N61165.AR.003468
CNC CHARLESTON
5090.3a

RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT ADDENDUM AND CORRECTIVE MEASURES STUDY WORK PLAN FOR SOLID WASTE MANAGEMENT UNIT 67 ZONE E CNC CHARLESTON SC

12/1/2003

CH2M HILL

RFI REPORT ADDENDUM AND CMS WORK PLAN

SWMU 67, Zone E

Charleston Naval Complex
North Charleston, South Carolina

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

CH2M Jones

December 2003

Contract N62467-99-C-0960

CH2MHILL TRANSMITTAL

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

From: Dean Williamson/CH2M-Jones

Date: Dec. 31, 2003

Re: Revision 2 pages for *RFI Report Addendum, SWMU 67, Zone E, Revision 1* – Submitted on June 19, 2003

We Are Sending You:

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

Quantity	Description
2	Revision 2 pages for *RFI Report Addendum, SWMU 67, Zone E, Revision 1* – Submitted on June 19, 2003

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

Copy To:

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, SWMU 67, ZONE E, REVISION 1* SUBMITTAL:

- REVISED COVER AND SPINE
- REVISED INSIDE COVER
- REVISION 2 CERTIFICATION PAGE
- REVISED TABLE OF CONTENTS AND ACRONYM AND ABBREVIATIONS LIST
- REVISED PG. 1-3
- REVISED SECTION 5.0 TEXT
- REVISED TABLE 5-1
- REVISED SECTION 7.0
- NEW SECTION 8.0
- REVISED SECTION 9.0
- NEW APPENDIX F CONTAINING FIGURE 1

CH2M HILL
115 Perimeter Center Place, NE
Suite 700
Atlanta, GA 30346-1278
Tel 770.604.9095
Fax 770.604.9282

CH2MHILL

June 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 (Revision 1) – SWMU 67, Zone E

Dear Mr. Scaturo:

Enclosed are four copies of the RFI Report Addendum (Revision 1) for SWMU 67 in Zone E of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

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

Sincerely,

CH2M HILL

Dean Williamson, P.E.

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

RFI REPORT ADDENDUM AND CMS WORK PLAN

SWMU 67, Zone E

Charleston Naval Complex
North Charleston, South Carolina

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

PREPARED BY
CH2M-Jones

December 2003

Revision 2
Contract N62467-99-C-0960
158814.ZE.PR.20

Certification Page for RFI Report Addendum and CMS Work Plan (Revision 2) – SWMU 67, 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

Dean Williamson, P.E.

12/19/2003

Date

Contents

Section Page

Acronyms and Abbreviations ..... **vii**
1.0 Introduction **1-1**
1.1 Background 1-1
1.2 Purpose of the RFI Report Addendum 1-2
1.3 Report Organization 1-2
Figure 1-1 Location of SWMU 67 in Zone E 1-4
Figure 1-2 Aerial Photograph of SWMU 67 1-5
2.0 Summary of RFI Conclusions for SWMU 67 ..... **2-1**
2.1 Soil Sampling and Analysis 2-1
2.1.1 Surface Soil Results 2-1
2.1.2 Subsurface Soil Results 2-1
2.2 Groundwater Sampling and Analysis 2-2
2.2.1 Shallow Groundwater Results 2-2
2.3 Wipe Sampling and Analysis 2-2
2.4 Air Sampling and Analysis 2-3
2.5 RFI Human Health Risk Assessment (HHRA) 2-3
2.5.1 Soils 2-3
2.5.2 Groundwater 2-3
2.6 RFI Conclusions and Recommendations 2-3
Figure 2-1 RFI Sample Locations 2-4
3.0 Interim Measures and UST/AST Removals **3-1**
3.1 UST/AST Removals 3-1
3.2 Interim Measures 3-1
4.0 Summary of Additional Investigations **4-1**
4.1 Air Sampling 4-1
4.2 Soil Sampling and Analysis 4-1
4.2.1 Surface Soil 4-3
4.2.2 Subsurface Soil 4-4
4.3 COPC Summary 4-5
Table 4-1 Surface Soil Detections, 2002 Sampling 4-6
Table 4-2 Subsurface Soil Detections, 2002 Sampling 4-10

Contents, Continued

Figure 4-1 December 2002 Sampling Locations 4-13
5.0 COPC/COC Refinement 5-1
5.1 Soil VOC Screening using SSL at DAF=1 5-1
5.2 COCs in Surface Soil 5-2
5.2.1 Antimony 5-2
5.2.2 Cadmium 5-2
5.2.3 Lead 5-3
5.2.4 Mercury 5-3
5.2.5 Zinc 5-4
5.3 Subsurface Soil COCs 5-4
5.4 Human Health Risk Assessment (HHRA) for Site Soils 5-5
5.4.1 Selection of COPCs 5-5
5.4.2 Exposure Assessment 5-6
5.4.3 Toxicity Assessment 5-7
5.4.4 Risk Characterization 5-7
5.5 COC Summary 5-8
Table 5-1 Surface and Subsurface Soil Concentrations of Mercury 5-9
Table 5-2 Detections of Mercury and Thallium in Groundwater 5-12
Table 5-3 Leachate Transport Analysis Model 5-13
Table 5-4 COPCs in Surface Soil and Subsurface Soil 5-14
Table 5-5 Exposure Factors for Surface and Subsurface Soil at SWMU 67 5-15
Table 5-6 Exposure Point Concentrations Estimated for Surface and Subsurface Soil at SWMU 67 5-16
Table 5-7 Toxicity Factors for the COPCs at SWMU 67 5-17
Table 5-8 Cancer Risks and Hazard Index Estimates Summary for Soil at SWMU 67 5-18
Figure 5-1 Soil Sampling Locations within 1-acre Area 5-20
6.0 Summary of Information Related to Site Closeout Issues 6-1
6.1 RFI Status 6-1
6.2 Presence of Inorganics in Groundwater 6-1
6.3 Potential Linkage to SWMU 37, Investigated Sanitary Sewers at the CNC 6-2
6.4 Potential Linkage to AOC 699, Investigated Storm Sewers at the CNC 6-2

Contents, Continued

6.5 Potential Linkage to AOC 504, Investigated Railroad Lines at the CNC 6-2
6.6 Potential Migration Pathways to Surface Water Bodies at the CNC 6-3
6.7 Potential Contamination in Oil/Water Separators (OWSs) 6-3
6.8 Land Use Controls (LUCs) 6-3
7.0 Recommendations 7-1
8.0 CMS Work Plan for SWMU 67 8-1
8.1 Remedial Action Objectives 8-1
8.2 Remedial Goal Options and Media Cleanup Standards 8-1
8.3 Potential Remedies to Evaluate 8-2
8.4 Focused CMS Approach 8-2
8.5 Approach to Evaluating Corrective Measure Alternatives 8-2
8.6 Focused CMS Report 8-4
9.0 References 9-1

Appendices

A Excerpts from the *Zone E RFI Report, Revision 0* (Ensafe, 1997), a Figure Showing Wipe Sample Locations, and Groundwater Contour Map
B Responses to Comments on *SWMU 67 RFI Report Addendum, Revision 0*
C Copies of Field Sampling Logs Documenting Ambient Air Sampling for Mercury
D Analytical Results Reports and Data Validation Summaries for 2002 Soil Sampling
E Comparison of Chemicals Detected at SWMU 67 with RBC and Background Values
F Figure 1 Soil BEQs at SWMU 67

Acronyms and Abbreviations

AOC	Area of concern
ALM	Adult Lead Model
AST	Aboveground storage tank
BCT	BRAC Cleanup Team
BRAC	Base Realignment and Closure Act
BRC	Background reference concentration
CA	Corrective action
CMS	Corrective measures study
CNC	Charleston Naval Complex
COC	Chemical of concern
COPC	Chemical of potential concern
CSI	Confirmatory sampling investigation
DAF	Dilution attenuation factor
ED	exposure duration
EF	exposure frequency
EnSafe	EnSafe Inc.
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
FRE	Fixed-point risk evaluation
ft bls	Feet below land surface
HHRA	Human health risk assessment
HI	Hazard Index
ILCR	Incremental lifetime cancer risk
IM	Interim measure
IR	Ingestion rate
LUC	Land use control
MCL	Maximum contaminant level
MCS	Media cleanup standard
μg/L	Microgram per liter

Acronyms and Abbreviations, Continued

mg/kg	Milligram per kilogram
mg/m^3	Milligram per cubic meter
mg/wipe	Milligram per wipe
ng/kg	Nanogram per kilogram
NAVBASE	Naval Base
NIOSH	National Institute of Occupational Safety and Health
NFA	No further action
NFI	No further investigation
OP	Organo-phosphorus
OWS	Oil/water separator
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial action objective
RBC	Risk-based concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RGO	Remedial goal option
RI	Remedial investigation
RME	Reasonable maximum exposure
SAP	Sampling and analysis plan
SCDHEC	South Carolina Department of Health and Environmental Control
SSL	Soil screening level
SVOC	Semivolatile organic compound
SWMU	Solid waste management unit
TDS	Total dissolved solids
TEQ	TCDD Equivalent
TWA	Time-weighted average
UST	Underground storage tank
VOC	Volatile organic compound

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 Solid Waste Management Unit (SWMU) 67 in Zone E of CNC. The location of this site in Zone E is shown on Figure 1-1. Figure 1-2 shows an aerial photograph of the site.

1.1 Background

SWMU 67 consists of a former mercury gauge room and a mercury storage area, each in separate locations within Building 3. Building 3 was constructed in 1905, with additions constructed in 1939 and 1943. The mercury gauge room was used to calibrate and test gauges for leaks. A room near the middle of the northwest wall of the ground floor was originally intended to serve as the gauge room, but it is not known whether mercury gauges were ever handled in this room. Mercury gauge operations are known to have been conducted for 25 years in this building. Currently the building is being used as a machine shop by CMMC Machine, Inc.

The only material of concern at SWMU 67 indicated in the *Final Zone E RFI Work Plan, Revision 1* (EnSafe Inc. [EnSafe]/Allen & Hoshall, 1995) was mercury. The Final RCRA Facility Assessment (RFA) recommended a confirmatory sampling investigation (CSI) for this site. This area of Zone E is proposed to be zoned M2 (industrial).

The RFI was initially conducted by the Navy/EnSafe Inc. (EnSafe) team. RFI activities were documented in the *Zone E RFI Report, Revision 0* (EnSafe, 1997) submitted during 1997.

Regulatory review was conducted on this document and a response to the comments from SCDHEC were prepared by the Navy/EnSafe team.

During a review of historical Public Works maps of the CNC, it was determined that the correct location of former Building 1025, which was identified as Area of Concern (AOC) 546 during the Zone E RFI, overlaps a portion of SWMU 67. This area was investigated by the CH2M-Jones/Navy team during 2002, as described in Section 4.0 of this report.

1.2 Purpose of the RFI Report Addendum

The purpose of this RFI Report Addendum is to document the results of previous RFI investigations conducted at SWMU 67 and the more recent soil sampling conducted at the former location of Building 1025 (AOC 546). 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 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 SWMU 67 – Summarizes the conclusions from the RFI investigations and risk evaluations for SWMU 67 as presented in the RFI report.

3.0 Interim Measures and UST/AST Removals – Summarizes any interim measures (IMs) or underground storage tank (UST)/aboveground storage tank (AST) removal activities conducted at the site.

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

5.0 COPC/COC Refinement – Identifies and evaluates chemicals of potential concern (COPC) based on current screening criteria using all RFI and additional data.

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 for SWMU 67 – Presents a CMS Work Plan for addressing BEQ exceedances in site surface soil.

9.0 References – Lists the references used in this document.

Appendix A – Contains excerpts from the RFI report, including a summary of detections of chemicals. Also included are a groundwater contour map for the site vicinity and a copy of Figure 10.7.3 from the RFI report showing wipe sample locations.

Appendix B – Contains Figures B1 and B2 showing the correct location of former Building 1025 (AOC 546) in Zone E.

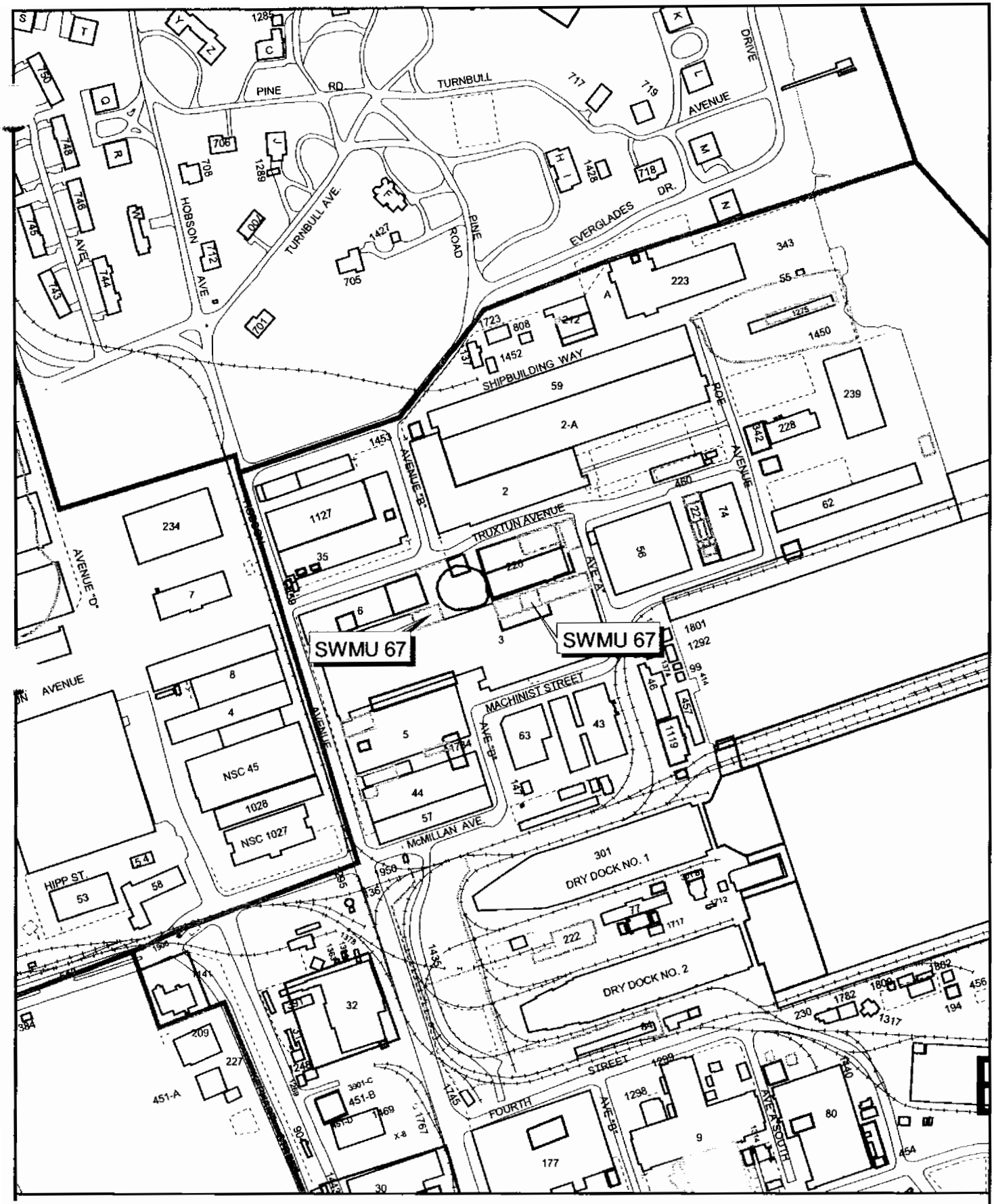
Appendix C – Contains copies of field logbook pages documenting the ambient air sampling for mercury.

Appendix D – Includes the analytical results reports and data validation summaries for the 2002 soil sampling conducted by the Navy/CH2M-Jones team.

Appendix E – Includes COPC screening tables used for the human health risk assessment (HHRA).

Appendix F – Contains figure showing the locations of surface soil samples with BEQ exceedances collected during the investigation of SWMU 37.

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



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

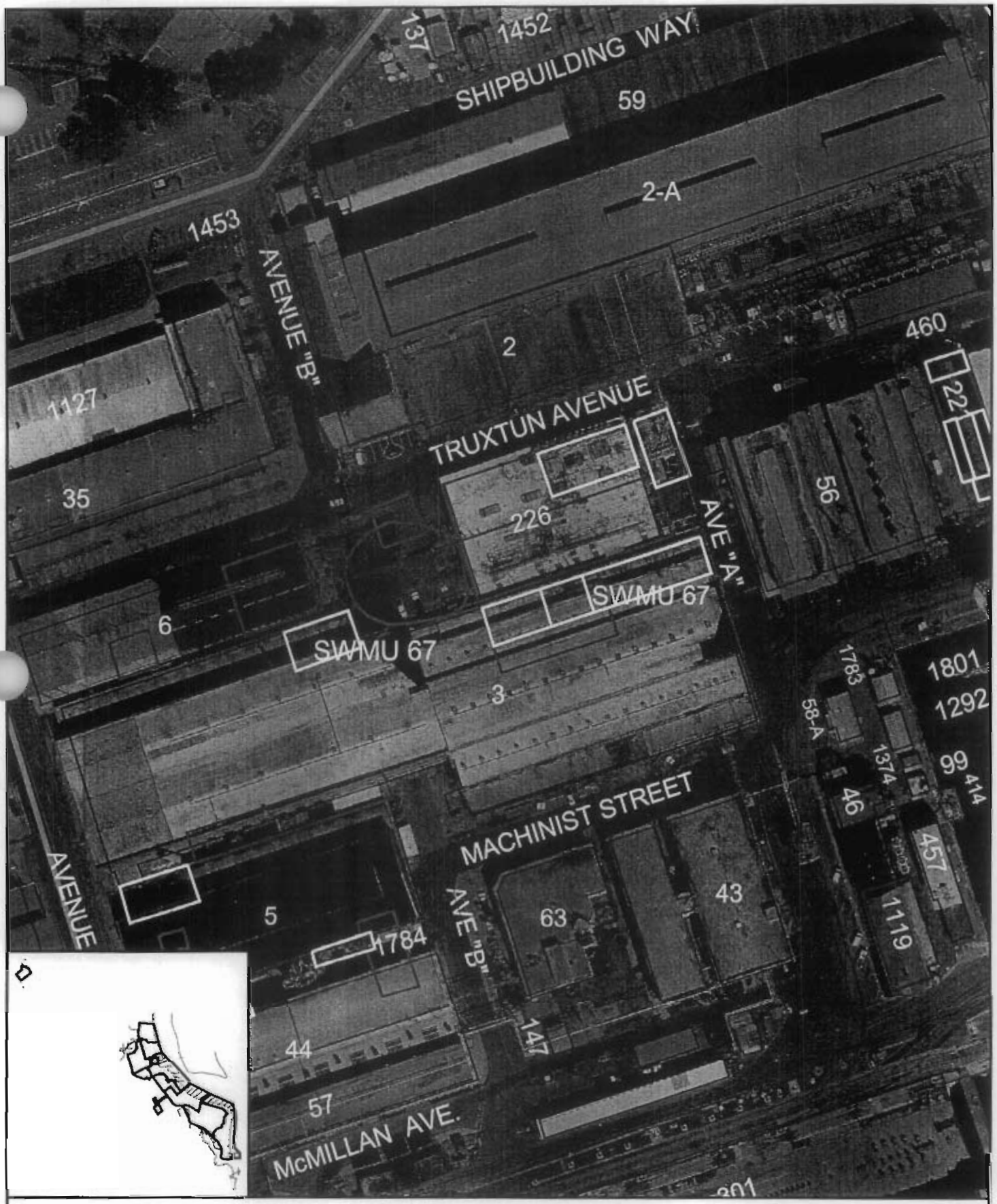
N

0 200 400 Feet

1 inch = 325 feet

Figure 1-1
Location of SWMU 67 in Zone E
Charleston Naval Complex

NOTE: Aerial Photo Date is 1997



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

N

0 100 200 Feet

1 inch = 139 feet

Figure 1-2
Aerial Photograph
SWMU 67, Zone E
Charleston Naval Complex

File Path: C:\Ifgis\CNC\cnc-epis.apr Date: 22 Jul 2002 13:52, User: MKARAFA, EGIS

Section 2.0

2.0 Summary of RFI Conclusions for SWMU 67

This section summarizes the results and conclusions from the soil, groundwater, air, and wipe sample investigations conducted at SWMU 67 as part of the Zone E RFI during 1995 and 1996. The results and conclusions concerning contamination and risk were reported in the *Zone E RFI Report, Revision 0* (EnSafe, 1997) and are summarized in the following sections. Figure 2-1 shows soil and groundwater sampling locations. A further evaluation of any chemicals of concern (COCs) at this site is provided in Section 5.0.

2.1 Soil Sampling and Analysis

During the soil sampling event, seven surface (0 to 1 foot below land surface [ft bls]) soil samples and seven co-located subsurface (3 to 5 ft bls) soil samples were collected at SWMU 67. All areas at SWMU 67 are under asphalt or concrete pavement. These boring locations were identified as E067SB001 through E067SB007. All samples were analyzed for mercury. Two subsurface soil samples were selected as duplicates. One duplicate sample was analyzed for mercury only. The other duplicate sample was analyzed for an extended list of parameters which includes herbicides, hexavalent chromium, organo-phosphorus (OP) pesticides, and dioxins. Figure 2-1 shows the soil sampling locations.

2.1.1 Surface Soil Results

During the RFI, surface soil detections of mercury were evaluated against the U.S. Environmental Protection Agency (EPA) Region III industrial risk-based concentrations (RBCs) and the Zone E background reference concentrations (BRCs).

- **Mercury:** Mercury detections did not exceed the screening criteria in surface soil.

2.1.2 Subsurface Soil Results

During the RFI, subsurface soil detections of mercury were compared with generic soil screening levels (SSLs) (using a dilution attenuation factor [DAF]=10) and the Zone E BRCs. Detections of organic analytes in the duplicate sample were compared with SSLs (DAF=10), and Zone E BRCs.

Detected concentrations of inorganic analytes from subsurface soil samples were as follows:

- **Mercury:** Mercury detections did not exceed their respective screening criteria in subsurface soil.

- **Herbicides:** Herbicides were not detected above their laboratory detection limits.
- **Hexavalent Chromium:** Hexavalent chromium was not detected above its laboratory detection limits.
- **OP Pesticides:** OP pesticides were not detected above their laboratory detection limits.
- **Dioxins:** The RFI report identified a TCDD Equivalent (TEQ) value of 0.0303 nanograms per kilogram (ng/kg) for the duplicate sample in subsurface soil. This value is below the dioxin detections in the background grid samples at the CNC, which range from 0.29 ng/kg to 14.11 ng/kg. The RFI indicated that no industrial RBCs exist for dioxins. Because this sample is a subsurface soil sample, human exposure is not a health concern.

