**

95% UPPER TOLERANCE INTERVAL	
UTL95 Normal	4.68
coverage	95%
UTL95 Lognormal	3.53
coverage	95%
UTL95 Nonparametric	10.30
coverage	96%

DISTRIBUTION TESTING	
Population is best described as:	NONPARAMETRIC
W_{normal}	0.415
W_{log}	0.868
$W_{\alpha = 0.05}$	0.920

Notes:

1. If population does not fit normal or lognormal distribution, check Q-Q plots and W-test values. The population may be close enough to one of those distributions to subjectively select a normal or lognormal distribution.

2. For site data, if the selected UCL95 exceeds the Max Detect, the Max Detect should be chosen as the EPC.

3. Lognormal UCL or UTL values caculated for less than 30 samples may be widely inflated.

4. If there is >90% nondetection, it is generally impossible to caclulate a UTL or UCL with any level of confidence.

Site:	SWMU 102
Media:	Subsurface Soil
Units:	mg/kg
Chemical:	Arsenic
CASRN:	

STATISTICS	
N	26
Detects	26
FOD	100%
Mean of Detect	18.43
Min of Detect	3.20
Max of Detect	64.10
Best Estimate of Mean (arithmetic)	22.6
Best Estimate of Mean (geometric)	15.2
Nondetects at 1/2 DL	YES

95% UPPER CONFIDENCE LIMITS FOR MEAN	
UCL95 Normal	22.9
t-statistic	1.71
UCL95 Lognormal	**23.9**
H-statistic	2.05
UCL95 Nonparametric	11.5
UCL95 Bootstrap	22.60

95% UPPER TOLERANCE INTERVAL	
UTL95 Normal	41.59
coverage	95%
UTL95 Lognormal	45.15
coverage	95%
UTL95 Nonparametric	64.10
coverage	96%

DISTRIBUTION TESTING	
Population is best described as:	LOGNORMAL
W_{normal}	0.775
W_{log}	0.971
$W_{\alpha = 0.05}$	0.920

Notes:

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

Site:	SWMU 102
Media:	Subsurface Soil
Units:	mg/kg
Chemical:	Lead
CASRN:	

STATISTICS	
N	26
Detects	25
FOD	96%
Mean of Detect	635.39
Min of Detect	17.20
Max of Detect	9930
Best Estimate of Mean (arithmetic)	1281.5
Best Estimate of Mean (geometric)	79.4
Nondetects at 1/2 DL	YES

95% UPPER CONFIDENCE LIMITS FOR MEAN	
UCL95 Normal	1292.2
t-statistic	1.71
UCL95 Lognormal	790.4
H-statistic	3.19
UCL95 Nonparametric	43.4
UCL95 Bootstrap	**1246**

95% UPPER TOLERANCE INTERVAL	
UTL95 Normal	4150.29
coverage	95%
UTL95 Lognormal	1282
coverage	95%
UTL95 Nonparametric	9930.00
coverage	96%

DISTRIBUTION TESTING	
Population is best described as:	NONPARAMETRIC
W_{normal}	0.323
W_{log}	0.823
$W_{\alpha = 0.05}$	0.920

Notes:

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

Site:	SWMU 102
Media:	Subsurface Soil
Units:	mg/kg
Chemical:	Mercury
CASRN:	

STATISTICS		
N	54	Includes old and new samples
Detects	50	
FOD	93%	
Mean of Detect	3.83	
Min of Detect	0.03	
Max of Detect	47.70	
Best Estimate of Mean (arithmetic)	5.5	
Best Estimate of Mean (geometric)	0.6	
Nondetects at 1/2 DL	YES	

95% UPPER CONFIDENCE LIMITS FOR MEAN	
UCL95 Normal	5.6
t-statistic	1.68
UCL95 Lognormal	**9.1**
H-statistic	3.01
UCL95 Nonparametric	1.01
UCL95 Bootstrap	**5.5**

95% UPPER TOLERANCE INTERVAL	
UTL95 Normal	18.49
coverage	95%
UTL95 Lognormal	16.13
coverage	95%
UTL95 Nonparametric	#N/A
coverage	98%

DISTRIBUTION TESTING	
Population is best described as:	Unknown
W_{normal}	--
W_{log}	--
$W_{\alpha = 0.05}$	--

Notes:

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