2.2 Groundwater Sampling and Analysis

During the RFI for SWMU 67, two shallow groundwater monitoring wells, identified as E067GW001 and E067GW002, were installed. Groundwater in these wells was sampled during four sampling events from the period of 1996 to 1997. During the first and second sampling events, shallow groundwater was analyzed for mercury, chlorides, sulfates, and total dissolved solids (TDS). During the third and fourth sampling events, shallow groundwater was analyzed for the Zone E RFI standard list of inorganic analytes. Figure 2-1 shows the monitoring well locations at SWMU 67.

During the RFI, 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.

2.2.1 Shallow Groundwater Results

The detections in the shallow groundwater samples were as follows at this site:

- **Inorganics:** No detected inorganics exceeded their screening criteria.

2.3 Wipe Sampling and Analysis

The *Zone E RFI Work Plan, Revision 1* proposed to collect seven wipe samples at SWMU 67. During the RFI, these seven proposed wipe samples and one additional wipe sample were collected and analyzed for mercury. Sample locations were determined in the field to identify areas of the heaviest possible mercury contamination. The samples were collected in an area where lead ingots and weights had been stored. The RFI reported that the results from the wipe samples showed that mercury was present in all eight samples, ranging from

0.05 milligrams per wipe (mg/wipe) to 0.30 mg/wipe. The RFI reported that no residential or industrial RBCs exist for wipe samples.

2.4 Air Sampling and Analysis

During the RFI, air was sampled at SWMU 67. A Jerome Mercury Vapor Analyzer was used to screen for ambient mercury vapor in the mercury gauge rooms at SWMU 67. Each room was assessed for the presence of mercury vapor by sampling the air at floor level. The baseboards of each room were frisked with the mercury vapor analyzer and the vinyl floor tiles were disturbed to assess the floor area.

The air analysis identified two areas in SWMU 67 with detectable mercury vapor in ambient air. The classroom area in the old mercury gauge area had mercury concentrations ranging from 0.006 milligrams per cubic meter (mg/m^3) to 0.024 mg/m^3. These concentrations were obtained by removing a section of floor tile and immediately sampling the exposed area; however, no mercury was detected in the classroom when the floor tiles were undisturbed. The office area in the mercury gauging area also had detectable quantities of mercury vapor. The mercury vapor was detected in the west end of the office area and concentrations ranged from 0.003 mg/m^3 to 0.044 mg/m^3. These values are below the range of National Institute of Occupational Safety and Health (NIOSH) time-weighted average (TWA) values of 0.050 to 0.100 mg/kg, considered acceptable for industrial worker exposure.

2.5 RFI Human Health Risk Assessment (HHRA)

The RFI report used a fixed-point risk evaluation (FRE) approach at this site. The FRE considered site resident and site worker scenarios during the FRE. The detailed risk assessment for SWMU 67 site is presented in Section 10.7.10 of the RFI report.

2.5.1 Soils

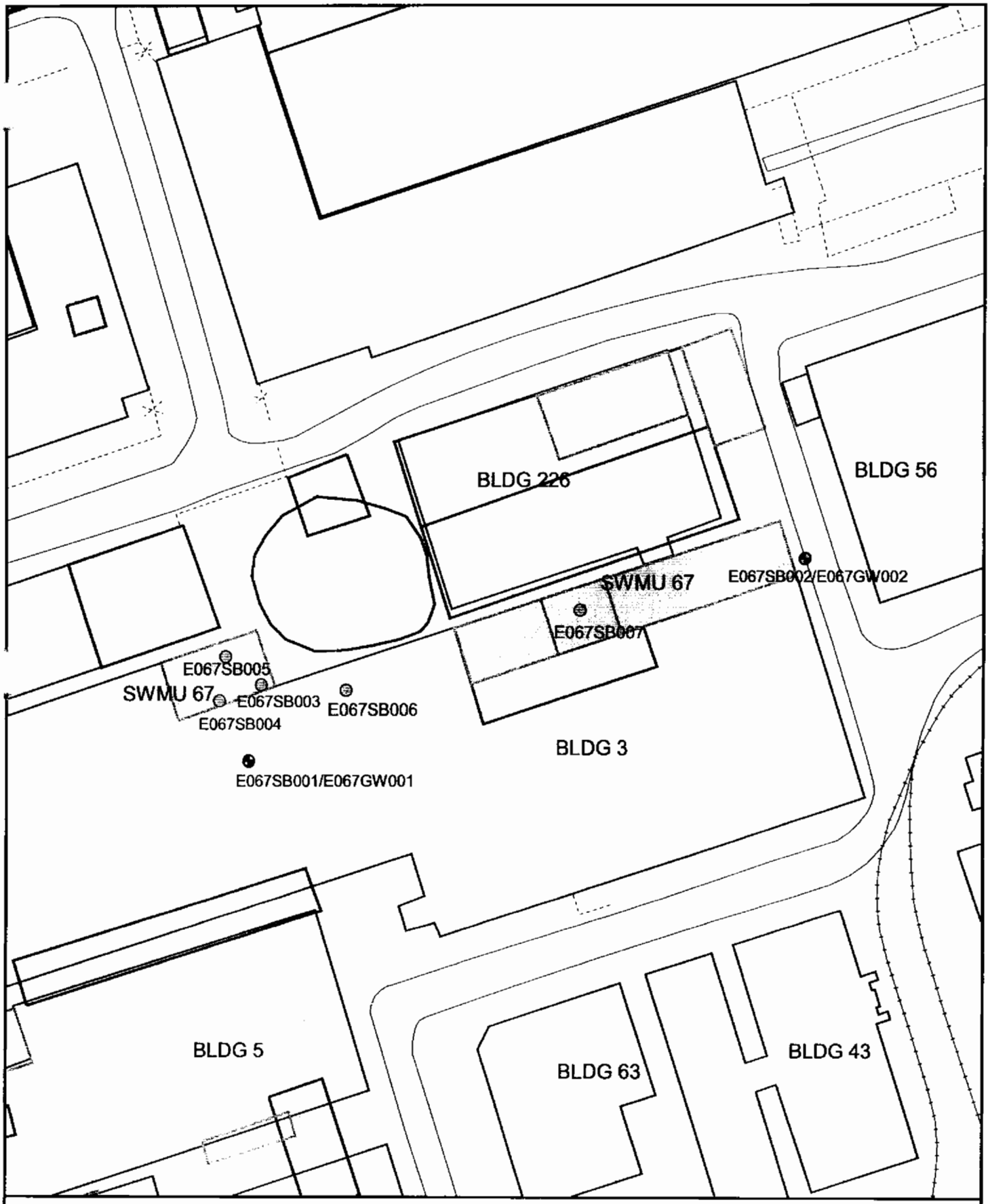
No COCs were identified in soils.

2.5.2 Groundwater

No COCs were identified in shallow groundwater.

2.6 RFI Conclusions and Recommendations

No COCs were identified for soil or groundwater at SWMU 67. Therefore, the RFI report recommended No Further Action (NFA) at SWMU 67.



Soil Sample Location
Groundwater Sample Location
Fence
Railroads
AOC Boundary
SWMU Boundary
Buildings
Zone Boundary

N

0 70 140 Feet

1 inch = 93 feet

Figure 2-1
RFI Sample Locations
SWMU 67, Zone E
Charleston Naval Complex

Section 3.0

3.0 Interim Measures and UST/AST Removals

3.1 UST/AST Removals

There are no known USTs or ASTs associated with SWMU 67.

3.2 Interim Measures

There were no IMs conducted at the site.

Section 4.0

4.0 Summary of Additional Investigations

No additional investigations had been conducted related to SWMU 67 since the RFI field investigations conducted by EnSafe during the period of 1995 to 1997.

In response to comments from SCDHEC on the *RFI Report Addendum for SWMU 67, Revision 0* (CH2M-Jones, 2002), ambient air and soil samples were collected at SWMU 67 to verify the presence of mercury and its current concentrations. Additional soil sampling was also conducted in the vicinity of SWMU 67 to complete the investigation for the former location of Building 1025 (AOC 546). Responses to comments for the *RFI Report Addendum for SWMU 67, Revision 0* are presented in Appendix B.

4.1 Air Sampling

Ambient air sampling using a Jerome Mercury Vapor Analyzer was conducted by CH2M-Jones in Building 3 on October 10, 2002. Samples were collected at approximately 5 feet above the floor, as requested by SCDHEC, in the former mercury gauge room on the first floor and the former mercury storage rooms on the first and second floors. Appendix C includes copies of field sampling logs showing the air sampling locations and readings from the Jerome Mercury Vapor Analyzer that was used for real-time air sampling. As indicated in these field sampling logs, there was only one detection of mercury vapor out of 60 readings at a concentration of 0.006 mg/m^3. This detection is below the NIOSH TWA range of 0.05 mg/m^3 to 0.10 mg/m^3 that is acceptable for industrial worker exposure, indicating that this single concentration is not a threat to industrial workers in this building. This building is not expected to undergo residential use.

4.2 Soil Sampling and Analysis

December 2002 Sampling

In response to SCDHEC comments on the *RFI Report Addendum for SWMU 67, Revision 0* (CH2M-Jones, 2002), a Sampling and Analysis Plan (SAP) to collect additional soil samples was prepared by CH2M-Jones. This SAP was reviewed and approved by SCDHEC during October 2002. In accordance with the SAP, surface and subsurface soil samples were collected during December 2002 in two areas north of SWMU 67 (within AOC 542) to delineate the concentrations of mercury around two soil borings LE037SB006 and LE037SB010, which were sampled as part of the RFI for SWMU 37 (Zone L sanitary sewer

investigation). These historical RFI surface soil mercury detections were 44.8 mg/kg and 9 mg/kg at LE037SB006 and LE037SB010, respectively. Both detections exceeded the EPA Region III residential RBC (with a Hazard Index [HI] = 0.1) for mercury of 2.3 mg/kg and the generic SSL of 1 mg/kg.

During the December 2002 sampling, samples were collected from two locations near E037SB006, identified as E542SB008 and E542SB009. Additional samples were collected at three locations around E037SB010, identified as E542SB010, E542SB011, and E542SB012. These sampling locations are shown on Figure 4-1. At each of these five locations, one surface soil sample (at 0 to 1 ft bls) and two subsurface soil samples (at 1 to 3 ft bls and 3 to 5 ft bls), were collected and analyzed for total mercury.

Detected mercury results for these samples are presented in Table 4-1 and discussed further in Sections 4.2.1 and 4.2.2.

AOC 546 Area Soil Sampling

During the preparation of the RFI Report Addendum for SWMU 65, AOC 544, and AOC 546 (Combined SWMU 65), attempts to verify the location of Building 1025 (AOC 546, former galvanizing shop) prior to its relocation next to Building 221 indicated that the Zone E RFA and the *Zone E RFI Report, Revision 0*, showed an incorrect former location for Building 1025. A review of the historical Public Works Map, Charleston Naval Base, dated June 30, 1937, showed the correct former location of Building 1025 to be approximately 160 feet northwest of the location shown in the RFI. Figure B-1 included in Appendix B of this report shows the actual former location of Building 1025 in relation to the location shown in the RFI. A copy of an excerpt from the Public Works map is included as Figure B-2 in Appendix B of this report. The legend confirms the operation at Building 1025 as a galvanizing shop. Former Building 1025 was demolished before the existing Building 3 was built over its footprint.

The actual former location of Building 1025 overlaps one part of SWMU 67, as shown on Figure A-2. Although soil samples were collected within the footprint of former Building 1025 as part of SWMU 67, the samples were analyzed only for mercury, the material of concern identified in the RFA for SMWU 67. Therefore, additional sampling for organics and inorganics (as part of the AOC 546 RFI activities) was warranted at the correct former location of Building 1025. A SAP Addendum was prepared by CH2M-Jones outlining this additional soil sampling. The SAP Addendum was approved by SCDHEC during November 2002 and the soil sampling was conducted during December 2002. The soil samples were collected from four locations at the former location of Building 1025 and

analyzed for VOCs, SVOCs and metals. The subsurface sample at boring location E546SB004 could not be collected due to water intrusion into the boring. Figure 4-1 shows the soil sampling locations. Appendix D contains copies of the analytical results reports and data validation summaries for this sampling event.

The analytical results from the two soil sampling efforts are discussed below.

4.2.1 Surface Soil

Surface soil detections of VOCs were compared with the EPA Region III residential and industrial RBCs (with a HI=0.1 for noncarcinogens) and generic SSLs (with a DAF =1). Surface soil detections of SVOCs were evaluated against the EPA Region III residential and industrial RBCs (HI=0.1 for noncarcinogens) and generic SSLs (DAF = 10). BEQs were evaluated against the CNC BEQ sitewide reference concentration for surface soils of 1.304 mg/kg. Surface soil detections of inorganic compounds were evaluated against the EPA Region III residential and industrial RBCs (HI=0.1 for noncarcinogens), SSLs (with a DAF= 10), and the range of Zone E background concentrations from grid samples. Surface soil detections of lead were compared with the EPA action level for unrestricted land use of 400 mg/kg and with the target cleanup goal for industrial land use of 1,218 mg/kg, which was developed for CNC using the EPA's Adult Lead Model (ALM).

Detected concentrations of various analytes from the 2002 sampling events are shown in Table 4-1 and summarized as follows:

VOCs: None of the detections exceeded COPC screening criteria.

SVOCs: None of the detections exceeded COPC screening criteria.

Inorganics:

- Antimony detections in samples from two locations, E546SB001 and E546SB002, with concentrations of 9.66 mg/kg and 8.95 mg/kg respectively, exceeded the EPA Region III residential RBC (at HI = 0.1) for antimony of 3.1 mg/kg and the maximum Zone E surface soil background antimony concentration of 7.4 mg/kg. These detections are below the EPA Region III industrial RBC (at HI = 0.1) for antimony of 82 mg/kg.
- One detection of cadmium at 46 mg/kg in the sample from E546SB002 exceeded the residential RBC (at HI = 0.1) of 7.8 mg/kg and the maximum Zone E surface soil background cadmium concentration of 1.5 mg/kg. This detection is below the EPA Region III industrial RBC (at HI = 0.1) for cadmium of 200 mg/kg.
- One detection of lead at 629 mg/kg in the sample from E546SB002 exceeded the EPA target cleanup goal of 400 mg/kg for unrestricted land use for lead. This detection is

below the target cleanup goal of 1,218 mg/kg for industrial land use for lead (based on the ALM).

- One detection of zinc at 24,800 mg/kg in the sample from E546SB002 exceeded the residential RBC (with a HI = 0.1) for zinc of 2,346 mg/kg and the maximum Zone E surface soil background zinc concentration of 855 mg/kg. This detection is below the EPA Region III industrial RBC (with a HI = 0.1) for zinc of 61,320 mg/kg.
- Three detections of mercury at 2.36 mg/kg, 3.99 mg/kg, and 12.20 mg/kg in the samples from E542SB009, E542SB012, and E542SB010, respectively, exceeded the residential RBC (with a HI = 0.1) for mercury of 2.3 mg/kg and generic SSL of 1 mg/kg. Two of these detections also exceeded the maximum Zone E surface soil background mercury concentration of 2.7 mg/kg. All of the mercury detections are below the EPA Region III industrial RBC (with a HI = 0.1) for mercury of 61.3 mg/kg.

4.2.2 Subsurface Soil

Subsurface soil detections of VOCs were compared with generic SSLs (using a DAF=1). Subsurface soil detections of SVOCs and inorganic chemicals were compared with generic SSLs (using a DAF=10). Detections of inorganic chemicals were also compared with the maximum background concentrations in Zone E grid samples. BEQs were evaluated against the CNC BEQ sitewide reference concentration for subsurface soils of 1.40 mg/kg.

Detected concentrations of various analytes from the 2002 sampling events are shown in Table 4-2 and summarized as follows:

VOCs: None of the detections exceeded COPC screening criteria.

SVOCs: None of the detections exceeded COPC screening criteria.

Inorganics:

- One detection of cobalt from E546SB003 of 2.75 mg/kg exceeded the maximum Zone E subsurface soil background concentration for cobalt of 1.5 mg/kg. No generic SSL or related parameters to enable calculation of a site-specific SSL have been published for cobalt. This chemical has very low solubility in water.
- All 10 subsurface samples from the five sample locations in the AOC 542 area showed detections of mercury above the generic SSL of 1 mg/kg and the maximum Zone E subsurface soil background concentration for mercury of 0.9 mg/kg. These detections range from 1.1 mg/kg to 7.29 mg/kg.

4.3 COPC Summary

Based on a comparison of detected concentrations of chemicals in surface and subsurface soils from the 2002 sampling, the following chemicals were identified as COPCs:

Surface Soil: Antimony, cadmium, lead, mercury and zinc for the unrestricted land use scenario. No COPCs were identified for the industrial land use scenario.

Subsurface Soil: Mercury above the generic SSL (with a DAF=10).

1

TABLE 4-1
Surface Soil Detections, 2002 Sampling
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Result (mg/kg)	Qual.	Date Sampled	EPA Region III Resid. RBC (HI=0.1) (mg/kg)	EPA Region III Industr. RBC (HI=0.1) (mg/kg)	SSL (mg/kg)	Range of Zone E Bkgd. Conc. (mg/kg)
VOCs									
1,1-Dichloroethene	E546SB00101	E546SB001	0.001	J	12/12/2002	1.1	9.5	0.003*	NA
Methyl isobutyl ketone (4-Methyl-2-pentanone)	E546SB00201	E546SB002	0.005	J	12/12/2002	630	16,000	0.0065**	NA
m+p Xylene	E546SB00101	E546SB001	0.002	J	12/12/2002	16,000	41,000	10*	
	E546SB00201	E546SB002	0.001	J	12/12/2002				
	E546SB00301	E546SB003	0.001	J	12/12/2002				
	E546SB00401	E546SB004	0.001	J	12/12/2002				
Xylenes, Total	E546SB00101	E546SB001	0.002	J	12/12/2002	16,000	41,000	10*	NA
	E546SB00201	E546SB002	0.001	J	12/12/2002				
	E546SB00301	E546SB003	0.001	J	12/12/2002				
	E546SB00401	E546SB004	0.001	J	12/12/2002				
SVOCs									
Acenaphthene	E546SB00301	E546SB003	0.080	J	12/12/2002	470	12,000	290	NA
	E546SB00401	E546SB004	0.025	J	12/12/2002				
Anthracene	E546SB00101	E546SB001	0.019	J	12/12/2002	2300	61,000	5900	NA
	E546SB00301	E546SB003	0.234	J	12/12/2002				
	E546SB00401	E546SB004	0.047	J	12/12/2002				
Benzo(g,h,i)-perylene	E546SB00101	E546SB001	0.068	J	12/12/2002	230[a]	6,100[a]	NA	NA
	E546SB00201	E546SB002	0.041	J	12/12/2002				
	E546SB00301	E546SB003	0.436	=	12/12/2002				
Carbazole	E546SB00301	E546SB003	0.150	J	12/12/2002	32	290	0.3	NA
	E546SB00401	E546SB004	0.068	J	12/12/2002				
Dibenzofuran	E546SB00301	E546SB003	0.037	J	12/12/2002	31	820	0.38	NA
	E546SB00401	E546SB004	0.049	J	12/12/2002				

TABLE 4-1
Surface Soil Detections, 2002 Sampling
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Result (mg/kg)	Qual.	Date Sampled	EPA Region III Resid. RBC (HI=0.1) (mg/kg)	EPA Region III Industr. RBC (HI=0.1) (mg/kg)	SSL (mg/kg)	Range of Zone E Bkgd. Conc. (mg/kg)
Fluoranthene	E546SB00101	E546SB001	0.191	J	12/12/2002	310	8,200	2,100	NA
	E546SB00201	E546SB002	0.106	J	12/12/2002				
	E546SB00401	E546SB004	0.153	J	12/12/2002				
Fluorene	E546SB00301	E546SB003	0.083	J	12/12/2002	310	8,200	280	NA
	E546SB00401	E546SB004	0.058	J	12/12/2002				
Naphthalene	E546SB00301	E546SB003	0.030	J	12/12/2002	160	4,100	42	NA
Phenanthrene	E546SB00101	E546SB001	0.128	J	12/12/2002	NA	NA	NA	NA
	E546SB00201	E546SB002	0.043	J	12/12/2002				
	E546SB00401	E546SB004	0.300	J	12/12/2002				
Pyrene	E546SB00101	E546SB001	0.122	J	12/12/2002	230	6,100	2,100	NA
	E546SB00201	E546SB002	0.069	J	12/12/2002				
	E546SB00301	E546SB003	1.300	J	12/12/2002				
	E546SB00401	E546SB004	0.076	J	12/12/2002				
BEQs	E546SB00101	E546SB001	0.473	=	12/12/2002	NA	NA	NA	1.304
	E546SB00201	E546SB002	0.283	=	12/12/2002				
	E546SB00301	E546SB003	1.276	=	12/12/2002				
	E546SB00401	E546SB004	0.458	=	12/12/2002				
Inorganics									
Antimony	E546SB00101	E546SB001	**9.66**	J	12/12/2002	3.1	82	3	0.50 - 7.4
	E546SB00201	E546SB002	**8.95**	J	12/12/2002				
Arsenic	E546SB00101	E546SB001	3.26	=	12/12/2002	0.43	3.8	14.5	0.95 - 68
	E546SB00201	E546SB002	9.42	=	12/12/2002				
	E546SB00301	E546SB003	1.88	J	12/12/2002				
	E546SB00401	E546SB004	0.623	J	12/12/2002				
Beryllium	E546SB00101	E546SB001	0.357	J	12/12/2002	15.6	409	31.5	0.13 - 1.6
	E546SB00201	E546SB002	1.18	=	12/12/2002				
	E546SB00301	E546SB003	0.218	J	12/12/2002				
	E546SB00401	E546SB004	0.126	J	12/12/2002				

TABLE 4-1
Surface Soil Detections, 2002 Sampling
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Result (mg/kg)	Qual.	Date Sampled	EPA Region III Resid. RBC (HI=0.1) (mg/kg)	EPA Region III Industr. RBC (HI=0.1) (mg/kg)	SSL (mg/kg)	Range of Zone E Bkgd. Conc. (mg/kg)
Cadmium	E546SB00101	E546SB001	1.58	=	12/12/2002	7.8	204	4	0.06 - 1.5
	E546SB00201	E546SB002	**46**	=	12/12/2002				
	E546SB00301	E546SB003	1.21	=	12/12/2002				
Chromium, Total	E546SB00101	E546SB001	11.7	=	12/12/2002	23.5	613	19	2.3 - 567
	E546SB00201	E546SB002	12.3	=	12/12/2002				
	E546SB00301	E546SB003	26.8	=	12/12/2002				
	E546SB00401	E546SB004	7.58	=	12/12/2002				
Cobalt	E546SB00101	E546SB001	2.32	J	12/12/2002	469	12,264	NA	0.35 - 111
	E546SB00201	E546SB002	5.5	J	12/12/2002				
	E546SB00301	E546SB003	1.95	J	12/12/2002				
	E546SB00401	E546SB004	1.16	J	12/12/2002				
Copper	E546SB00101	E546SB001	210	=	12/12/2002	312	8,176	550	0.47 - 866
	E546SB00201	E546SB002	78.9	=	12/12/2002				
	E546SB00301	E546SB003	62.6	=	12/12/2002				
	E546SB00401	E546SB004	14.5	=	12/12/2002				
Lead	E546SB00101	E546SB001	244	=	12/12/2002	400	1,218	400	1.0 - 400
	E546SB00201	E546SB002	**629**	=	12/12/2002				
	E546SB00301	E546SB003	73.2	=	12/12/2002				
	E546SB00401	E546SB004	6.46	=	12/12/2002				
		Site Average Concentration	238.16			238.165			
Mercury	542SB00801	542SB008	1.37	=	12/11/2002	2.3	61.3	1	0.03 - 2.7
	542SB00901	542SB009	2.36	=	12/11/2002				
	542SB01001	542SB010	**12.2**	=	12/11/2002				
	542SB01101	542SB011	1.92	=	12/11/2002				
	542SB01201	542SB012	**3.99**	=	12/11/2002				
	E546SB00101	E546SB001	0.158	=	12/12/2002				
	E546SB00201	E546SB002	0.066	J	12/12/2002				

TABLE 4-1
Surface Soil Detections, 2002 Sampling
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Result (mg/kg)	Qual.	Date Sampled	EPA Region III Resid. RBC (HI=0.1) (mg/kg)	EPA Region III Industr. RBC (HI=0.1) (mg/kg)	SSL (mg/kg)	Range of Zone E Bkgd. Conc. (mg/kg)
	E546SB00301	E546SB003	0.103	J	12/12/2002				
	E546SB00401	E546SB004	0.006	J	12/12/2002				
Nickel	E546SB00101	E546SB001	33.1	J	12/12/2002	156	4,088	65	0.6 - 72
	E546SB00201	E546SB002	26.9	J	12/12/2002				
	E546SB00301	E546SB003	25.4	=	12/12/2002				
	E546SB00401	E546SB004	3.1	J	12/12/2002				
Selenium	E546SB00101	E546SB001	0.595	J	12/12/2002	39	1,022	3	0.57 - 4.0
	E546SB00201	E546SB002	0.898	J	12/12/2002				
	E546SB00301	E546SB003	1.4	=	12/12/2002				
Silver	E546SB00101	E546SB001	0.148	J	12/12/2002	39	1,022	17	0.75 - 0.91
Tin (Sn)	E546SB00101	E546SB001	73.2	=	12/12/2002	4,692	122,640	NA	0.77 - 45
	E546SB00201	E546SB002	135	=	12/12/2002				
	E546SB00301	E546SB003	5.95	=	12/12/2002				
Vanadium	E546SB00101	E546SB001	12.5	=	12/12/2002	55	1,431	3,000	1.1 - 60
	E546SB00201	E546SB002	22.3	=	12/12/2002				
	E546SB00301	E546SB003	23	=	12/12/2002				
	E546SB00401	E546SB004	10.9	J	12/12/2002				
Zinc	E546SB00101	E546SB001	1490	=	12/12/2002	2,346	61,320	6,000	1.9 - 855
	E546SB00201	E546SB002	**24,800**	=	12/12/2002				
	E546SB00301	E546SB003	425	=	12/12/2002				
	E546SB00401	E546SB004	9.84	=	12/12/2002				

NOTES:

*	SSLs used for VOCs are with a DAF=1
**	No generic SSLs published in the EPA SSL Guidance Document. SSLs cited are from the EPA Region III RBC Tables of October 2000.
a	No RBCs published for benzo(g,h,i)perylene. Values for Pyrene used instead, for comparison.
HI	Hazard index
=	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.
U	Indicates analyte not detected above laboratory detection limit.

1

1

TABLE 4-2
Subsurface Soil Detections, 2002 Sampling
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Result (mg/kg)	Qual.	Date Sampled	EPA Region III Resid. RBC (HI=0.1) (mg/kg)	EPA Region III Industr. RBC (HI=0.1) (mg/kg)	SSL (mg/kg)	Range of Zone E Bkgd. Conc. (mg/kg)
VOCs									
1,1-Dichloroethene	E546SB00102	E546SB001	0.001	J	12/12/2002	NA	NA	0.003*	NA
	E546SB00302	E546SB003	0.001	J	12/12/2002				
m+p Xylene	E546SB00202	E546SB002	0.001	J	12/12/2002			10	NA
Xylenes, Total	E546SB00102	E546SB001	0.001	J	12/12/2002			10	NA
	E546SB00202	E546SB002	0.001	J	12/12/2002				
SVOCs									
2-Methylnaphthalene	E546SB00302	E546SB003	0.024	J	12/12/2002	160	4,100	11	NA
Acenaphthene	E546SB00302	E546SB003	0.078	J	12/12/2002	470	12,000	290	NA
Anthracene	E546SB00302	E546SB003	0.169	J	12/12/2002	2,300	61,000	5,900	NA
Benzo(g,h,i)-perylene	E546SB00302	E546SB003	0.290	J	12/12/2002	230[a]	61,00[a]	NA	NA
Carbazole	E546SB00302	E546SB003	0.114	J	12/12/2002	32	290	0.3	NA
Dibenzofuran	E546SB00302	E546SB003	0.034	J	12/12/2002	31	820	0.38	NA
Fluorene	E546SB00302	E546SB003	0.059	J	12/12/2002	310	8,200	280	NA
Naphthalene	E546SB00302	E546SB003	0.026	J	12/12/2002	160	4,100	42	NA
Pyrene	E546SB00302	E546SB003	0.717	J	12/12/2002	230	6,100	2,100	NA
BEQs	E546SB00302	E546SB003	0.913	=	12/12/2002	NA	NA	NA	1.4
Inorganics									
Arsenic	E546SB00102	E546SB001	0.881	J	12/12/2002	NA	NA	14.5	0.83 - 26
	E546SB00202	E546SB002	1.01	J	12/12/2002				
	E546SB00302	E546SB003	2.2	J	12/12/2002				
Beryllium	E546SB00102	E546SB001	0.178	J	12/12/2002	NA	NA	31.5	0.15 - 1.6
	E546SB00202	E546SB002	0.144	J	12/12/2002				

TABLE 4-2
Subsurface Soil Detections, 2002 Sampling
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Result (mg/kg)	Qual.	Date Sampled	EPA Region III Resid. RBC (HI=0.1) (mg/kg)	EPA Region III Industr. RBC (HI=0.1) (mg/kg)	SSL (mg/kg)	Range of Zone E Bkgd. Conc. (mg/kg)
	E546SB00302	E546SB003	0.231	J	12/12/2002				
Cadmium	E546SB00202	E546SB002	0.613	J	12/12/2002	NA	NA	4	0.13 - 0.96
	E546SB00302	E546SB003	1.6	=	12/12/2002				
Chromium, Total	E546SB00102	E546SB001	6.24	=	12/12/2002	NA	NA	19	1.6 - 75
	E546SB00202	E546SB002	5.45	=	12/12/2002				
	E546SB00302	E546SB003	14.4	=	12/12/2002				
Cobalt	E546SB00102	E546SB001	0.467	J	12/12/2002	NA	NA	NA	0.41 - 1.5
	E546SB00202	E546SB002	0.502	J	12/12/2002				
	E546SB00302	E546SB003	**2.75**	J	12/12/2002				
Copper	E546SB00102	E546SB001	3.41	J	12/12/2002	NA	NA	550	1.3 - 192
	E546SB00202	E546SB002	21.4	=	12/12/2002				
	E546SB00302	E546SB003	83.5	=	12/12/2002				
Lead	E546SB00102	E546SB001	6	=	12/12/2002	NA	NA	400	1.8 - 322
	E546SB00202	E546SB002	46.2	=	12/12/2002				
	E546SB00302	E546SB003	74.4	=	12/12/2002				
Mercury	E542SB00802	E542SB008	**1.1**	=	12/11/2002	NA	NA	1	0.04 - 0.90
	E542SB00803	E542SB008	**1.69**	=	12/11/2002				
	E542SB00902	E542SB009	**2.09**	=	12/11/2002				
	E542SB00903	E542SB009	**3.37**	=	12/11/2002				
	E542SB01002	E542SB010	**2.12**	=	12/11/2002				
	E542SB01003	E542SB010	**7.29**	=	12/11/2002				
	E542SB01102	E542SB011	**3.35**	=	12/11/2002				
	E542SB01103	E542SB011	**3.03**	=	12/11/2002				
	E542SB01202	E542SB012	**2.65**	=	12/11/2002				
	E542SB01203	E542SB012	**5.16**	J	12/11/2002				

TABLE 4-2
Subsurface Soil Detections, 2002 Sampling
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Result (mg/kg)	Qual.	Date Sampled	EPA Region III Resid. RBC (HI=0.1) (mg/kg)	EPA Region III Industr. RBC (HI=0.1) (mg/kg)	SSL (mg/kg)	Range of Zone E Bkgd. Conc. (mg/kg)
	E546SB00102	E546SB001	0.022	J	12/12/2002				
	E546SB00202	E546SB002	0.015	J	12/12/2002				
	E546SB00302	E546SB003	0.094	J	12/12/2002				
Nickel	E546SB00102	E546SB001	3.05	J	12/12/2002	NA	NA	65	0.85 - 20
	E546SB00202	E546SB002	14.6	=	12/12/2002				
	E546SB00302	E546SB003	27.8	=	12/12/2002				
Selenium	E546SB00202	E546SB002	0.495	J	12/12/2002	NA	NA	3	0.59 - 2.4
Tin (Sn)	E546SB00102	E546SB001	0.427	J	12/12/2002	NA	NA	NA	2.8 - 24
	E546SB00202	E546SB002	1	J	12/12/2002				
	E546SB00302	E546SB003	5.88	=	12/12/2002				
Vanadium	E546SB00102	E546SB001	6.86	J	12/12/2002	NA	NA	3,000	1.6 - 71
	E546SB00202	E546SB002	5.92	J	12/12/2002				
	E546SB00302	E546SB003	14.4	=	12/12/2002				
Zinc	E546SB00102	E546SB001	53.1	=	12/12/2002	NA	NA	6,000	5.8 - 438
	E546SB00202	E546SB002	159	=	12/12/2002				
	E546SB00302	E546SB003	432	=	12/12/2002				

NOTES:

* SSLs used for VOCs are with a DAF=1

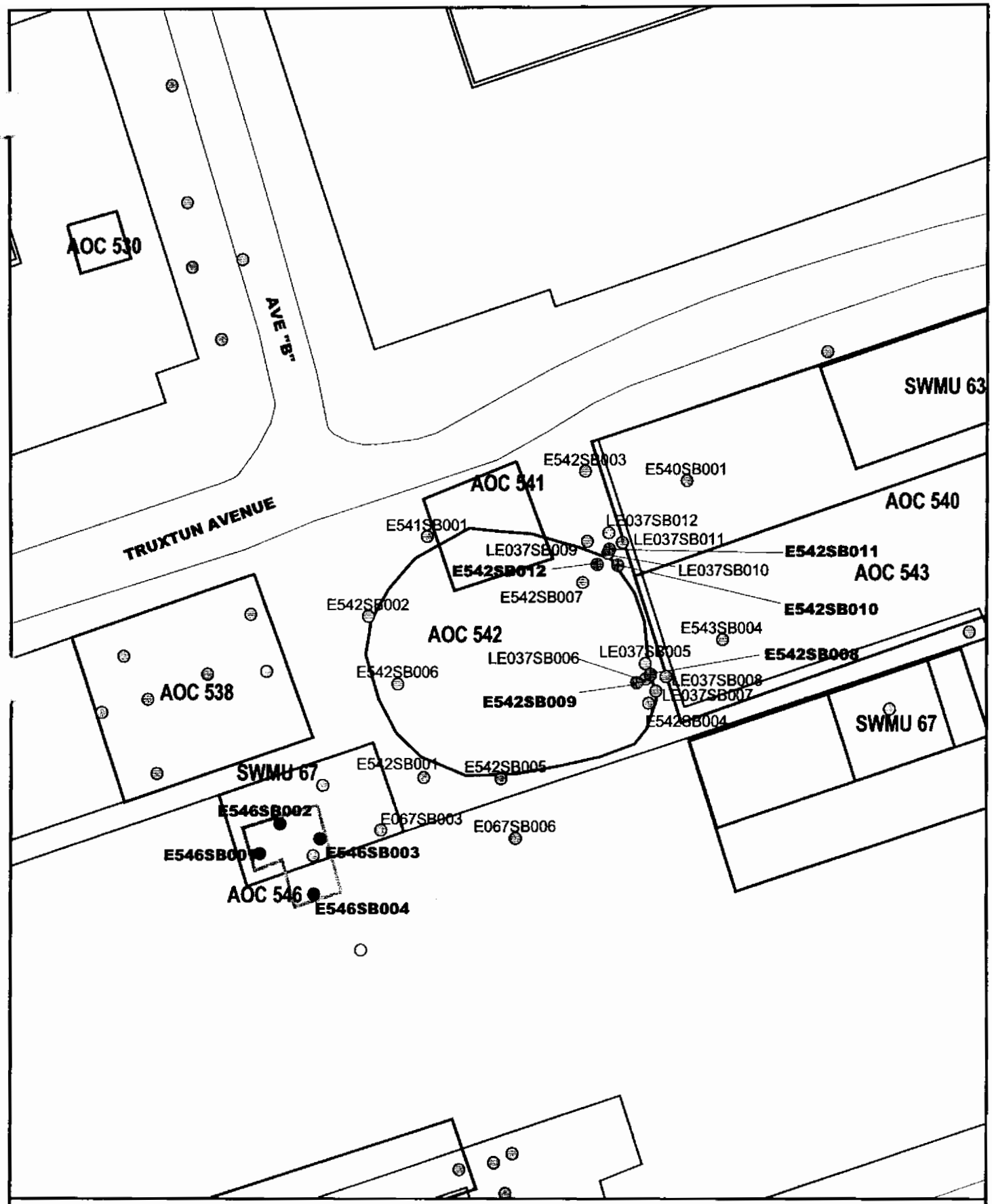
a No RBCs published for benzo(g,h,i)perylene. Values for Pyrene used instead, for comparison.

HI Hazard index

= 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.

U Indicates analyte not detected above laboratory detection limit.



December 2002 Sampling Locations
RFI Soil Sampling Locations
Roads
AOC Boundary
SWMU Boundary
Buildings

N

0 40 80 Feet

1 inch = 58 feet

Figure 4-1
December 2002 Sampling Locations
SWMU 67, Zone E
Charleston Naval Complex

CH2MHILL

Section 5.0

5.0 COPC/COC Refinement

The *Zone E RFI Report, Revision 0* (EnSafe, 1997) did not identify any COCs for soil or groundwater at SWMU 67. In response to comments on the *RFI Report Addendum for SWMU 67, Revision 0* (CH2M-Jones, 2002), additional soil sampling was conducted during 2002 by the Navy/CH2M-Jones team at areas north of SWMU 67 and at the former location of Building 1025 (see Section 4.0). Based on the analytical results from this sampling effort, antimony, cadmium, lead, mercury, and zinc were identified as COPCs in surface soil for the unrestricted land use scenario. No COPCs were identified for the industrial land use scenario.

Mercury was identified as a COPC in subsurface soil, based on exceedance of its generic SSL (DAF = 10).

Because of the presence of several chemicals above the EPA residential RBC (with a HI=0.1), a HHRA was conducted to determine which of these COPCs pose a risk at the site. As part of this HHRA, surface soil detections of COPCs were evaluated for exposure under both the future unrestricted (residential) and industrial land use scenarios. Surface and subsurface soils were also evaluated for the construction worker scenario. This HHRA is discussed in the sections below.

The BCT has agreed to rescreen soil VOC data using generic SSLs based on a DAF of 1. The results of this rescreening are presented below.

The nature of occurrence and the relevance of detected chemicals at the site are also discussed below.

5.1 Soil VOC Screening using SSL at DAF=1

During the initial RFI, soil samples at SWMU 67 were not analyzed for VOCs since the only material of concern was mercury. During 2002 sampling at the former location of AOC 546, three VOCs, 1,1-dichlorothene, methyl isobutyl ketone, and xylenes, were detected in surface soil samples above laboratory detection limits. In subsurface soil samples, 1,1-dichloroethene and xylenes were detected above laboratory detection limits. These detections are shown in Table 4-1. None of the VOC detections in surface or subsurface soil samples exceeded the generic SSL (with a DAF=1). Detections of methyl isobutyl ketone

were compared with EPA Region III risk-based SSL (with a DAF=1), since no generic SSLs have been published for this chemical. No exceedances of the SSLs were identified.

5.2 COCs in Surface Soil

5.2.1 Antimony

During the initial RFI for SWMU 67, antimony was not identified as a COC. During the December 2002 sampling for AOC 546 at the former location of Building 1025 near Building 3, antimony was detected in surface soil samples from two locations, E546SB001 and E546SB002, at 9.66 mg/kg and 8.95 mg/kg, respectively. The detections are above the EPA Region III residential RBC (with a HI = 0.1) for antimony of 3.1 mg/kg and the maximum Zone E surface soil background antimony concentration of 7.4 mg/kg. These detections are below the EPA Region III industrial RBC (with a HI = 0.1) for antimony of 82 mg/kg. Table 4-1 shows the detections of antimony from the December 2002 sampling.

Soil sampling locations within a 1-acre area (as shown on Figure 5-1), which includes soil boring locations from the Zone E RFI, the SWMU 37 (Zone L RFI) sewer investigations, and the December 2002 soil sampling, were targeted to provide data for the HHRA. Based on exceedances of the unrestricted land use criteria, antimony was included as a COPC for the HHRA as presented in Section 5.4 below.

5.2.2 Cadmium

During the initial RFI for SWMU 67, cadmium was not identified as a COC. During the December 2002 sampling for AOC 546 at the former location of Building 1025 near Building 3, one detection of cadmium at 46 mg/kg in the sample from E546SB002 exceeded the residential RBC (with a HI = 0.1) for cadmium of 7.8 mg/kg and the maximum Zone E surface soil background cadmium concentration of 1.5 mg/kg. This detection is below the EPA Region III industrial RBC (with a HI = 0.1) for cadmium of 200 mg/kg. Table 4-1 shows the detections of cadmium from the December 2002 sampling.

Soil sampling locations within a 1-acre area (as shown on Figure 5-1), which includes soil boring locations from the Zone E RFI, the SWMU 37 (Zone L RFI) sewer investigations, and the December 2002 soil sampling, were targeted to provide data for the HHRA. Based on exceedances of the unrestricted land use criteria, cadmium was included as a COPC for the HHRA as presented in Section 5.4 below.

5.2.3 Lead

During the initial RFI for SWMU 67, lead was not identified as a COC. During the September 2002 sampling for AOC 546 at the former location of Building 1025 near Building 3, one detection of lead at 629 mg/kg in the sample from E546SB002 exceeded the EPA target cleanup goal of 400 mg/kg for unrestricted land use for lead. This detection is below the EPA target cleanup goal of 1,218 mg/kg for industrial land use for lead (based on the ALM). The site average for surface soil lead is 238.16 mg/kg, which is below the target cleanup goal of 400 mg/kg for unrestricted land use.

Based on these observations, lead is not considered a surface soil COC at this site for unrestricted land use. Lead is discussed further in the HHRA section below. Soil sampling locations within a 1-acre area (as shown on Figure 5-1), which includes soil boring locations from the Zone E RFI, the SWMU 37 (Zone L RFI) sewer investigations, and the December 2002 soil sampling, were targeted to provide data for the HHRA.

5.2.4 Mercury

Mercury was not identified as a COC in the RFI for SWMU 67. Based on elevated detections in soil borings introduced north of SWMU 67 as part of the SWMU 37 (Zone L RFI) sewer investigations, additional delineation sampling was conducted during December 2002. The elevated detections from the SWMU 37 RFI were 44.8 mg/kg at LE037SB006 and 9 mg/kg at LE037SB010.

In surface soil samples from the SWMU 67 RFI, the SWMU 37 (Zone L RFI) sewer investigations, and the December 2002 sampling at SWMU 67, mercury was detected in 12 out of 16 samples, with concentrations ranging from 0.006 mg/kg to 44.8 mg/kg. Eight surface soil samples showed detections above the Zone E maximum surface soil background concentration for mercury of 2.7 mg/kg, the EPA Region III residential RBC (with a HI = 0.1) for mercury of 2.3 mg/kg, and the generic SSL of 1 mg/kg. The mercury detections above these criteria ranged from 2.36 mg/kg to 44.8 mg/kg.

Table 5-1 lists detected mercury concentrations detected in surface and subsurface soil samples collected in this area from these sampling events. Mercury in surface soil was included as a COPC for a risk assessment. Soil sampling locations within a 1-acre area (as shown on Figure 5-1) which includes soil boring locations from the Zone E RFI, the SWMU 37 (Zone L RFI) sewer investigations, and the December 2002 soil sampling were targeted to provide data for the HHRA.

5.2.5 Zinc

Zinc was not identified as a COC during the RFI. During the December 2002 sampling, one detection of zinc at 24,800 mg/kg in the sample from E546SB002 exceeded the EPA Region III residential RBC (with a HI = 0.1) for zinc of 2,346 mg/kg and the maximum Zone E surface soil background zinc concentration of 855 mg/kg. This detection is below the EPA Region III industrial RBC (with a HI = 0.1) for zinc, of 61,320 mg/kg. Based on exceedances of the unrestricted land use criteria, zinc was included as a COPC for a risk assessment. Soil sampling locations within a 1-acre area (as shown on Figure 5-1), which includes soil boring locations from the Zone E RFI, the SWMU 37 (Zone L RFI) sewer investigations, and the December 2002 soil sampling, were targeted to provide data for the HHRA.

5.3 Subsurface Soil COCs

In subsurface soil samples from the SWMU 67 RFI, the SWMU 37 (Zone L RFI) sewer investigations, and the December 2002 sampling, mercury was detected in 15 out of 20 subsurface soil samples, with concentrations ranging from 0.015 mg/kg to 7.29 mg/kg. Several samples exceeded the generic SSL of 1 mg/kg.

The site average concentration for mercury in subsurface soil was calculated to be 1.62 mg/kg, as shown in Table 5-1. This value is above the generic SSL (with a DAF = 10) for mercury.

Site-specific SSLs were calculated for mercury for this area, with 0.536 mg/kg for the unpaved scenario and 5.43 mg/kg for the paved scenario, as shown in Table 5-3. The site average concentration of 1.62 mg/kg for mercury in subsurface soil is above the site-specific SSL for the unpaved scenario and below the site-specific SSL for the paved scenario. This area of Zone E is expected to remain paved under a future industrial land use scenario.

Based on observations of mercury detections in groundwater in three shallow wells in this area, E542GW003, E542GW004 and LE037GW002, only two detections of mercury were observed above laboratory detection limits. These detections were observed in samples from well E542GW004 during the second and fourth sampling events and are both at 0.29 µg/L, which is below the MCL for mercury of 2 µg/L. These detections were preceded and followed by detections below laboratory detection limits, as shown in Table 5-2. The infrequent detections of mercury in groundwater in this area indicate that soil concentrations of mercury at the site are not a leaching threat to groundwater. Based on these observations, mercury is not considered a subsurface soil COC at this site.

5.4 Human Health Risk Assessment (HHRA) for Site Soils

Using the data presented in Sections 2.0 and 4.0, a HHRA was conducted to evaluate the cumulative risks and hazards from the COPCs discussed above. The HHRA was conducted in accordance with the Risk Assessment Guidance for Superfund (RAGS) and EPA Region 4 supplemental guidance (EPA, 1989, and EPA, 1994).

5.4.1 Selection of COPCs

The detected concentrations of organic and inorganic chemicals detected in surface and subsurface soils were screened by comparing the maximum detected soil residual concentration against RBCs (HI=0.1 for noncarcinogens) and background concentrations range. Chemicals detected above RBCs and maximum background levels are included for risk estimation as COPCs. Though only five of the inorganic chemicals were identified as COPCs based on the results of analysis presented in Section 2.0 and 4.0, all the existing data were rescreened for identification of COPCs. Although no organic chemicals were identified as COPCs at the end of Sections 2.0 and 4.0, all the organic and inorganic chemicals were rescreened to determine whether any cumulative risks and HI could occur, since these soils are still in place at the site. Soil sampling locations within a 1-acre area (as shown on Figure 5-1), which includes soil boring locations from the Zone E RFI, the SWMU 37 (Zone L RFI) sewer investigations, and the December 2002 soil sampling, were targeted to provide data for the HHRA.

Additionally, the area around SWMU 67 is extensively paved with asphalt material and the surficial soils have been periodically disturbed over the life of the site. One sample collected at the underground sewer investigations, 037SB012E1, had an elevated BEQ concentration (~74 mg/kg), which significantly biases the 95% Upper Confidence Limit calculations and risk estimation. No other samples near this sample location had elevated PAHs (see Appendix E Table-3). Therefore this sample was not included for risk and HI calculation, as it was identified as likely due to having been impacted by asphalt material.

Appendix E presents a detailed listing for all detected chemicals in surface and soils, compared with the RBC and background values. Table 5-4 below presents list of COPCs selected for surface soil and subsurface soil. The surface soils were evaluated for industrial workers and residential receptors and subsurface soils were evaluated for construction workers, as discussed in the exposure assessment section below.

5.4.2 Exposure Assessment

Based on anticipated future land use considerations, the following potentially exposed populations were identified:

- Industrial workers
- Residential receptors (both, adult and child)
- Utility workers

Other potentially exposed populations could occur; however, their likely exposure will be lower than those receptors listed above. It assumed that if the listed receptors are protected, all other potentially exposed populations will also be protected. Exposure assumptions were selected to be conservative representations to estimate the possible upper-bound exposures, using the reasonable maximum exposure (RME) levels from the EPA guidance. Also, when multiple exposure factors are available, a more conservative factor was selected to ensure conservatism in the exposure assessment.

Table 5-5 presents the exposure factors assumed for the receptors evaluated below.

Industrial Worker

This scenario was evaluated assuming the site would be converted into a future industrial facility where a worker spends his/her entire work day at the site and in direct contact with soils. Depending on site-specific conditions, future use for these sites could potentially allow for light industrial/commercial use, which would bring industrial workers into contact with site media. The industrial worker assumptions include soil ingestion rate (IR) of 50 mg/day, exposure frequency (EF) of 250 days/yr, and exposure duration (ED) of 25 years. The dermal exposure and inhalation route exposure assumptions are listed in Table 5-5.

Construction Worker

A future utility worker scenario was evaluated for subsurface soil exposure at various sites where COPCs were identified in subsurface soil. The subsurface soil COPCs were selected by comparing detected concentrations in subsurface soil samples against residential RBC values. The typical construction work is assumed to last for an ED of 1 year, with an EF of 250 days. The soil ingestion rate for a construction worker is conservatively assumed to be 480 mg/day, which is higher than any other worker scenario. All other exposure factors are similar to those of an industrial worker scenario as included in risk tables in Appendix E. Exposure point concentrations (EPCs) for a construction worker were calculated by combining surface and subsurface soil, as construction activities tend to mix both of these layers of soils.

Residential Receptors

To offer the most flexible future land use considerations for the site, future residents were assumed to have direct contact with surface soils and to use site groundwater as their potable source. It is highly unlikely that SWMU 67, which is located within Zone E, will be used for residential land use. However, this scenario was evaluated to provide the most conservatively protective risk estimation and it offers the most flexible future land use. If the risks for this scenario are within acceptable limits, the site can be used for unrestricted land use. The default exposure assumptions for an adult and a child were used. A child is assumed an EF of 350 days/yr and an ED of 6 years, and an adult is assumed an EF of 350 days/yr and an ED is 30 years.

5.4.3 Toxicity Assessment

Table 5-7 present the toxicity criteria used in this HHRA and the source from which these toxicity factors were obtained.

5.4.4 Risk Characterization

Table 5-8 presents the HHRA summary by receptor and by the medium.

Industrial worker: The estimated combined ELCR for an industrial worker exposed to area-wide soil is 1.5E-6, which is less than the acceptable risk range of 1E-4 to 1E-6. The noncarcinogenic HI is 0.065, which is much less than the target HI value of 1.0. For this reason, SWMU 67 does not present unacceptable risks or hazards to a future industrial worker in this area.

Construction worker: A construction worker was chosen over a utility worker as being a more conservative representative of both groups, due to the higher soil ingestion rate assumed for the construction worker scenario. Construction worker exposure was evaluated for both surface soil and subsurface soil. The ELCR estimated for exposure to surface and subsurface soils is 5.2E-7, which is less than the acceptable risk range of 1E-4 to 1E-6. The estimated HI for exposure to surface soils is 0.33, which is less than the target HI of 1.0 for noncarcinogenic exposure. Thus, site surface and subsurface soil do not present unacceptable health risks to future construction/utility workers.

Residential Receptors: The a residential adult ELCR is 1.3E-5, which is within the EPA acceptable risk range of 1E-4 to 1E-6. The carcinogenic risk is estimated based on age-adjusted scenario where continuous exposure is assumed for a 6-year-old child and a 24-year-old adult. The HI for an adult is 0.19, which is less than the target value of 1.0.

The residential child HI is estimated at 1.6, mostly from metals; however, no single target-organ-specific HI exceeded a value of 1.0 (see Table 5-8). For this reason, no excessive hazards are expected from exposure to soils at the site.

Lead: Average concentration (see Table 5-6) of lead is 112 mg/kg in site surface soil and 80 mg/kg in site subsurface soil, which are both lower than the conservative residential-land-use-based screening value. For this reason, lead is not considered a COC for future land use at SWMU 67.

In summary, there are no soil COCs for future industrial or unrestricted land use at SWMU 67. One sample near the utility lines had elevated BEQs, which are common to this area of Zone E and not considered to be associated with the past site operations. Rather, the elevated BEQ detection is likely from asphalt pavement in this area, since all nearby samples have BEQ levels similar to site background levels.

5.5 COC Summary

Based on the HHRA, no COCs are identified for soil at SWMU 67. Additionally , no COCs are identified in subsurface soil or groundwater at this site.

However, consistent with previous agreements made by the BCT for similar sites at the CNC, BEQs are retained as a surface soil COC because BEQ concentrations in several surface soil samples within the general investigation area exceeded the CNC sitewide reference concentation for surface soil of 1,304 μg/kg. The locations of surface soil samples with BEQ exceedances of the reference concentration are just west and adjacent to Building 226, near AOC 542. These soil samples were collected as part of the investigation of SWMU 37, the sanitary sewer system. All of these samples are located beneath asphalt pavement. Figure 1 in Appendix F presents the locations of these samples.

Because this site is located in Zone E, which will be subject to LUCs. Consequently, this site is suitable for its intended industrial future land use, and LUCs to restrict the site to industrial land use only will be applied. However, it is not expected that additional remediation activities will be necessary. A CMS will be prepared to address the BEQs in surface soil.

1

TABLE 5-1
Surface and Subsurface Soil Concentrations of Mercury
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Result (mg/kg)	Qual.	Date Sampled	EPA Region III Resid. RBC (HI = 0.1) (mg/kg)	EPA Region III Industr. RBC (HI = 0.1) (mg/kg)	SSL (DAF=10) (mg/kg)	Range of Zone E Bkgd. Conc. (mg/kg)
Mercury									
Surface Soil	E067SB00701	E067SB007	0.11	U	09/06/1995	2.3	61.3	1	0.03 - 2.7
	E067SB00601	E067SB006	0.04	J	09/10/1995				
	E067SB00501	E067SB005	0.21	=	09/06/1995				
	E067SB00401	E067SB004	0.11	U	09/06/1995				
	E067SB00301	E067SB003	0.11	U	09/06/1995				
	E067SB00201	E067SB002	0.07	=	10/13/1995				
	E067SB00101	E067SB001	0.11	U	09/06/1995				
	E542SB00801	E542SB008	1.37	=	12/11/2002				
	E542SB00901	E542SB009	**2.36**	=	12/11/2002				
	E542SB01001	E542SB010	**12.2**	=	12/11/2002				
	E542SB01101	E542SB011	1.92	=	12/11/2002				
	E542SB01201	E542SB012	**3.99**	=	12/11/2002				
	E546SB00101	E546SB001	0.158	=	12/12/2002				
	E546SB00201	E546SB002	0.066	J	12/12/2002				
	E546SB00301	E546SB003	0.103	J	12/12/2002				
	E546SB00401	E546SB004	0.006	J	12/12/2002				
	E542SB00401[a]	E542SB004	0.98	=	08/30/1995				
	E542SB00701	E542SB007	1.10	U	08/30/1995				
	LE037SB005E1	LE037SB005	1.50	=	06/07/1997				
	LE037SB006E1	LE037SB006	**44.80**	=	06/07/1997				
	LE037SB007E1	LE037SB007	**2.70**	=	06/07/1997				
	LE037SB008E1	LE037SB008	2.20	=	06/09/1997				
	LE037SB009E1	LE037SB009	**3.10**	=	05/20/1997				
	LE037SB010E1	LE037SB010	**9.00**	=	06/09/1997				

TABLE 5-1
Surface and Subsurface Soil Concentrations of Mercury
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Result (mg/kg)	Qual.	Date Sampled	EPA Region III Resid. RBC (HI = 0.1) (mg/kg)	EPA Region III Industr. RBC (HI = 0.1) (mg/kg)	SSL (DAF=10) (mg/kg)	Range of Zone E Bkgd. Conc. (mg/kg)
	LE037SB011E1	LE037SB011	**3.00**	=	06/09/1997				
	LE037SB012E1	LE037SB012	1.80	=	06/09/1997				
Subsurface Soil									
	E067SB00302	E067SB003	0.11	U	09/06/1995	NA	NA	1	0.04 - 0.90
	E067SB00702	E067SB007	0.11	U	09/06/1995				
	E067SB00602	E067SB006	0.08	J	09/10/1995				
	E067SB00502	E067SB005	0.11	U	09/06/1995				
	E067SB00202	E067SB002	0.02	=	10/13/1995				
	E067SB00102	E067SB001	0.11	U	09/06/1995				
	E067SB00402	E067SB004	0.11	U	09/06/1995				
	E542SB00802	E542SB008	**1.1**	=	12/11/2002				
	E542SB00803	E542SB008	**1.69**	=	12/11/2002				
	E542SB00902	E542SB009	**2.09**	=	12/11/2002				
	E542SB00903	E542SB009	**3.37**	=	12/11/2002				
	E542SB01002	E542SB010	**2.12**	=	12/11/2002				
	E542SB01003	E542SB010	**7.29**	=	12/11/2002				
	E542SB01102	E542SB011	**3.35**	=	12/11/2002				
	E542SB01103	E542SB011	**3.03**	=	12/11/2002				
	E542SB01202	E542SB012	**2.65**	=	12/11/2002				
	E542SB01203	E542SB012	**5.16**	J	12/11/2002				
	E546SB00102	E546SB001	0.022	J	12/12/2002				
	E546SB00202	E546SB002	0.015	J	12/12/2002				
	E546SB00302	E546SB003	0.094	J	12/12/2002				
	LE037SB008E2	LE037SB008	**2.30**	=	06/09/1997				
	LE037SB009E2	LE037SB009	0.17	=	05/20/1997				

TABLE 5-1
Surface and Subsurface Soil Concentrations of Mercury
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Parameter	Sample ID	Station ID	Result (mg/kg)	Qual.	Date Sampled	EPA Region III Resid. RBC (HI = 0.1) (mg/kg)	EPA Region III Industr. RBC (HI = 0.1) (mg/kg)	SSL (DAF=10) (mg/kg)	Range of Zone E Bkgd. Conc. (mg/kg)
	LE037SB010E2	LE037SB010	**3.40**	=	06/09/1997				
	LE037SB011E2	LE037SB011	0.38	=	06/09/1997				
		Subsurface Soil Average Conc.	**1.62**						

TABLE 5-2
Detections of Mercury and Thallium in Groundwater
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Parameter	Sample	Result (µg/L)	Qual.	Station ID	Date Sample	MCL (µg/L)	Range of Zone E Background Concentration (µg/L)
Mercury	037GW002E1	0.10	UJ	LE037GW002	08/04/1997	2.0	0.14 - 0.64
	542GW00101	0.20	U	E542GW001	04/23/1996		
	542GW00102	0.10	U	E542GW001	08/05/1996		
	542GW00103	0.10	U	E542GW001	12/04/1996		
	542GW00104	0.12	U	E542GW001	02/19/1997		
	542GW00201	0.20	U	E542GW002	04/23/1996		
	542GW00202	0.10	U	E542GW002	08/05/1996		
	542GW00203	0.10	U	E542GW002	12/04/1996		
	542GW00204	0.12	U	E542GW002	02/20/1997		
	542GW00301	0.20	U	E542GW003	04/22/1996		
	542GW00302	0.10	U	E542GW003	08/05/1996		
	542GW00303	0.10	U	E542GW003	12/04/1996		
	542GW00304	0.12	U	E542GW003	02/20/1997		
	542GW00401	0.20	U	E542GW004	04/22/1996		
	542GW00402	0.29	=	E542GW004	08/06/1996		
	542GW00403	0.20	U	E542GW004	12/05/1996		
	542GW00404	0.29	=	E542GW004	02/20/1997		
Thallium							
	067GW00103	2.7	UJ	E067GW001	12/04/1996	2.0	3.2 - 5.8
	067GW00104	5.0	U	E067GW001	02/19/1997		
	067GW00203	4.0	J	E067GW002	12/03/1996		
	067GW00204	5.0	U	E067GW002	02/19/1997		

TABLE 5-3
Leachate Transport Analysis Model
RFI Report Addendum, SWMU 67, 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**
ks	=	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)	**9.1** m		**30** ft		
da	=	Aquifer Thickness		**6.9** m		**22.5** ft		
d	=	Groundwater Mixing Zone thickness	(paved)	0.99 m		3.2 ft		
			(unpaved)	1.27 m		4.2 ft		
i	=	Groundwater Gradient			**7.3E-03**	(unitless)		
Ks	=	Saturated Hydraulic Conductivity		556.2 m/yr		1825.0 ft/yr		
θw	=	Volumetric Water Content of Soil Pore Space		0.3 cm^3_{vapor}/cm^3_{soil}		0.3 in^3_{vapor}/in^3_{soil}		
θv	=	Volumetric Vapor Content of Soil Pore Space		0.15 cm^3_{vapor}/cm^3_{soil}		0.15 in^3_{vapor}/in^3_{soil}		
ρs	=	Soil Bulk Density		1.5 g/cm^3		93.64 lb_m/ft^3		
qi	=	Water Infiltration Rate	(paved)	**0.0086** m/yr		0.0283 ft/yr		
			(unpaved)	**0.1372** m/yr		0.4500 ft/yr		
Partition Term, Cw/Csoil, (L/kg)								5.22E+01
Dilution Term, dimensionless			(paved)					5.20E+01
			(unpaved)					5.13E+00
Csoil/Cw =Partition term * Dilution term (mg/kg / mg/L) = L/kg			(paved)					2.72E+03
			(unpaved)					2.68E+02
Calculated Site Specific Target Level for Soil								
C_{soil} calculated source soil concentration (SSL, mg/kg) Cw*(partion term)*(dilution term)							(paved)	**5.432**
							(unpaved)	**0.536**

$$\frac{C_{soil}}{C_w} = \left(\frac{\theta_w + K_s\rho_s + H\theta_v}{\rho_s}\right)\left(\frac{K_s i d + q_i S_w}{q_i S_w}\right)$$

Cwt is the MCL from EPA National Drinking Water Standards (March 2001)or US EPA Region III RBCs (October, 2000).
H from Table 36 of the Soil Screening Guidance; Technical Background Document (EPA, 1996).
ks = koc x foc.
koc from Table 39 of the Soil Screening Guidance; Technical Background Document (EPA, 1996).
foc calculated as the mean foc from TOC measurements from Zone E.
Sw Conservatively estimated as the distance along groundwater flow path at each of 2 separate soil borings E542SB002 and E037SB011.
d is calculated as $M = (0.0112\ L^2)^{0.5} + da\{1 - e^{[-L\ qi/Ks\ da]}\}$ or da, whichever is less.
da is based on top of Ashley (-20 ft, GIS) and nearest isocontour line for groundwater level (2.5 ft msl, GIS).
i Calculated from groundwater elevations in Zone E measured during May 2000; wells E063GW001 and E063GW002, CH2MHill, 2002).
Ks Based on CH2MHill's hydraulic conductivity theme in the GIS (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 is a derived value (unpaved, 5.4 in/yr or paved, 0.34 in/yr) based on annual precipitation, evapo-transportation, and runoff coefficient values for the Charleston area.

1

TABLE 5-4
COPCs in Surface Soil and Subsurface Soil
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Surface Soil (0 - 1 ft)	Soil Column (0 - 5 ft)
Antimony	Antimony
Cadmium	Cadmium
Copper	Copper
Lead	Lead
Mercury	Mercury
Zinc	Zinc
PCB1254	PCB1254
Benzo(a)pyrene equivalents (BEQ)	Benzo(a)pyrene equivalents (BEQ)

2

1

TABLE 5-5
Exposure Factors for Surface and Subsurface Soil at SWMU 67
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Parameter	Industrial Worker	Construction Worker	Residential Adult	Residential Child
Exposure Frequency (day/year)	250	250	350	350
Exposure Duration (years)	25	1	30	6
Averaging Time –Carcinogenic (days)	25,550	25,550	25,550	--
Averaging Time – Noncarcinogenic (days)	9,125	365	10,950	2190
Body Weight (kg)	70	70	70	15
Ingestion				
Ingestion Rate (mg/day)	50	480	100	200
Age-adjusted Ingestion Rate [(mg-day)/(kg-year)]*	NA	NA	114	NA
Fraction Ingested	1	1	1	1
Dermal				
Surface Area (cm^2)	2,679	2,679	5,049	2351
Age-adjusted Skin Surface Area [(cm^2-yr)/kg]*	NA	NA	2671	NA
Soil-to-Skin Adherence Factor (mg/cm^2)	0.03	0.1	0.03	0.15
Inhalation				
Particulate Emission Factor (m^3/kg)	1.32E+09	1.32E+09	1.32E+09	1.32E+09
Inhalation Rate (m^3/day)	20	20	20	15
Age-adjusted Inhalation Rate [(m^3-yr)/(kg-day)]*	NA	NA	13	NA

* For carcinogenic scenarios only

2

1

TABLE 5-6
Exposure Point Concentrations Estimated for Surface and Subsurface Soil at SWMU 67
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

							Exposure Point Concentration		
Chemical	**N**	**Detects**	**Best Estimate of the Mean[1]**	**Maximum**	**UCL_{95}**	**Distribution**	**Value**	**Basis**	**Units**
Surface Soil (0-1 ft)									
Antimony	23	13	10	41	14	NP	14	UCL_{95} - NP	mg/kg
Cadmium	23	15	3.2	46	6.7	NP	6.7	UCL_{95} - NP	mg/kg
Copper	23	23	296	4,590	1,173	L	1,173	UCL_{95} - L	mg/kg
Lead	23	23	112	629	156	NP	156	UCL_{95} - NP	mg/kg
Mercury	33	22	2.8	45	5.1	NP	5.1	UCL_{95} - NP	mg/kg
Zinc	23	23	1,466	24,800	6,152	L	6,152	UCL_{95} - L	mg/kg
PCB1254	15	6	0.21	1.2	0.35	NP	0.35	UCL_{95} - NP	mg/kg
Benzo(a)pyrene equivalents (BEQ)	21	21	0.9	2	1.0	NORMAL	1.0	UCL_{95} - N	mg/kg
Soil Column (0-5 ft)									
Antimony	38	15	7.1	41	9.8	NP	9.8	UCL_{95} - NP	mg/kg
Cadmium	38	21	2.2	46	4.3	NP	4.3	UCL_{95} - NP	mg/kg
Copper	38	36	189	4,590	388	NP	388	UCL_{95} - NP	mg/kg
Lead	38	38	80	629	111	NP	111	UCL_{95} - NP	mg/kg
Mercury	63	40	2.1	45	3.3	NP	3.3	UCL_{95} - NP	mg/kg
Zinc	38	38	959	24,800	2,116	NP	2,116	UCL_{95} - NP	mg/kg
PCB1254	23	7	0.16	1.2	0.25	NP	0.25	UCL_{95} - NP	mg/kg
Benzo(a)pyrene equivalents (BEQ)	36	36	0.8	2	1.0	L	1.0	UCL_{95} - L	mg/kg

[1] Best estimate of the mean includes non-detects at 1/2 the detection limit
N Number of samples
UCL Upper confidence limit
Basis
UCL_{95}-NP Nonparametric UCL_{95} (Bootstrap)
UCL_{95}-L Lognormal UCL_{95} (Land's H-statistic)
UCL_{95}-N Normal UCL_{95} (Student's t)
MAX Maximum detected value

2

1

TABLE 5-7
Toxicity Factors for the COPCs at SWMU 67
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Chemical	GI Absorption Factor (ABS_{GI})	Dermal Absorption Factor (DAF)	WOE	Oral Slope Factor (kg-day/mg)	Inhalation Slope Factor (kg-day/mg)	Chronic Oral Reference Dose (mg/kg-day)	Chronic Inhalation Reference Dose (mg/kg-day)	Source
Antimony	2%	0.1%				4.00E-04		IRIS
Cadmium	1%	0.1%	B1		1.90E+00	1.00E-03	5.70E-05 *	IRIS / *NCEA
Copper	0.3	0.1%	D			0.04		HEAST
Lead	15%	0.1%	B2					IRIS
Mercury	7%	0.1%	D			3.00E-04 [1]	8.60E-05	IRIS
Zinc	20%	0.1%	D			3.00E-01		IRIS
PCB1254	90%	6%	B2	2.00E+00	2.00E+00	2.00E-05		IRIS
BEQ	31%	1%	B2	7.30E+00	3.10E+00			IRIS

BEQ - Benzo(a)pyrene equivalent
WOE - Weight-of-Evidence Class definitions:
A = known carcinogen
B1 = probable human carcinogen
B2 = suspected carcinogen
D = not classifiable
Source definition
IRIS = EPA Integrated Risk Information System
HEAST = Health Effects Assessment Summary Tables
*NCEA = National Center for Environmental Assessment, Region III RBC tables
[1] Mecuric chloride value used as surrogate

2

TABLE 5-8
Cancer Risks and Hazard Index Estimates Summary for Soil at SWMU 67
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Receptor	ELCR Ingestion	Dermal	Inhalation	Total	HI Ingestion	Dermal	Inhalation	Total	Target Organ
Industrial Worker									
	Surface Soil				*Surface Soil*				
Antimony					0.017	0.0014		0.019	Whole body, Blood
Cadmium			6.8E-10	6.8E-10	0.0033	5.29E-04	1.75E-05	0.0038	Kidney
Copper					0.014	7.69E-05		0.014	GI Tract
Lead									CNS, Kidney, Reproduction
Mercury					0.0083	1.90E-04	8.74E-06	0.0085	CNS
Zinc					0.010	8.06E-05		0.010	Blood
PCB1254	1.2E-07	1.3E-08	3.7E-11	1.4E-07	0.0086	9.24E-04		0.0095	Immune System
BEQ	1.3E-06	6.7E-08	1.7E-10	1.4E-06					NA
	1.4E-06	**8.0E-08**	**8.8E-10**	**1.5E-06**	**0.062**	**0.0032**	**2.62E-05**	**0.065**	
Construction Worker									
	Soil Column				*Soil Column*				
Antimony					0.11	0.0032		0.12	Whole body, Blood
Cadmium			1.7E-11	1.7E-11	0.020	0.0011	1.11E-05	0.021	Kidney
Copper					0.046	8.47E-05		0.046	GI Tract
Lead									CNS, Kidney, Reproduction
Mercury					0.052	4.14E-04	5.71E-06	0.052	CNS
Zinc					0.033	9.24E-05		0.033	Blood
PCB1254	3.3E-08	1.2E-09	1.0E-12	3.4E-08	0.058	0.0021		0.060	Immune System
BEQ	4.7E-07	8.5E-09	6.3E-12	4.8E-07					NA
	5.1E-07	**9.7E-09**	**2.5E-11**	**5.2E-07**	**0.32**	**0.0071**	**1.68E-05**	**0.33**	
Residential Adult									
	Surface Soil				*Surface Soil*				
Antimony					0.048	0.0055		0.054	Whole body, Blood

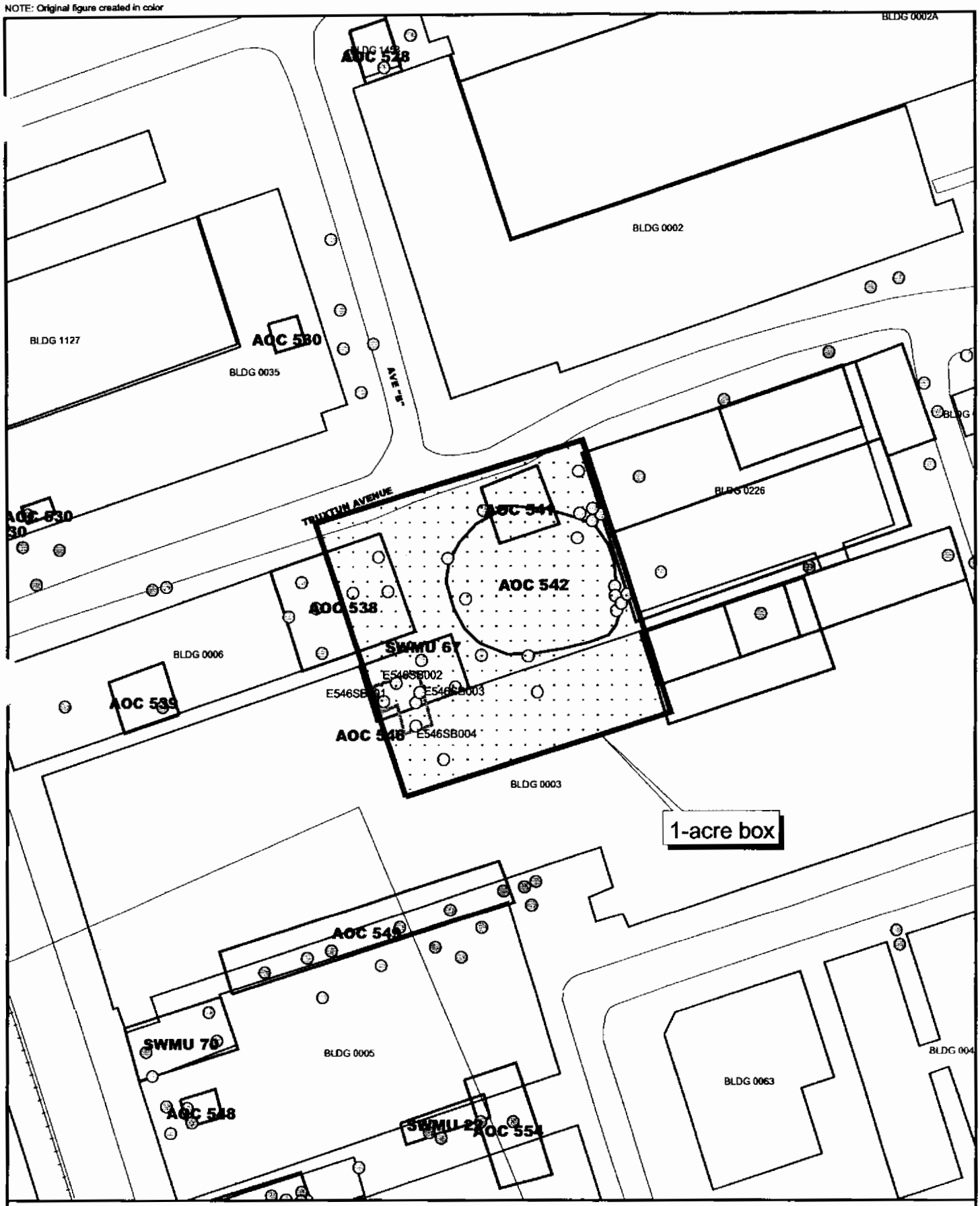
TABLE 5-8
Cancer Risks and Hazard Index Estimates Summary for Soil at SWMU 67
RFI Report Addendum, SWMU 67, Zone E, Charleston Naval Complex

Receptor	ELCR Ingestion	Dermal	Inhalation	Total	HI Ingestion	Dermal	Inhalation	Total	Target Organ
Cadmium			1.7E-09	1.7E-09	0.0092	0.0021	2.45E-05	0.011	Kidney
Copper					0.040	3.06E-04		0.040	GI Tract
Lead									CNS, Kidney, Reproduction
Mercury					0.023	0.0018	1.22E-05	0.025	CNS
Zinc					0.028	7.48E-04		0.029	Blood
PCB1254	1.1E-06	3.4E-08	4.1E-11	1.1E-06	0.024	0.0086		0.033	Immune System
BEQ	1.2E-05	1.7E-07	1.8E-10	1.2E-05					NA
	1.3E-05	**2.1E-07**	**1.9E-09**	**1.3E-05**	**0.17**	**0.019**	**3.67E-05**	**0.19**	
Residential Child									
	Surface Soil				*Surface Soil*				
Antimony	--	--	--		0.45	0.063		0.51	Whole body, Blood
Cadmium	--	--	--		0.086	0.024	8.57E-05	0.11	Kidney
Copper	--	--	--		0.37	0.0035		0.38	GI Tract
Lead	--	--	--						CNS, Kidney, Reproduction
Mercury	--	--	--		0.22	0.0085	4.28E-05	0.22	CNS
Zinc	--	--	--		0.26	0.0036		0.27	Blood
PCB1254	--	--	--		0.23	0.042		0.27	Immune System
BEQ	--	--	--						NA
	--	--	--	**NA**	**1.6**	**0.14**	**1.28E-04**	**1.8**	

Risk and hazard drivers are those chemicals contributing an ELCR above 1E-6 and HQ greater than 1, respectively.

BEQ - Benzo(a)pyrene equivalents

NOTE: Original figure created in color



Soil Samples considered in risk assessment

N

0 70 140 Feet

1 inch = 96 feet

Figure 5-1
Soil Sampling Locations within 1-acre area
SWMU 67 , Zone E
Charleston Naval Complex

CH2MHILL

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/AOCs within Zone E of the CNC, including SWMU 67. 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 NFA status or to a corrective measures study (CMS). Based on sampling conducted at the former location of Building 1025 (AOC 546), and additional delineation sampling for mercury in the AOC 542 area, antimony, mercury and zinc were identified as COCs in surface soil, as described in Section 5.0.

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. There were no detections of antimony in shallow wells above the laboratory detection limits. There were no detections of arsenic above the MCL in samples from the shallow groundwater monitoring wells. One detection of thallium exceeded its MCL of 2 micrograms per liter (µg/L) in well E067GW002 at an estimated concentration of 4 µg/L, but did not exceed its Zone E maximum thallium background concentration in shallow groundwater of 5.4 µg/L. Thallium detections in groundwater are shown in Table 5-2.

Intermittent detections of thallium in groundwater above its MCL have been detected base-wide at CNC and are attributed to natural occurrence. There is no indication at SWMU 67 that thallium was related to site activities, or that a thallium release occurred. Additionally, the detection of thallium in well E067GW002 was followed by a detection below laboratory detection limits, thus indicating that there is no persistent presence of thallium in groundwater at this site. Therefore, thallium is not considered a COC at SWMU 67 and further evaluation of this issue is not warranted.

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

The nearest sanitary sewer manhole is located approximately 35 feet north of SWMU 67. Data indicate that this SWMU was never connected to the sanitary sewer system, and there were no COCs identified at the site.

Elevated detections of mercury of 9 mg/kg and 44.8 mg/kg in surface soil samples from two SWMU 37 soil borings, E037SB010 and E037SB006, respectively, prompted further delineation soil sampling for mercury. This sampling is described in Sections 4.0 and 5.0 of this report. Mercury has been identified as a surface soil COC at this site. No additional evaluation of this issue is warranted.

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

There is no evidence that past site use or the presence of contamination at the site could have potentially impacted the stormwater sewer system. Further evaluation of this linkage is not warranted.

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

The closest railroad line is located 140 feet southeast of SWMU 67. There is no known linkage between SWMU 67 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 SWMU 67 is the Cooper River, which lies approximately 210 feet southeast 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 buildings and 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 surface soil. No further evaluation of a potential pathway for contaminant migration via stormwater runoff is warranted.

6.7 Potential Contamination in Oil/Water Separators (OWSs)

There are no OWSs associated with SWMU 67. In addition, there is no reference to an OWS at the site in the *Oil Water Separator Data* report (Department of the Navy, September 2000). Therefore, further evaluation of this issue is not warranted.

6.8 Land Use Controls (LUCs)

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. These LUCs will apply at SWMU 67, due to its location within Zone E.

Section 7.0

7.0 Recommendations

SWMU 67 consists of a former mercury gauge room and a mercury storage area, each in separate locations within Building 3. Currently Building 3 is used as a machine shop.

The CNC RCRA Permit identified SWMU 67 as requiring a CSI.

The *Zone E RFI Report, Revision 0* (EnSafe, 1997) did not identify any COCs at SWMU 67 and concluded that no further corrective measures are necessary for the site.

Based on the identification of the correct location of former Building 1025 (AOC 546) as overlapping SWMU 67, additional soil sampling was conducted in this area to complete the investigation for AOC 546. In addition, elevated detections of mercury in soil samples from soil borings north of SWMU 67 during the SWMU 37 investigation prompted additional delineation soil sampling for mercury.

Based on the analytical results from the RFI and the December 2002 sampling and an evaluation of COPC criteria currently used by the CNC BCT, several COPCs were identified in surface soil. Based on the results of the HHRA, site risks were determined to be below or within the acceptable risk range for both industrial and residential receptors. Consequently, no surface or subsurface soil COCs were identified based on the risk assessment. No groundwater COCs were identified at this site.

However, consistent with previous agreements made by the BCT for similar sites at the CNC, BEQs are retained as a surface soil COC because BEQ concentrations in several surface soil samples within the general investigation area exceeded the CNC sitewide reference concentation for surface soil of 1,304 $\mu g/kg$. A CMS is recommended to select the remedy for the BEQs in surface soil.

This site is suitable for future industrial land use. Because of the site's location within Zone E, LUCs to restrict the site to industrial land use only will be applied. However, it is not expected that additional remediation activities will be necessary.

Section 8.0

8.0 CMS Work Plan for SWMU 67

BEQs were identified as COCs in surface soils at SWMU 67. Because all locations at which BEQs in surface soil exceeded the CNC sitewide reference concentration are paved, there is currently no unacceptable exposure or risk from BEQs. However, it is feasible that in the future, should 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 that the remedial actions are designed to accomplish in order to protect human health and the environment, by preventing or reducing exposures under current and future land use conditions. The RAOs identified for surface soil at SWMU 67 are being chosen to prevent ingestion and direct/dermal contact with surface soil containing COCs at unacceptable levels.

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 exposure medium of concern for SWMU 67 is surface soil impacted by BEQs. Because SWMU 67 is 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.

For BEQs, the target MCS for surface soil should be the CNC BEQ sitewide reference concentration of 1,304 $\mu g/kg$, which was developed by the BCT. Other potential RGOs, such as the 1E-06 ILCR level, were considered but regarded as not applicable because the site background concentrations of BEQs are significantly greater than this level. No BEQ reference concentrations for industrial use have been developed for CNC.

8.3 Potential Remedies to Evaluate

Because of the relatively small quantity of contaminated soil and the presence of several subsurface utilities, vaults, and other unknown obstructions at the site, the list of practicable remedial alternatives for this site is limited. The two presumptive remedies that will be evaluated as part of the CMS include:

- Soil excavation and offsite disposal, and
- LUCs.

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 time frame to achieve the RGOs. Estimates of the time frame 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 SWMU 67. A proposed outline of the report, as shown in Table 8-1, provides an example of the report format and content.

Section 9.0

9.0 References

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

EnSafe Inc./Allen & Hoshall. *Final RCRA Facility Assessment, NAVBASE Charleston*. July 1995.

EnSafe Inc./Allen & Hoshall. *Final Zone E RFI Work Plan, Revision 1, NAVBASE Charleston*. June 1995.

CH2M-Jones. *Technical Memorandum: A Summary of Inorganic Chemical Concentrations in Background Soil and Groundwater at the CNC*. 2001.

CH2M-Jones. *Technical Memorandum: Results from Additional Background Sampling of the CNC Railroad Lines and Naval Annex (Zone K). CNC*. August 2001.

South Carolina Department of Health and Environmental Control, Final RCRA Part B Permit No. SC0 170 022 560.

Appendix A

Table 10.7.A
Chemicals Present in Site Samples
SWMU 67 - Surface Soil
NAVBASE - Charleston
Charleston, South Carolina

Parameter	Frequency of Detection		Range of Detection		Average Detected Concentration	Range of SQL		Screening Concentration Residential RBC	Industrial RBC	Reference	Units	Number Exceeding Res.	Ind.	Ref
Mercury (Hg)	3	7	0.04	0.21	0.11	0.11	0.11	2.3	61	2.6	MG/KG			

MG/KG - milligrams per kilogram
SQL - Sample quantitation limit
RBC - Risk-based concentration

Groundwater Well
Shallow Groundwater Contours ft bls (Known)
Fence
Railroads
Roads - Lines
AOC Boundary
SWMU Boundary
Buildings
Zone Boundary

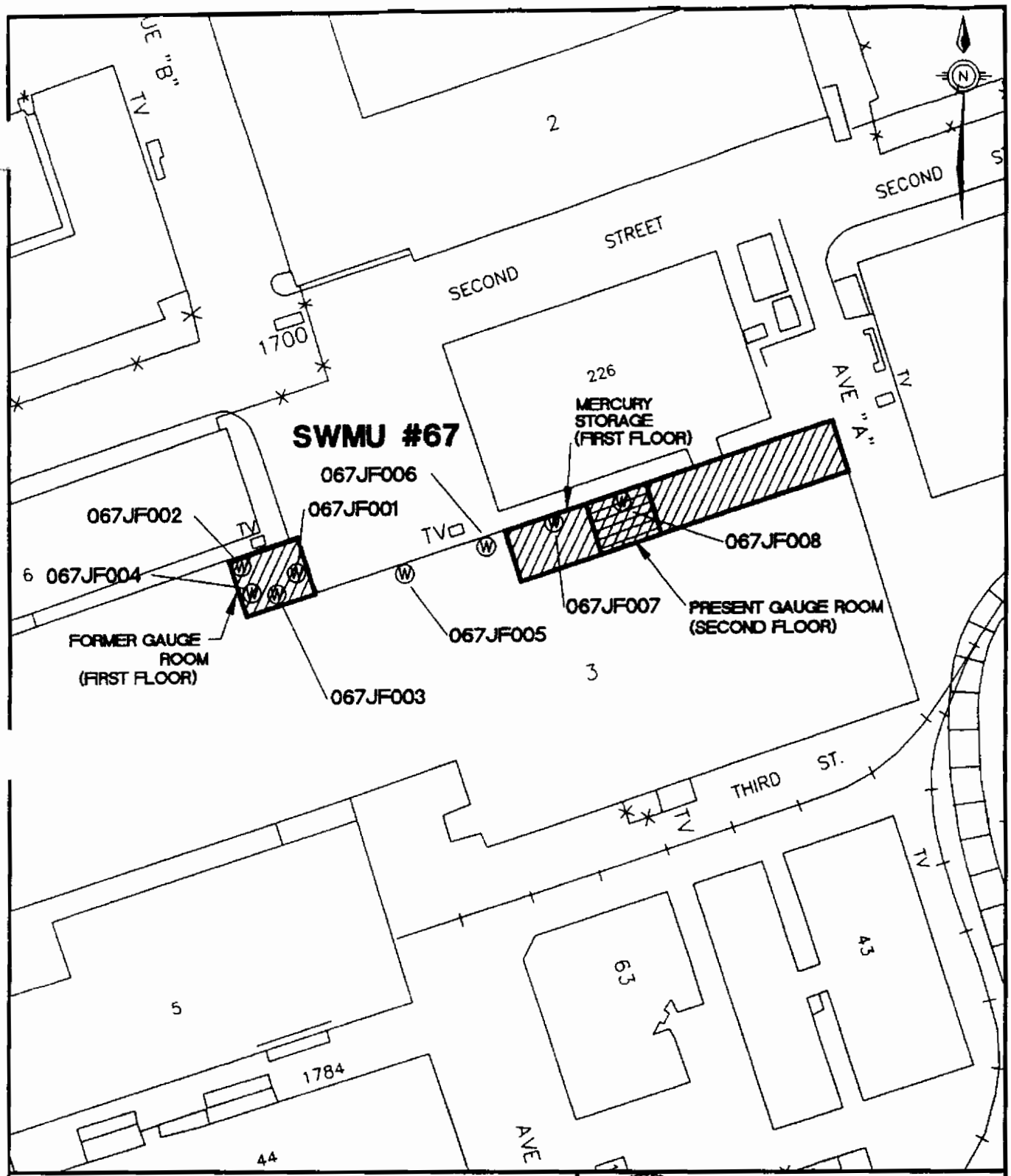
N

0 100 200 Feet

1 inch = 93 feet

Figure A-1
Shallow Groundwater Contour Map
SWMU 67, Zone E
Charleston Naval Complex

File Path: C:\18gis\CNC\cnc-eqis.aoc Date: 22 Mar 2002 9:40 User: MKARAFA EGIS



LEGEND

- ● – SOIL BORINGS
- Ⓒ – CORE SAMPLES
- ◒ – DEEP MONITORING WELLS
- ◭ – SHALLOW MONITORING WELLS
- ▲ – SEDIMENT SAMPLES
- Ⓣ – THICKNESS SAMPLES
- Ⓦ – WIPE SAMPLES
- Ⓢ – SURFACE WATER SAMPLES

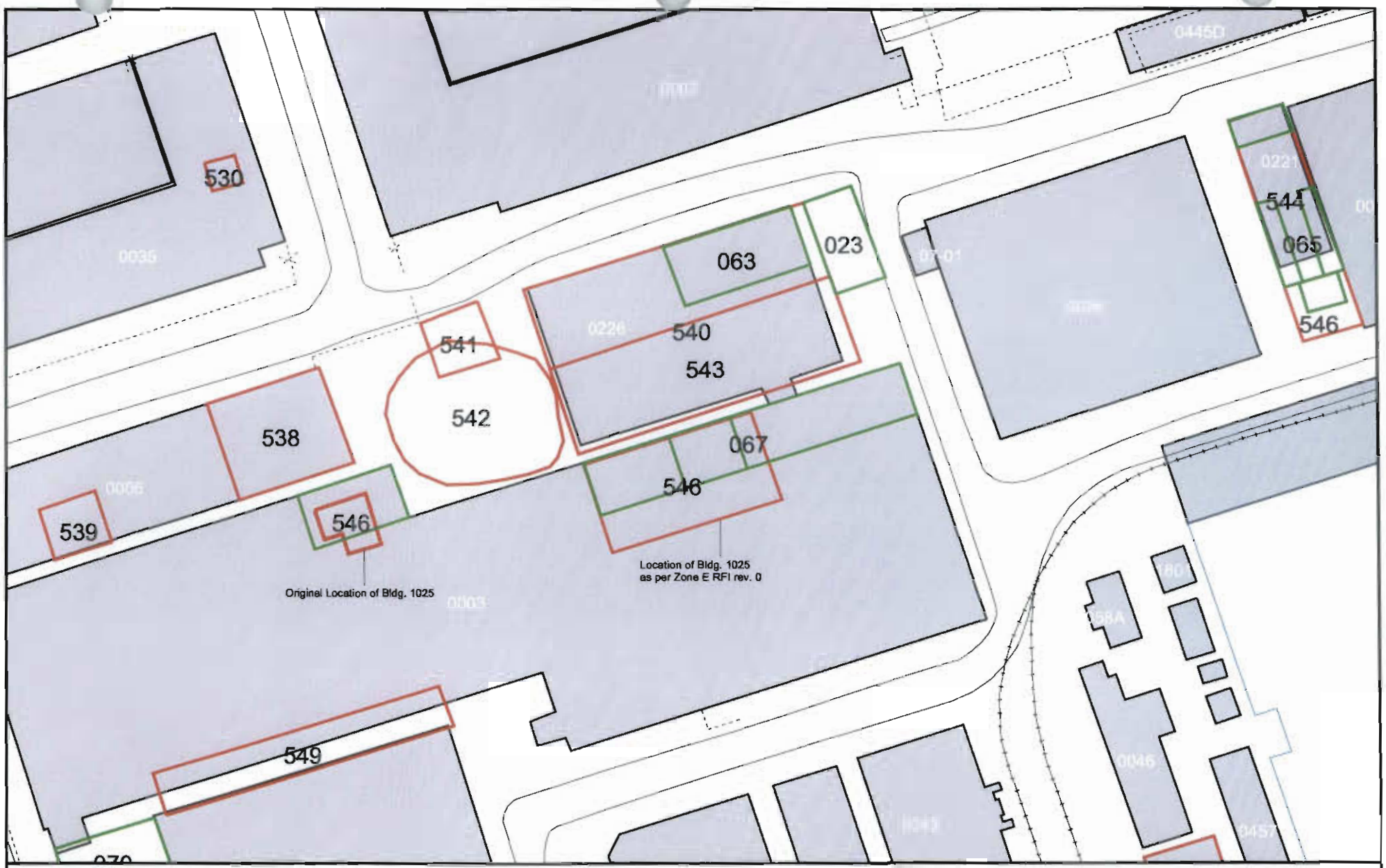
GRAPHIC SCALE 100 0 100 200

ZONE E
RFI REPORT
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 10.7.3
WIPE SAMPLE LOCATIONS
SWMU #67
GAUGE ROOM
BUILDING 3

DWG DATE: 09/02/97 | DWG NAME: 10-7-3

Appendix B



Fence
Railroads
Roads
AOC Boundary
SWMU Boundary
Buildings
Zone Boundary

N

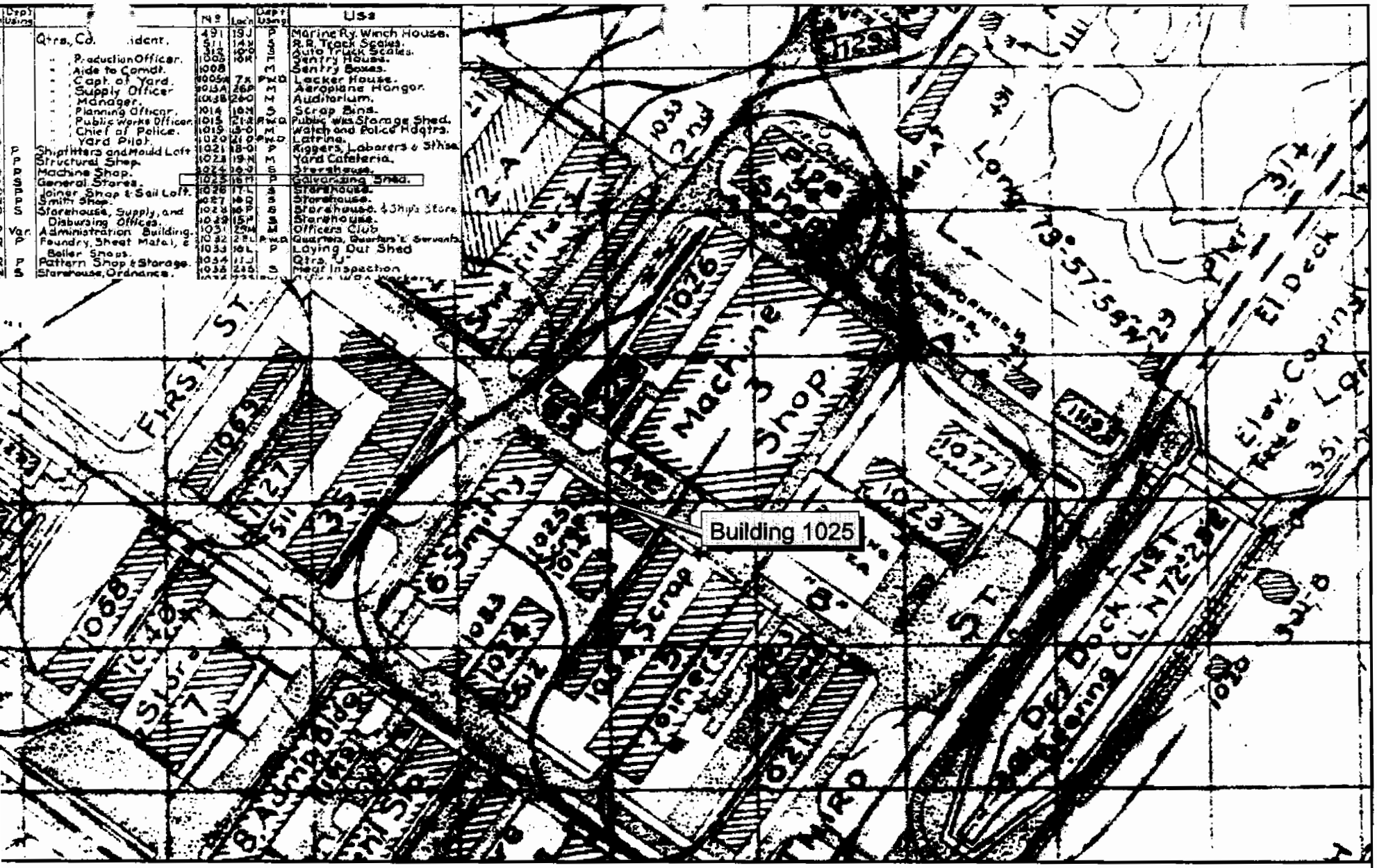
0 70 140 Feet

1 inch = 100 feet

Figure B-1
Previous Location of Building 1025, Zone E
Charleston Naval Complex

CH2MHILL

File Path: c:\18gis\projects\zone_e\swmu 65 aocs 544 546-cnc-egis.apr, Date: 20 Nov 2002 15:42, User: TWILEY



Layout from Public Works Map, June 30, 1937 h606-39

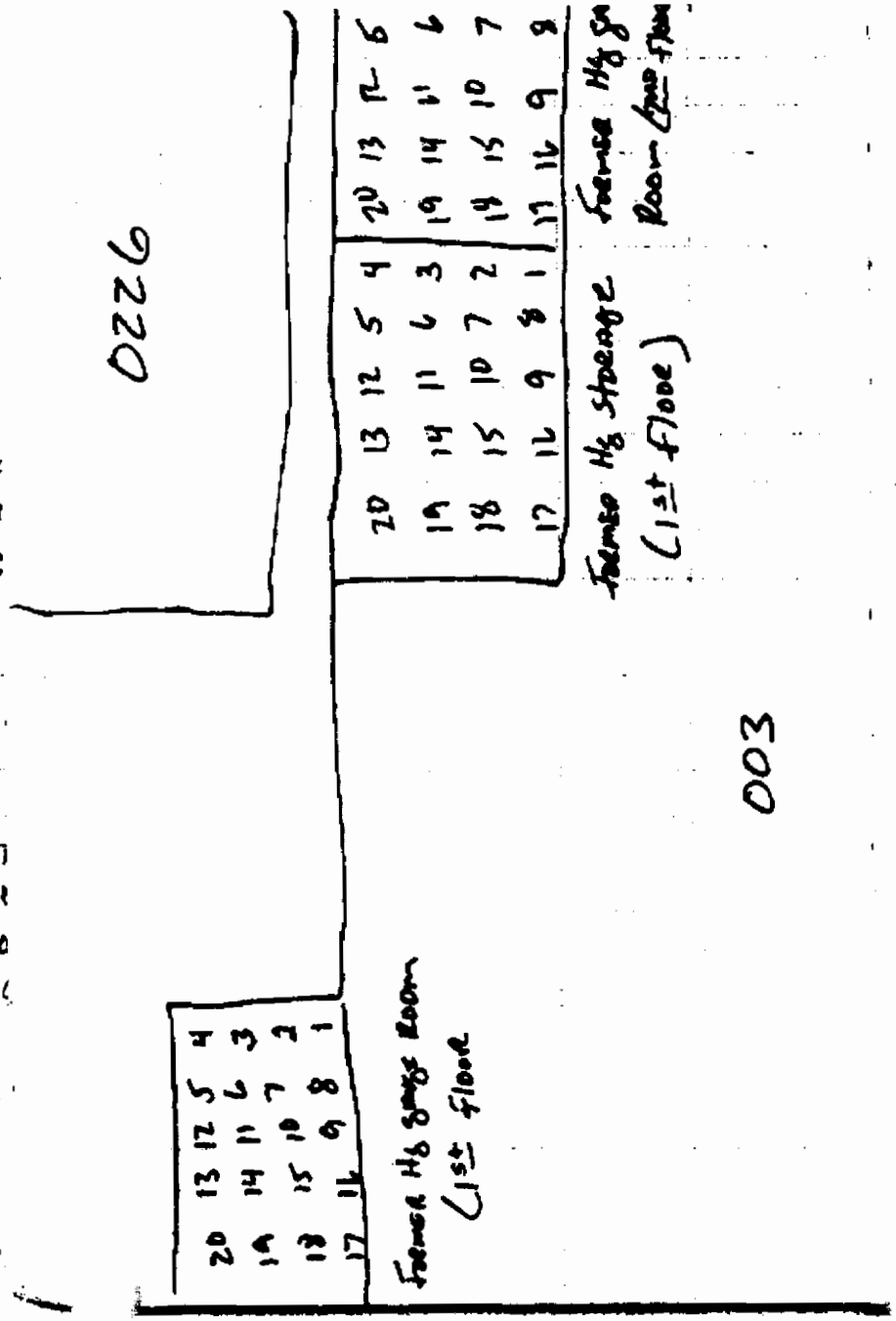
N

Figure B-2
Original Location of Building 1025
AOC 546, Zone E
Charleston Naval Complex

CH2MHILL

e Path: o:\18gis\projects\zone_eu\wmu 65 aocs 544 546-cnc-egis.apr, Date: 20 Nov 2002 12:00, User: TWILEY

Appendix C



SWMU 67 10-10-02

MISAWE site to collect AIR samples using a JEROME MERCURY VAPOR ANALYZER. MODEL # 431 X / SERIAL NO. 1679. Rented from Total Safety. Certificate of Calibration on file.

TEMP = 82 % R. Humidity = 79 %

FORMER MERCURY STORAGE AREA (1st FLOOR)

Sample NO	mg/m³	Sample NO	mg/m³
1	0.0	16	0.0
2	0.0	17	0.0
3	0.0	18	0.0
4	0.0	19	0.0
5	0.0	20	0.0
6	0.0		
7	0.0		
8	0.0		
9	0.0		
10	0.0		
11	0.0		
12	0.0		
13	0.0		
14	0.0		
15	0.0		

CONTINUED →

SWMU 67

Former Mercury Gauge Rooms

(2nd Floor) Sample No.	mg/m³	(1st Floor) Sample No.	mg/m³
1	0.0	1	0.0
2	0.0	2	0.0
3	0.0	3	0.0
4	0.0	4	0.0
5	0.006	5	0.0
6	0.0	6	0.0
7	0.0	7	0.0
8	0.0	8	0.0
9	0.0	9	0.0
10	0.0	10	0.0
11	0.0	11	0.0
12	0.0	12	0.0
13	0.0	13	0.0
14	0.0	14	0.0
15	0.0	15	0.0
16	0.0	16	0.0
17	0.0	17	0.0
18	0.0	18	0.0
19	0.0	19	0.0
20	0.0	20	0.0

T.S.I # 3802

Certificate of Instrument Calibration

Arizona Instrument
1912 W. 4th Street • Tempe, AZ 85281 • (602) 470-1414 • (800) 528-7411 • Fax (480) 804-0656 • www.aic.com
Manufacturers of Computrac® Moisture Analyzers and Jerome® Toxic Gas Analyzers

Company Total Safety
Address P.O. Box 421289
Houston TX 77242

This is to certify that the JEROME X431-0002 Gold Film Mercury Analyzer, 110 VAC Serial Number 1679 with Sensor Number 8-12-16-S-B, was calibrated with standard units traceable to NIST

Calibration Status as Received: Out of Calibration

Incoming:	Actual	Calibration Gas	Allowable Range
Level 1	.088	0.107 mg/m3 Hg	1017-1124 (+/-5%)
RSD	6.87		<3%

Outgoing:	Actual	Calibration Gas	Allowable Range
Level 1	1063	0.107 mg/m3 Hg	1017-1124 (+/-5%)
RSD	1.46		<3%
Level 2	N/A	0.025 mg/m3 Hg	0.020 - 0.030 mg/m3
SD	N/A		<0.005 mg/m3
Level 3	N/A	0.010 mg/m3 Hg	0.005 - 0.015 mg/m3
SD	N/A		<0.005 mg/m3

Calibration Status as Left: In Calibration

Estimated Uncertainty of Calibration System: 3.5%
Ambient conditions during calibration:
Temperature degrees F: 74.1 % Relative Humidity: 25.3

Calibration Date 4/3/02 **Re-Calibration Date** 4/2/03

Approved By: Jeffrey Chubbs **Date:** 4/4/02
Title: Jeffrey Chubbs - Quality Assurance Technician

Equipment Used

Permeation Tube		S/N: 498-3663	NIST: 153337-1
Calibration Date:	1/9/02	Calibration Date Due: 1/8/03	
DynaCalibrator		S/N: M978	NIST: 255085.95;NBS Buret #81 and #K10
Calibration Date:	7/23/01	Calibration Date Due: 7/23/02	
Flowmeter		S/N: 1243	NIST: 821/258030-97; 821/256504-97;
Calibration Date:	6/19/01	Calibration Date Due: 6/19/02	
Digital Multimeter		S/N: 2376064	NIST: D5076
Calibration Date:	7/24/01	Calibration Date Due: 7/24/02	

Calibration Procedure Used 3109-0005

Arizona Instrument certifies that the above listed instrument meets or exceeds all published specifications and has been calibrated using standards whose accuracy is traceable to the NATIONAL INSTITUTE OF STANDARDS TECHNOLOGY within the limitations of the Institute's calibration services or have been derived from accepted values of natural physical constants or have been derived by the ratio type of self-calibration techniques. Arizona Instruments has reviewed ANSI STD Z540-2A and believes to comply.
DISCLAIMER Any unauthorized adjustments, removal or breaking of QC seals, or other continuous modifications on your Jerome Analyzer WILL VOID this factory calibration certificate. Because any of the above acts could affect the calibration and readings of the instrument, their certificate will no longer be valid and, further, Arizona Instrument Corporation WILL NOT be responsible for any liabilities incurred as a result of using the instrument after such adjustments, seal removal, or modifications.
Specific adjustments detailed in the User's Manual may be performed according to the directions and within the limits set by the manual. As long as a functional test is within range according to the procedure outlined in the Operator's Manual, the instrument is performing correctly. Factory Calibrations are recommended at least yearly. This document shall not be reproduced except in full without the written approval of Arizona Instrument.

Appendix D

Data Validation Summary - Charleston Naval Complex - Zone E, AOCs 546 and 542

TO: Tom Wiley/CH2M HILL/ATL

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

DATE: January 10, 2003

The purpose of this memorandum is to present the results of the data validation process for the samples collected in Zone E, AOCs 546 and 542. The samples were collected on December 11 and 12, 2002.

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

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

Samples were submitted to General Engineering Laboratories, Inc., in Charleston, South Carolina, for the following analyses: SW-846 8260 Volatile Organic Compounds (VOC), SW-846 8270 Semivolatile Organic Compounds (SVOC), 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
BL	Blank
BD	Blank Spike/Blank Spike Duplicate or (LCS/LCSD) Precision
BS	Blank Spike/LCS
CC	Continuing Calibration Verification
DL	Dilution
FD	Field Duplicate
HT	Holding Time
IB	In-Between (metals – B's → J's)
IC	Initial Calibration
IS	Internal Standard
LD	Lab Duplicate
LR	Concentration exceeded Linear Range
MD	MS/MSD or LCS/LCSD Precision
MS	Matrix Spike/Matrix Spike Duplicate
OT	Other (see DV worksheet)
PD	Pesticide Degradation
PS	Post Spike
RE	Re-extraction/Re-analysis
SD	Serial Dilution
SS	Spiked Surrogate
TD	Total vs. Dissolved
TN	Tune

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

SDG	Station ID	Sample ID	Lab Sample ID	Matrix	Sample Type	Depth	Depth	Collected	SW8260B	SW8270C	SW6010B	SW7470A/ SW7471A
72084	FIELDQC	546EB001M1	72084001	WQ	EB			12/12/02	X	X	X	X
72084	FIELDQC	546TB001M1	72084002	WQ	TB			12/12/02	X			
72084	FIELDQC	542EB001M1	72084003	WQ	EB			12/11/02				X
72084	LABQC	1200350778	1200350778	WQ	LB					X		
72084	LABQC	1200350783	1200350783	WQ	BS					X		
72084	LABQC	1200351218	1200351218	WQ	LB						X	
72084	LABQC	1200351219	1200351219	WQ	BS						X	
72084	LABQC	1200352248	1200352248	WQ	LB							X
72084	LABQC	1200352249	1200352249	WQ	BS							X
72084	LABQC	1200354744	1200354744	WQ	LB				X			
72084	LABQC	1200354745	1200354745	WQ	BS				X			
72085	E542SB009	542SB00902	72085001	SO	N	3	5	12/11/02				X
72085	E542SB008	542SB00801	72085002	SO	N	0	1	12/11/02				X
72085	E542SB008	542SB00803	72085003	SO	N	1	3	12/11/02				X
72085	E542SB008	542SB00802	72085004	SO	N	3	5	12/11/02				X
72085	E542SB009	542SB00901	72085005	SO	N	0	1	12/11/02				X
72085	E542SB009	542SB00903	72085006	SO	N	1	3	12/11/02				X
72085	E542SB010	542SB01001	72085007	SO	N	0	1	12/11/02				X
72085	E542SB010	542SB01003	72085008	SO	N	1	3	12/11/02				X

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
72085	E542SB010	542SB01002	72085009	SO	N	3	5	12/11/02				X
72085	E542SB011	542SB01101	72085010	SO	N	0	1	12/11/02				X
72085	E542SB011	542SB01103	72085011	SO	N	1	3	12/11/02				X
72085	E542SB011	542CB01103	72085012	SO	FD	1	3	12/11/02				X
72085	E542SB011	542SB01102	72085013	SO	N	3	5	12/11/02				X
72085	E542SB012	542SB01201	72085014	SO	N	0	1	12/11/02				X
72085	E542SB012	542SB01203	72085015	SO	N	1	3	12/11/02				X
72085	E542SB012	542SB01202	72085016	SO	N	3	5	12/11/02				X
72085	LABQC	1200352288	1200352288	SQ	LB							X
72085	LABQC	1200352289	1200352289	SQ	BS							X
72085	E542SB009	542SB00902MS	1200352290	SO	MS	3	5	12/11/02				X
72085	E542SB009	542SB00902SD	1200352291	SO	SD	3	5	12/11/02				X
72086	E546SB004	546SB00401	72086001	SO	N	0	1	12/12/02	X	X	X	X
72086	E546SB001	546SB00101	72086002	SO	N	0	1	12/12/02	X	X	X	X
72086	E546SB001	546SB00102	72086003	SO	N	3	5	12/12/02	X	X	X	X
72086	E546SB002	546SB00201	72086004	SO	N	0	1	12/12/02	X	X	X	X
72086	E546SB002	546SB00202	72086005	SO	N	3	5	12/12/02	X	X	X	X
72086	E546SB003	546SB00301	72086006	SO	N	0	1	12/12/02	X	X	X	X
72086	E546SB003	546SB00302	72086007	SO	N	3	5	12/12/02	X	X	X	X
72086	E546SB003	546CB00302	72086008	SO	FD	3	5	12/12/02	X	X	X	X
72086	LABQC	1200350796	1200350796	SQ	LB					X		

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
72086	LABQC	1200350797	1200350797	SQ	BS					X		
72086	E546SB004	546SB00401MS	1200350798	SO	MS	0	1	12/12/02		X		
72086	E546SB004	546SB00401SD	1200350799	SO	SD	0	1	12/12/02		X		
72086	LABQC	1200351277	1200351277	SQ	LB						X	
72086	LABQC	1200351278	1200351278	SQ	BS						X	
72086	E546SB004	546SB00401MS	1200351279	SO	MS	0	1	12/12/02			X	
72086	E546SB004	546SB00401SD	1200351280	SO	SD	0	1	12/12/02			X	
72086	LABQC	1200352292	1200352292	SQ	LB							X
72086	LABQC	1200352293	1200352293	SQ	BS							X
72086	E546SB004	546SB00401MS	1200352294	SO	MS	0	1	12/12/02				X
72086	E546SB004	546SB00401SD	1200352295	SO	SD	0	1	12/12/02				X
72086	E546SB004	546SB00401MS	1200352553	SO	MS	0	1	12/12/02	X			
72086	E546SB004	546SB00401SD	1200352554	SO	SD	0	1	12/12/02	X			
72086	LABQC	1200353739	1200353739	SQ	LB				X			
72086	LABQC	1200353740	1200353740	SQ	BS				X			
72086	LABQC	1200357407	1200357407	SQ	LB				X			
72086	LABQC	1200357408	1200357408	SQ	BS				X			

MATRIX CODE

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

SAMPLE TYPE CODE

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

LR TYPE CODE

DL - Dilution

ANALYSIS CODE

VOC - Volatile Organic Compounds
SVOC - Semivolatile Organic Compounds

Organic Parameters

Quality Control Review

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

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

Volatile Organic Compounds (VOC) Analyses

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

Blanks

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

TABLE 2
Blank Contamination: VOCs
Charleston Naval Complex, Zone E, AOCs 546 and 542, Charleston, SC

72084	1200354744	1200354744	LB	1,2,3-Trichlorobenzene	0.44	µg/L	2.2 µg/L
72084	546EB001M1	72084001	EB	Acetone	8.4	µg/L	84.0 µg/L
				Toluene	0.44	µg/L	2.2 µg/L
				o-Xylene	0.26	µg/L	1.3 µg/L
				Xylenes (total)	0.26	µg/L	1.3 µg/L
72086	546EB001M1	72084001	EB	Acetone	8.4	µg/L	84.0 µg/Kg
				Toluene	0.44	µg/L	2.2 µg/Kg
				o-Xylene	0.26	µg/L	1.3 µg/Kg
				Xylenes (total)	0.26	µg/L	1.3 µg/Kg

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

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

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

Recoveries - Surrogate, MS/MSD and LCS

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

TABLE 3
Surrogate, MS/MSD, and LCS Recoveries Out of QC Limits: VOC
Charleston Naval Complex, Zone E, AOCs 546 and 542, Charleston, SC

72084	546EB001M1	Toluene-d8 (surrogate)	80*	88-110	546EB001M1	No Flags Applied (field blank)
		Bromofluorobenzene (surrogate)	78*	86-115		
72084	546TB001M1	Toluene-d8 (surrogate)	82*	88-110	546TB001M1	No Flags Applied (field blank)
		Bromofluorobenzene (surrogate)	77*	86-115		
72086	546SB00101	Toluene-d8 (surrogate)	143*	84-138	546SB00101	Detects only-J
		Bromofluorobenzene (surrogate)	160*	59-113		
72086	546SB00201	Bromofluorobenzene (surrogate)	123*	59-113	546SB00201	Detects only-J
72086	546SB00202	Bromofluorobenzene (surrogate)	126*	59-113	546SB00202	Detects only-J
72086	546SB00301	Bromofluorobenzene (surrogate)	134*	59-113	546SB00301	Detects only-J
72086	546CB00302	Bromofluorobenzene (surrogate)	123*	59-113	546CB00302	Detects only-J
72086	546SB00401	Bromofluorobenzene (surrogate)	117*	59-113	546SB00401	Detects only-J
72086	546SB00102	Bromofluorobenzene (surrogate)	120*	59-113	546SB00102	Detects only-J
72086	546SB00302	Dibromofluoromethane (surrogate)	130*	70-130	546SB00302	Detects only-J
		Bromofluorobenzene (surrogate)	133*	59-113		
72086	1200353740 LCS	2-Chloroethyl vinyl ether	68*	70-130	546SB00101, 546SB00201, 546SB00202, 546SB00301, 546CB00302	Detects-J, non-detects-UJ
		1,2,3-Trichlorobenzene	131.2*	70-130		Detects only-J
72086	546SB00401 MS/MSD	Bromomethane	140* / 123.2	70-130	546SB00401	Detects only-J
		Trans-1,2-Dichloroethylene	147.6* / 126.6	70-130		
		Cis-1,2-Dichloroethylene	142* / 123	70-130		
		Chloroform	134.6* / 120	70-130		
		1,1,1-Trichloroethane	139* / 125.2	70-130		

TABLE 3
Surrogate, MS/MSD, and LCS Recoveries Out of QC Limits: VOC
Charleston Naval Complex, Zone E, AOCs 546 and 542, Charleston, SC

72086	546SB00401 MS/MSD	Carbon tetrachloride	137.2* / 124.6	70-130	546SB00401	Detects only-J
		Trichloroethylene	161.4* / 133.4*	70-130		
		Bromodichloromethane	133.6* / 117	70-130		
		Cic-1,3-Dichloropropane	133.2* / 120.2	70-130		
		Toluene	131* / 112.2	70-130		
		Trans-1,3-Dichloropropane	139.4* / 119.6	70-130		
		1,1,2-Trichloroethane	141.2* / 122.2	70-130		
		Tetrachloroethylene	150.8* / 127	70-130		
		Dibromochloromethane	157.2* / 135.6*	70-130		
		Chlorobenzene	134.2* / 116.4	70-130		
		o-Xylene	134* / 116.6	70-130		
		m,p-Xylenes	133* / 113	70-130		
		Xylenes (total)	133.3* / 114	70-130		
		Styrene	134.8* / 119.6	70-130		
		Bromoform	152* / 132.2*	70-130		
		1,3-Dichlorobenzene	131* / 112.2	70-130		
		1,2,4-Trichlorobenzene	158.6* / 131.6*	70-130		
		1,2,3-Trichlorobenzene	182.8* / 156*	70-130		
72086	546SB00401 MS/MSD	Vinyl acetate	8.4* / 8.4*	70-130	546SB00401	Detects-J, non-detects-R

* - out of control limits

Initial and Continuing Calibration Criteria

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

TABLE 4
Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: VOC
Charleston Naval Complex, Zone E, AOCs 546 and 542, Charleston, SC

VOA1-CCAL-12/19/02, 0846	1,1,1-Trichloroethylene	20.3% low	72084 – All (Field blanks only)
	1,2-Dichloroethane	23.1% low	
VOA2-CCAL-12/17/02, 1402	Chloromethane	28.6% low	546SB00101, 546SB00201, 546SB00202, 546SB00301, 546CB00302
	Vinyl acetate	26.4% low	
	2-Butanone	23.7% low	
	2-Chloroethyl vinyl ether	31.9% low	
	2-Hexanone	23.9% low	
	Dibromochloromethane	21.4% high	
	Bromoform	21.2% high	
	1,2,3-Trichlorobenzene	31.1% high	
VOA2-CCAL-12/19/02, 1000	Chloromethane	23.3% low	546SB00102, 546SB00302, 546SB00401
	Vinyl acetate	26.5% low	
	2-Butanone	25.6% low	
	2-Chloroethyl vinyl ether	20.3% l ow	
	2-Hexane	25.5% low	
	Bromoform	22.2% high	
	1,2,3-Trichlorobenzene	26.6% high	

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.

Internal Standard Area

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

- 1,4-Dichlorobenzene-d4 in sample 72086002 (546SB00101) had a 60.1% low recovery. Detects were qualified as "J" and non-detects were qualified "UJ".

Semivolatile Organic Compounds (SVOC) Analyses

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

Blanks

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

TABLE 5
Blank Contamination: SVOCs
Charleston Naval Complex, Zone E, AOCs 546 and 542, Charleston, SC

72084	1200350778	1200350778	LB	Bis(2-ethylhexyl)phthalate	3.5	µg/L	35.0 µg/L
72084	546EB001M1	72084001	EB	Bis(2-ethylhexyl)phthalate	5.9	µg/L	59.0 µg/L
72086	546EB001M1	72084001	EB	Bis(2-ethylhexyl)phthalate	5.9	µg/L	59.0 µg/L

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

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

No results were qualified due to blank contamination.

Initial and Continuing Calibration Criteria

All initial calibration criteria and continuing calibration criteria were met, except as listed in Table 6.

TABLE 6
Exceptions to Initial Calibration Criteria and Continuing Calibration Criteria: SVOC
Charleston Naval Complex, Zone E, AOCs 546 and 542, Charleston, SC

MSD8-ICAL-12/03/02, 2224	Benzoic acid	R^2=0.984	546EB001M1 (Field blank – no flags)
	Hexachlorocyclopentadiene	R^2=0.981	
	2-Methyl-4,6-dinitrophenol	R^2=0.986	
	Di-n-octylphthalate	R^2=0.987	
MSD8-CCAL-12/16/02, 1117	o-Nitroaniline	29.2% low	546EB001M1 (Field blank – no flags)
	m-Nitroaniline	25.6% low	
	p-Nitroaniline	30.0% low	
	3,3'-Dichlorobenzidine	22.2% low	
MSD2-ICAL-12/06/02, 2135	Benzoic acid	R^2=0.980	72086 - All
	Hexachlorocyclopentadiene	R^2=0.980	
	2-Methyl-4,6-dinitrophenol	R^2=0.982	
	Pentachlorophenol	R^2=0.983	
MSD2-CCAL-12/13/02, 1313	Bis(2-Chloroisopropyl)ether	28.8% low	72086 - All
	Pyrene	32.1% low	
	p-Nitroaniline	31.3% low	

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

- When the percent Relative Standard Deviation (%RSD) or correlation coefficient (R^2) was out in the initial calibration, all associated samples were qualified. Detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.
- When the percent difference (%D) was low in the continuing calibration standards, detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.

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 7.

TABLE 7
Blank Contamination: Metals
Charleston Naval Complex, Zone E, AOCs 546 and 542, Charleston, SC

72084	CCB		CCB	Cobalt	1.47	ug/L	7.35 ug/L
72084	CCB		CCB	Silver	2.17	ug/L	10.85 ug/L
72084	CCB		CCB	Vanadium	1.85	ug/L	9.25 ug/L
72086	CCB		CCB	Cadmium	0.447	ug/L	0.11175 mg/Kg
72086	CCB		CCB	Lead	2.27	ug/L	0.5675 mg/Kg
72086	CCB		CCB	Zinc	2.84	ug/L	0.71 mg/Kg
72086	1200351277	1200351277	LB	Lead	0.203	mg/Kg	1.015 mg/Kg
72086	1200351277	1200351277	LB	Zinc	0.205	mg/Kg	1.025 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 – Matrix Spike/Matrix Spike Duplicate (MS/MSD) and Laboratory Control Sample (LCS)

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

TABLE 8
MS/MSD and LCS Recoveries Out of QC Limits: Metals
Charleston Naval Complex, Zone E, AOCs 546 and 542, Charleston, SC

72084	1200351219 LCS	Silver	19.6*	80-120	72084 – All	No flags applied (field blanks only)
72086	546SB00401 MS/MSD	Cobalt	96 / 124.5*	80-120	72086 - All	Detects only - J
* - out of control limits						

Rejected Data

The majority of rejected data were associated with re-runs and dilutions (there can only be a single valid result per parameter per sample). However, there was a selected result qualified as "R", rejected, due to associated QC parameters out of criteria. The rejected data is summarized in Table 9 below.

TABLE 9
Data Qualification Summary: Rejected Data
Charleston Naval Complex, Zone E, AOCs 546 and 542, Charleston, SC

72086	546SB00401	VOA	Vinyl acetate	11.5	U	11.5	R	µg/Kg	MS

Conclusion

A review of the analytical data submitted regarding the investigation of Zone E, AOCs 546 and 542 at the Charleston Naval Complex, Charleston, South Carolina by CH2M HILL has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed, and that the analytical results should be considered usable as qualified.

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

	StationID	E546SB001		E546SB001		E546SB002	
	SampleID	546SB00101 (0-1ft)		546SB00102 (3-5ft)		546SB00201 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002		12/13/2002	
	DateAnalyzed	12/17/2002		12/19/2002		12/17/2002	
	SDGNumber	72086		72086		72086	
Parameter	**Units**						
Chloromethane	ug/kg	10.3	UJ	10.9	UJ	12.9	UJ
Vinyl chloride	ug/kg	10.3	U	10.9	U	12.9	U
Bromomethane	ug/kg	10.3	U	10.9	U	12.9	U
Chloroethane	ug/kg	10.3	U	10.9	U	12.9	U
1,1-Dichloroethene	ug/kg	1.1	J	0.71	J	6.4	U
Acetone	ug/kg	10.3	U	11.7	U	14.4	U
Carbon Disulfide	ug/kg	5.2	U	5.4	U	6.4	U
Methylene Chloride	ug/kg	5.2	U	5.4	U	6.4	U
trans-1,2-Dichloroethene	ug/kg	5.2	U	5.4	U	6.4	U
1,1-Dichloroethane	ug/kg	5.2	U	5.4	U	6.4	U
Vinyl acetate	ug/kg	10.3	UJ	10.9	UJ	12.9	UJ
Methyl ethyl ketone (2-Butanone)	ug/kg	10.3	UJ	10.9	UJ	12.9	UJ
cis-1,2-Dichloroethylene	ug/kg	5.2	U	5.4	U	6.4	U
1,2-Dichloroethene (total)	ug/kg	5.2	U	5.4	U	6.4	U
Chloroform	ug/kg	5.2	U	5.4	U	6.4	U
1,1,1-Trichloroethane	ug/kg	5.2	U	5.4	U	6.4	U
Carbon Tetrachloride	ug/kg	5.2	U	5.4	U	6.4	U
1,2-Dichloroethane	ug/kg	5.2	U	5.4	U	6.4	U
Benzene	ug/kg	5.2	U	5.4	U	6.4	U
Trichloroethylene (TCE)	ug/kg	5.2	U	5.4	U	6.4	U
1,2-Dichloropropane	ug/kg	5.2	U	5.4	U	6.4	U
Bromodichloromethane	ug/kg	5.2	U	5.4	U	6.4	U
2-Chloroethyl vinyl ether	ug/kg	10.3	UJ	10.9	UJ	12.9	UJ
cis-1,3-Dichloropropene	ug/kg	5.2	U	5.4	U	6.4	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/kg	10.3	U	10.9	U	5.3	J
Toluene	ug/kg	5.2	U	5.4	U	6.4	U
trans-1,3-Dichloropropene	ug/kg	5.2	U	5.4	U	6.4	U
1,1,2-Trichloroethane	ug/kg	5.2	U	5.4	U	6.4	U
2-Hexanone	ug/kg	10.3	UJ	10.9	UJ	12.9	UJ
Tetrachloroethylene (PCE)	ug/kg	5.2	U	5.4	U	6.4	U

	StationID	E546SB002		E546SB003		E546SB003	
	SampleID	546SB00202 (3-5ft)		546CB00302 (3-5ft)		546SB00301 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002		12/13/2002	
	DateAnalyzed	12/17/2002		12/17/2002		12/17/2002	
	SDGNumber	72086		72086		72086	
Parameter	**Units**						
Chloromethane	ug/kg	10.6	UJ	10.4	UJ	10.6	UJ
Vinyl chloride	ug/kg	10.6	U	10.4	U	10.6	U
Bromomethane	ug/kg	10.6	U	10.4	U	10.6	U
Chloroethane	ug/kg	10.6	U	10.4	U	10.6	U
1,1-Dichloroethene	ug/kg	5.3	U	1.5	J	5.3	U
Acetone	ug/kg	17.6	U	10.4	U	41.4	U
Carbon Disulfide	ug/kg	5.3	U	5.2	U	5.3	U
Methylene Chloride	ug/kg	5.3	U	5.2	U	5.3	U
trans-1,2-Dichloroethene	ug/kg	5.3	U	5.2	U	5.3	U
1,1-Dichloroethane	ug/kg	5.3	U	5.2	U	5.3	U
Vinyl acetate	ug/kg	10.6	UJ	10.4	UJ	10.6	UJ
Methyl ethyl ketone (2-Butanone)	ug/kg	10.6	UJ	10.4	UJ	10.6	UJ
cis-1,2-Dichloroethylene	ug/kg	5.3	U	5.2	U	5.3	U
1,2-Dichloroethene (total)	ug/kg	5.3	U	5.2	U	5.3	U
Chloroform	ug/kg	5.3	U	5.2	U	5.3	U
1,1,1-Trichloroethane	ug/kg	5.3	U	5.2	U	5.3	U
Carbon Tetrachloride	ug/kg	5.3	U	5.2	U	5.3	U
1,2-Dichloroethane	ug/kg	5.3	U	5.2	U	5.3	U
Benzene	ug/kg	5.3	U	5.2	U	5.3	U
Trichloroethylene (TCE)	ug/kg	5.3	U	5.2	U	5.3	U
1,2-Dichloropropane	ug/kg	5.3	U	5.2	U	5.3	U
Bromodichloromethane	ug/kg	5.3	U	5.2	U	5.3	U
2-Chloroethyl vinyl ether	ug/kg	10.6	UJ	10.4	UJ	10.6	UJ
cis-1,3-Dichloropropene	ug/kg	5.3	U	5.2	U	5.3	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/kg	10.6	U	10.4	U	10.6	U
Toluene	ug/kg	5.3	U	5.2	U	5.3	U
trans-1,3-Dichloropropene	ug/kg	5.3	U	5.2	U	5.3	U
1,1,2-Trichloroethane	ug/kg	5.3	U	5.2	U	5.3	U
2-Hexanone	ug/kg	10.6	UJ	10.4	UJ	10.6	UJ
Tetrachloroethylene (PCE)	ug/kg	5.3	U	5.2	U	5.3	U

	StationID	E546SB003		E546SB004	
	SampleID	546SB00302 (3-5ft)		546SB00401 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002	
	DateAnalyzed	12/19/2002		12/19/2002	
	SDGNumber	72086		72086	
Parameter	**Units**				
Chloromethane	ug/kg	10.5	UJ	11.5	UJ
Vinyl chloride	ug/kg	10.5	U	11.5	U
Bromomethane	ug/kg	10.5	U	11.5	U
Chloroethane	ug/kg	10.5	U	11.5	U
1,1-Dichloroethene	ug/kg	1.1	J	5.8	U
Acetone	ug/kg	10.5	U	30.7	U
Carbon Disulfide	ug/kg	5.2	U	5.8	U
Methylene Chloride	ug/kg	5.2	U	5.8	U
trans-1,2-Dichloroethene	ug/kg	5.2	U	5.8	U
1,1-Dichloroethane	ug/kg	5.2	U	5.8	U
Vinyl acetate	ug/kg	10.5	UJ	11.5	R
Methyl ethyl ketone (2-Butanone)	ug/kg	10.5	UJ	11.5	UJ
cis-1,2-Dichloroethylene	ug/kg	5.2	U	5.8	U
1,2-Dichloroethene (total)	ug/kg	5.2	U	5.8	U
Chloroform	ug/kg	5.2	U	5.8	U
1,1,1-Trichloroethane	ug/kg	5.2	U	5.8	U
Carbon Tetrachloride	ug/kg	5.2	U	5.8	U
1,2-Dichloroethane	ug/kg	5.2	U	5.8	U
Benzene	ug/kg	5.2	U	5.8	U
Trichloroethylene (TCE)	ug/kg	5.2	U	5.8	U
1,2-Dichloropropane	ug/kg	5.2	U	5.8	U
Bromodichloromethane	ug/kg	5.2	U	5.8	U
2-Chloroethyl vinyl ether	ug/kg	10.5	UJ	11.5	UJ
cis-1,3-Dichloropropene	ug/kg	5.2	U	5.8	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/kg	10.5	U	11.5	U
Toluene	ug/kg	5.2	U	5.8	U
trans-1,3-Dichloropropene	ug/kg	5.2	U	5.8	U
1,1,2-Trichloroethane	ug/kg	5.2	U	5.8	U
2-Hexanone	ug/kg	10.5	UJ	11.5	UJ
Tetrachloroethylene (PCE)	ug/kg	5.2	U	5.8	U

	StationID	E546SB001		E546SB001		E546SB002	
	SampleID	546SB00101 (0-1ft)		546SB00102 (3-5ft)		546SB00201 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002		12/13/2002	
	DateAnalyzed	12/17/2002		12/19/2002		12/17/2002	
	SDGNumber	72086		72086		72086	
Parameter	**Units**						
Dibromochloromethane	ug/kg	5.2	U	5.4	U	6.4	U
Chlorobenzene	ug/kg	5.2	U	5.4	U	6.4	U
Ethylbenzene	ug/kg	5.2	U	5.4	U	6.4	U
m+p Xylene	ug/kg	1.6	J	0.83	J	1.2	J
o-Xylene	ug/kg	5.2	U	5.4	U	6.4	U
Xylenes, Total	ug/kg	1.6	J	0.83	J	1.2	J
Styrene	ug/kg	5.2	U	5.4	U	6.4	U
Bromoform	ug/kg	5.2	U	5.4	U	6.4	U
1,1,2,2-Tetrachloroethane	ug/kg	5.2	UJ	5.4	U	6.4	U
1,3-Dichlorobenzene	ug/kg	5.2	UJ	5.4	U	6.4	U
1,4-Dichlorobenzene	ug/kg	5.2	UJ	5.4	U	6.4	U
1,2-Dichlorobenzene	ug/kg	5.2	UJ	5.4	U	6.4	U
1,2,4-Trichlorobenzene	ug/kg	5.2	UJ	5.4	U	6.4	U
1,2,3-Trichlorobenzene	ug/kg	5.2	UJ	5.4	U	6.4	U

	StationID	E546SB002		E546SB003		E546SB003	
	SampleID	546SB00202 (3-5ft)		546CB00302 (3-5ft)		546SB00301 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002		12/13/2002	
	DateAnalyzed	12/17/2002		12/17/2002		12/17/2002	
	SDGNumber	72086		72086		72086	
Parameter	**Units**						
Dibromochloromethane	ug/kg	5.3	U	5.2	U	5.3	U
Chlorobenzene	ug/kg	5.3	U	5.2	U	5.3	U
Ethylbenzene	ug/kg	5.3	U	5.2	U	5.3	U
m+p Xylene	ug/kg	1.2	J	0.72	J	1.1	J
o-Xylene	ug/kg	5.3	U	5.2	U	5.3	U
Xylenes, Total	ug/kg	1.2	J	0.72	J	1.1	J
Styrene	ug/kg	5.3	U	5.2	U	5.3	U
Bromoform	ug/kg	5.3	U	5.2	U	5.3	U
1,1,2,2-Tetrachloroethane	ug/kg	5.3	U	5.2	U	5.3	U
1,3-Dichlorobenzene	ug/kg	5.3	U	5.2	U	5.3	U
1,4-Dichlorobenzene	ug/kg	5.3	U	5.2	U	5.3	U
1,2-Dichlorobenzene	ug/kg	5.3	U	5.2	U	5.3	U
1,2,4-Trichlorobenzene	ug/kg	5.3	U	5.2	U	5.3	U
1,2,3-Trichlorobenzene	ug/kg	5.3	U	5.2	U	5.3	U

	StationID	E546SB003		E546SB004	
	SampleID	546SB00302 (3-5ft)		546SB00401 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002	
	DateAnalyzed	12/19/2002		12/19/2002	
	SDGNumber	72086		72086	
Parameter	**Units**				
Dibromochloromethane	ug/kg	5.2	U	5.8	U
Chlorobenzene	ug/kg	5.2	U	5.8	U
Ethylbenzene	ug/kg	5.2	U	5.8	U
m+p Xylene	ug/kg	5.2	U	0.88	J
o-Xylene	ug/kg	5.2	U	5.8	U
Xylenes, Total	ug/kg	5.2	U	0.88	J
Styrene	ug/kg	5.2	U	5.8	U
Bromoform	ug/kg	5.2	U	5.8	U
1,1,2,2-Tetrachloroethane	ug/kg	5.2	U	5.8	U
1,3-Dichlorobenzene	ug/kg	5.2	U	5.8	U
1,4-Dichlorobenzene	ug/kg	5.2	U	5.8	U
1,2-Dichlorobenzene	ug/kg	5.2	U	5.8	U
1,2,4-Trichlorobenzene	ug/kg	5.2	U	5.8	U
1,2,3-Trichlorobenzene	ug/kg	5.2	U	5.8	U

	StationID	E546SB001		E546SB001		E546SB002	
	SampleID	546SB00101 (0-1ft)		546SB00102 (3-5ft)		546SB00201 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002		12/13/2002	
	DateAnalyzed	12/13/2002		12/13/2002		12/13/2002	
	SDGNumber	72086		72086		72086	
Parameter	**Units**						
Benzo(g,h,i)Perylene	ug/kg	68.2	J	381	U	40.8	J
Phenol	ug/kg	354	U	381	U	383	U
bis(2-Chloroethyl) ether (2-Chloroethyl Ether)	ug/kg	354	U	381	U	383	U
Bis(2-Chloroisopropyl)Ether	ug/kg	354	UJ	381	UJ	383	UJ
2-Chlorophenol	ug/kg	354	U	381	U	383	U
Benzyl alcohol	ug/kg	354	U	381	U	383	U
2-Methylphenol (o-Cresol)	ug/kg	354	U	381	U	383	U
N-Nitrosodi-n-propylamine	ug/kg	354	U	381	U	383	U
3-Methylphenol/4-Methylphenol (mp-Cresol)	ug/kg	354	U	381	U	383	U
Hexachloroethane	ug/kg	354	U	381	U	383	U
Nitrobenzene	ug/kg	354	U	381	U	383	U
Isophorone	ug/kg	354	U	381	U	383	U
2-Nitrophenol	ug/kg	354	U	381	U	383	U
2,4-Dimethylphenol	ug/kg	354	U	381	U	383	U
bis(2-Chloroethoxy) Methane	ug/kg	354	U	381	U	383	U
2,4-Dichlorophenol	ug/kg	354	U	381	U	383	U
Benzoic acid	ug/kg	1720	UJ	1840	UJ	1860	UJ
Naphthalene	ug/kg	354	U	381	U	383	U
4-Chloroaniline	ug/kg	354	U	381	U	383	U
Hexachlorobutadiene	ug/kg	354	U	381	U	383	U
4-Chloro-3-methylphenol	ug/kg	322	U	346	U	348	U
2-Methylnaphthalene	ug/kg	354	U	381	U	383	U
Hexachlorocyclopentadiene	ug/kg	354	UJ	381	UJ	383	UJ
2,4,6-Trichlorophenol	ug/kg	354	U	381	U	383	U
2,4,5-Trichlorophenol	ug/kg	1720	U	1840	U	1860	U
2-Chloronaphthalene	ug/kg	354	U	381	U	383	U
2-Nitroaniline	ug/kg	1720	U	1840	U	1860	U
3-Nitroaniline	ug/kg	1720	U	1840	U	1860	U
Dimethyl Phthalate	ug/kg	354	U	381	U	383	U
2,6-Dinitrotoluene	ug/kg	354	U	381	U	383	U

	StationID	E546SB002		E546SB003		E546SB003	
	SampleID	546SB00202 (3-5ft)		546CB00302 (3-5ft)		546SB00301 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002		12/13/2002	
	DateAnalyzed	12/13/2002		12/13/2002		12/13/2002	
	SDGNumber	72086		72086		72086	
Parameter	**Units**						
Benzo(g,h,i)Perylene	ug/kg	351	U	94.1	J	436	=
Phenol	ug/kg	351	U	377	U	362	U
bis(2-Chloroethyl) ether (2-Chloroethyl Ether)	ug/kg	351	U	377	U	362	U
Bis(2-Chloroisopropyl)Ether	ug/kg	351	UJ	377	UJ	362	UJ
2-Chlorophenol	ug/kg	351	U	377	U	362	U
Benzyl alcohol	ug/kg	351	U	377	U	362	U
2-Methylphenol (o-Cresol)	ug/kg	351	U	377	U	362	U
N-Nitrosodi-n-propylamine	ug/kg	351	U	377	U	362	U
3-Methylphenol/4-Methylphenol (mp-Cresol)	ug/kg	351	U	377	U	362	U
Hexachloroethane	ug/kg	351	U	377	U	362	U
Nitrobenzene	ug/kg	351	U	377	U	362	U
Isophorone	ug/kg	351	U	377	U	362	U
2-Nitrophenol	ug/kg	351	U	377	U	362	U
2,4-Dimethylphenol	ug/kg	351	U	377	U	362	U
bis(2-Chloroethoxy) Methane	ug/kg	351	U	377	U	362	U
2,4-Dichlorophenol	ug/kg	351	U	377	U	362	U
Benzoic acid	ug/kg	1700	UJ	1820	UJ	1760	UJ
Naphthalene	ug/kg	351	U	377	U	30.4	J
4-Chloroaniline	ug/kg	351	U	377	U	362	U
Hexachlorobutadiene	ug/kg	351	U	377	U	362	U
4-Chloro-3-methylphenol	ug/kg	319	U	343	U	330	U
2-Methylnaphthalene	ug/kg	351	U	377	U	28.9	J
Hexachlorocyclopentadiene	ug/kg	351	UJ	377	UJ	362	UJ
2,4,6-Trichlorophenol	ug/kg	351	U	377	U	362	U
2,4,5-Trichlorophenol	ug/kg	1700	U	1820	U	1760	U
2-Chloronaphthalene	ug/kg	351	U	377	U	362	U
2-Nitroaniline	ug/kg	1700	U	1820	U	1760	U
3-Nitroaniline	ug/kg	1700	U	1820	U	1760	U
Dimethyl Phthalate	ug/kg	351	U	377	U	362	U
2,6-Dinitrotoluene	ug/kg	351	U	377	U	362	U

	StationID	E546SB003		E546SB004	
	SampleID	546SB00302 (3-5ft)		546SB00401 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002	
	DateAnalyzed	12/13/2002		12/13/2002	
	SDGNumber	72086		72086	
Parameter	**Units**				
Benzo(g,h,i)Perylene	ug/kg	290	J	412	U
Phenol	ug/kg	374	U	412	U
bis(2-Chloroethyl) ether (2-Chloroethyl Ether)	ug/kg	374	U	412	U
Bis(2-Chloroisopropyl)Ether	ug/kg	374	UJ	412	UJ
2-Chlorophenol	ug/kg	374	U	412	U
Benzyl alcohol	ug/kg	374	U	412	U
2-Methylphenol (o-Cresol)	ug/kg	374	U	412	U
N-Nitrosodi-n-propylamine	ug/kg	374	U	412	U
3-Methylphenol/4-Methylphenol (mp-Cresol)	ug/kg	374	U	412	U
Hexachloroethane	ug/kg	374	U	412	U
Nitrobenzene	ug/kg	374	U	412	U
Isophorone	ug/kg	374	U	412	U
2-Nitrophenol	ug/kg	374	U	412	U
2,4-Dimethylphenol	ug/kg	374	U	412	U
bis(2-Chloroethoxy) Methane	ug/kg	374	U	412	U
2,4-Dichlorophenol	ug/kg	374	U	412	U
Benzoic acid	ug/kg	1810	UJ	2000	UJ
Naphthalene	ug/kg	25.9	J	412	U
4-Chloroaniline	ug/kg	374	U	412	U
Hexachlorobutadiene	ug/kg	374	U	412	U
4-Chloro-3-methylphenol	ug/kg	340	U	374	U
2-Methylnaphthalene	ug/kg	24.1	J	412	U
Hexachlorocyclopentadiene	ug/kg	374	UJ	412	UJ
2,4,6-Trichlorophenol	ug/kg	374	U	412	U
2,4,5-Trichlorophenol	ug/kg	1810	U	2000	U
2-Chloronaphthalene	ug/kg	374	U	412	U
2-Nitroaniline	ug/kg	1810	U	2000	U
3-Nitroaniline	ug/kg	1810	U	2000	U
Dimethyl Phthalate	ug/kg	374	U	412	U
2,6-Dinitrotoluene	ug/kg	374	U	412	U

	StationID	E546SB001		E546SB001		E546SB002	
	SampleID	546SB00101 (0-1ft)		546SB00102 (3-5ft)		546SB00201 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002		12/13/2002	
	DateAnalyzed	12/13/2002		12/13/2002		12/13/2002	
	SDGNumber	72086		72086		72086	
Parameter	**Units**						
Acenaphthylene	ug/kg	354	U	381	U	383	U
Acenaphthene	ug/kg	322	U	346	U	348	U
2,4-Dinitrophenol	ug/kg	1720	U	1840	U	1860	U
Dibenzofuran	ug/kg	354	U	381	U	383	U
2,4-Dinitrotoluene	ug/kg	322	U	346	U	348	U
Diethyl Phthalate	ug/kg	354	U	381	U	383	U
4-Nitrophenol	ug/kg	1720	U	1840	U	1860	U
Fluorene	ug/kg	354	U	381	U	383	U
4-Chlorophenyl Phenyl Ether	ug/kg	354	U	381	U	383	U
4,6-Dinitro-2-methylphenol	ug/kg	1720	UJ	1840	UJ	1860	UJ
4-Nitroaniline	ug/kg	1720	UJ	1840	UJ	1860	UJ
Diphenylamine	ug/kg	354	U	381	U	383	U
4-Bromophenyl Phenyl Ether	ug/kg	354	U	381	U	383	U
Hexachlorobenzene	ug/kg	354	U	381	U	383	U
Pentachlorophenol	ug/kg	1720	UJ	1840	UJ	1860	UJ
Phenanthrene	ug/kg	128	J	381	U	42.7	J
Anthracene	ug/kg	19.1	J	381	U	383	U
Di-n-butyl Phthalate	ug/kg	354	U	381	U	383	U
Fluoranthene	ug/kg	191	J	381	U	106	J
Pyrene	ug/kg	122	J	381	UJ	69.2	J
Benzyl Butyl Phthalate	ug/kg	354	U	381	U	383	U
Benzo(a)Anthracene	ug/kg	100	J	381	U	57.4	J
3,3'-Dichlorobenzidine	ug/kg	708	U	761	U	765	U
Chrysene	ug/kg	107	J	381	U	64.5	J
bis(2-Ethylhexyl) Phthalate	ug/kg	354	U	381	U	383	U
Di-n-octylphthalate	ug/kg	354	U	381	U	383	U
Benzo(b)Fluoranthene	ug/kg	164	J	381	U	75	J
Benzo(k)Fluoranthene	ug/kg	354	U	381	U	42	J
Benzo(a)Pyrene	ug/kg	84.5	J	381	U	58.5	J
Indeno(1,2,3-c,d)pyrene	ug/kg	59.4	J	381	U	383	U

	StationID	E546SB002		E546SB003		E546SB003	
	SampleID	546SB00202 (3-5ft)		546CB00302 (3-5ft)		546SB00301 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002		12/13/2002	
	DateAnalyzed	12/13/2002		12/13/2002		12/13/2002	
	SDGNumber	72086		72086		72086	
Parameter	**Units**						
Acenaphthylene	ug/kg	351	U	377	U	362	U
Acenaphthene	ug/kg	319	U	343	U	79.5	J
2,4-Dinitrophenol	ug/kg	1700	U	1820	U	1760	U
Dibenzofuran	ug/kg	351	U	377	U	36.8	J
2,4-Dinitrotoluene	ug/kg	319	U	343	U	330	U
Diethyl Phthalate	ug/kg	351	U	377	U	362	U
4-Nitrophenol	ug/kg	1700	U	1820	U	1760	U
Fluorene	ug/kg	351	U	377	U	83	J
4-Chlorophenyl Phenyl Ether	ug/kg	351	U	377	U	362	U
4,6-Dinitro-2-methylphenol	ug/kg	1700	UJ	1820	UJ	1760	UJ
4-Nitroaniline	ug/kg	1700	UJ	1820	UJ	1760	UJ
Diphenylamine	ug/kg	351	U	377	U	362	U
4-Bromophenyl Phenyl Ether	ug/kg	351	U	377	U	362	U
Hexachlorobenzene	ug/kg	351	U	377	U	362	U
Pentachlorophenol	ug/kg	1700	UJ	1820	UJ	1760	UJ
Phenanthrene	ug/kg	351	U	110	J	1340	=
Anthracene	ug/kg	351	U	24.6	J	234	J
Di-n-butyl Phthalate	ug/kg	351	U	377	U	362	U
Fluoranthene	ug/kg	351	U	247	J	2360	=
Pyrene	ug/kg	351	UJ	178	J	1300	J
Benzyl Butyl Phthalate	ug/kg	351	U	377	U	362	U
Benzo(a)Anthracene	ug/kg	351	U	146	J	881	=
3,3'-Dichlorobenzidine	ug/kg	701	U	753	U	724	U
Chrysene	ug/kg	351	U	140	J	1020	=
bis(2-Ethylhexyl) Phthalate	ug/kg	351	U	377	U	362	U
Di-n-octylphthalate	ug/kg	351	U	377	U	362	U
Benzo(b)Fluoranthene	ug/kg	351	U	276	J	1780	=
Benzo(k)Fluoranthene	ug/kg	351	U	377	U	362	U
Benzo(a)Pyrene	ug/kg	351	U	144	J	808	=
Indeno(1,2,3-c,d)pyrene	ug/kg	351	U	81.7	J	362	U

	StationID	E546SB003		E546SB004	
	SampleID	546SB00302 (3-5ft)		546SB00401 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002	
	DateAnalyzed	12/13/2002		12/13/2002	
	SDGNumber	72086		72086	
Parameter	**Units**				
Acenaphthylene	ug/kg	374	U	412	U
Acenaphthene	ug/kg	78.2	J	24.9	J
2,4-Dinitrophenol	ug/kg	1810	U	2000	U
Dibenzofuran	ug/kg	34.4	J	48.5	J
2,4-Dinitrotoluene	ug/kg	340	U	374	U
Diethyl Phthalate	ug/kg	374	U	412	U
4-Nitrophenol	ug/kg	1810	U	2000	U
Fluorene	ug/kg	59.1	J	57.7	J
4-Chlorophenyl Phenyl Ether	ug/kg	374	U	412	U
4,6-Dinitro-2-methylphenol	ug/kg	1810	UJ	2000	UJ
4-Nitroaniline	ug/kg	1810	UJ	2000	UJ
Diphenylamine	ug/kg	374	U	412	U
4-Bromophenyl Phenyl Ether	ug/kg	374	U	412	U
Hexachlorobenzene	ug/kg	374	U	412	U
Pentachlorophenol	ug/kg	1810	UJ	2000	UJ
Phenanthrene	ug/kg	779	=	300	J
Anthracene	ug/kg	169	J	46.8	J
Di-n-butyl Phthalate	ug/kg	374	U	412	U
Fluoranthene	ug/kg	1320	=	153	J
Pyrene	ug/kg	717	J	76.1	J
Benzyl Butyl Phthalate	ug/kg	374	U	412	U
Benzo(a)Anthracene	ug/kg	556	=	31	J
3,3'-Dichlorobenzidine	ug/kg	748	U	823	U
Chrysene	ug/kg	555	=	21.8	J
bis(2-Ethylhexyl) Phthalate	ug/kg	374	U	412	U
Di-n-octylphthalate	ug/kg	374	U	412	U
Benzo(b)Fluoranthene	ug/kg	873	=	412	U
Benzo(k)Fluoranthene	ug/kg	374	U	412	U
Benzo(a)Pyrene	ug/kg	554	=	412	U
Indeno(1,2,3-c,d)pyrene	ug/kg	268	J	412	U

	StationID	E546SB001		E546SB001		E546SB002	
	SampleID	546SB00101 (0-1ft)		546SB00102 (3-5ft)		546SB00201 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002		12/13/2002	
	DateAnalyzed	12/13/2002		12/13/2002		12/13/2002	
	SDGNumber	72086		72086		72086	
Parameter	**Units**						
Dibenz(a,h)anthracene	ug/kg	354	U	381	U	383	U
Carbazole	ug/kg	354	U	381	U	383	U

	StationID	E546SB002		E546SB003		E546SB003	
	SampleID	546SB00202 (3-5ft)		546CB00302 (3-5ft)		546SB00301 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002		12/13/2002	
	DateAnalyzed	12/13/2002		12/13/2002		12/13/2002	
	SDGNumber	72086		72086		72086	
Parameter	**Units**						
Dibenz(a,h)anthracene	ug/kg	351	U	377	U	362	U
Carbazole	ug/kg	351	U	377	U	150	J

	StationID	E546SB003		E546SB004	
	SampleID	546SB00302 (3-5ft)		546SB00401 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002	
	DateExtracted	12/13/2002		12/13/2002	
	DateAnalyzed	12/13/2002		12/13/2002	
	SDGNumber	72086		72086	
Parameter	**Units**				
Dibenz(a,h)anthracene	ug/kg	374	U	412	U
Carbazole	ug/kg	114	J	67.8	J

	StationID	E542SB008		E542SB008		E542SB008		E542SB009	
	SampleID	542SB00801 (0-1ft)		542SB00802 (3-5ft)		542SB00803 (1-3ft)		542SB00901 (0-1ft)	
	DateCollected	12/11/2002		12/11/2002		12/11/2002		12/11/2002	
	DateExtracted	12/17/2002		12/17/2002		12/17/2002		12/17/2002	
	DateAnalyzed	12/18/2002		12/18/2002		12/18/2002		12/18/2002	
	SDGNumber	72085		72085		72085		72085	
Parameter	**Units**								
Tin (Sn)	mg/kg								
Antimony	mg/kg								
Arsenic	mg/kg								
Beryllium	mg/kg								
Cadmium	mg/kg								
Chromium, Total	mg/kg								
Cobalt	mg/kg								
Copper	mg/kg								
Lead	mg/kg								
Nickel	mg/kg								
Selenium	mg/kg								
Silver	mg/kg								
Thallium	mg/kg								
Vanadium	mg/kg								
Zinc	mg/kg								
Mercury	mg/kg	1.37	=	1.1	=	1.69	=	2.36	=

	StationID	E542SB009		E542SB009		E542SB010		E542SB010	
	SampleID	542SB00902 (3-5ft)		542SB00903 (1-3ft)		542SB01001 (0-1ft)		542SB01002 (3-5ft)	
	DateCollected	12/11/2002		12/11/2002		12/11/2002		12/11/2002	
	DateExtracted	12/17/2002		12/17/2002		12/17/2002		12/17/2002	
	DateAnalyzed	12/18/2002		12/18/2002		12/18/2002		12/18/2002	
	SDGNumber	72085		72085		72085		72085	
Parameter	**Units**								
Tin (Sn)	mg/kg								
Antimony	mg/kg								
Arsenic	mg/kg								
Beryllium	mg/kg								
Cadmium	mg/kg								
Chromium, Total	mg/kg								
Cobalt	mg/kg								
Copper	mg/kg								
Lead	mg/kg								
Nickel	mg/kg								
Selenium	mg/kg								
Silver	mg/kg								
Thallium	mg/kg								
Vanadium	mg/kg								
Zinc	mg/kg								
Mercury	mg/kg	2.09	=	3.37	=	12.2	=	2.12	=

	StationID	E542SB010		E542SB011		E542SB011		E542SB011	
	SampleID	542SB01003 (1-3ft)		542CB01103 (1-3ft)		542SB01101 (0-1ft)		542SB01102 (3-5ft)	
	DateCollected	12/11/2002		12/11/2002		12/11/2002		12/11/2002	
	DateExtracted	12/17/2002		12/17/2002		12/17/2002		12/17/2002	
	DateAnalyzed	12/18/2002		12/18/2002		12/18/2002		12/18/2002	
	SDGNumber	72085		72085		72085		72085	
Parameter	**Units**								
Tin (Sn)	mg/kg								
Antimony	mg/kg								
Arsenic	mg/kg								
Beryllium	mg/kg								
Cadmium	mg/kg								
Chromium, Total	mg/kg								
Cobalt	mg/kg								
Copper	mg/kg								
Lead	mg/kg								
Nickel	mg/kg								
Selenium	mg/kg								
Silver	mg/kg								
Thallium	mg/kg								
Vanadium	mg/kg								
Zinc	mg/kg								
Mercury	mg/kg	7.29	=	2.83	=	1.92	=	3.35	=

	StationID	E542SB011		E542SB012		E542SB012		E542SB012	
	SampleID	542SB01103 (1-3ft)		542SB01201 (0-1ft)		542SB01202 (3-5ft)		542SB01203 (1-3ft)	
	DateCollected	12/11/2002		12/11/2002		12/11/2002		12/11/2002	
	DateExtracted	12/17/2002		12/17/2002		12/17/2002		12/17/2002	
	DateAnalyzed	12/18/2002		12/18/2002		12/18/2002		12/18/2002	
	SDGNumber	72085		72085		72085		72085	
Parameter	**Units**								
Tin (Sn)	mg/kg								
Antimony	mg/kg								
Arsenic	mg/kg								
Beryllium	mg/kg								
Cadmium	mg/kg								
Chromium, Total	mg/kg								
Cobalt	mg/kg								
Copper	mg/kg								
Lead	mg/kg								
Nickel	mg/kg								
Selenium	mg/kg								
Silver	mg/kg								
Thallium	mg/kg								
Vanadium	mg/kg								
Zinc	mg/kg								
Mercury	mg/kg	3.03	=	3.99	=	2.65	=	5.16	J

	StationID	E546SB001		E546SB001		E546SB001		E546SB001	
	SampleID	546SB00101 (0-1ft)		546SB00101 (0-1ft)		546SB00102 (3-5ft)		546SB00102 (3-5ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/16/2002		12/18/2002		12/16/2002		12/18/2002	
	DateAnalyzed	12/18/2002		12/19/2002		12/18/2002		12/19/2002	
	SDGNumber	72086		72086		72086		72086	
Parameter	**Units**								
Tin (Sn)	mg/kg	73.2	=			0.427	J		
Antimony	mg/kg	9.66	J			0.741	U		
Arsenic	mg/kg	3.26	=			0.881	J		
Beryllium	mg/kg	0.357	J			0.178	J		
Cadmium	mg/kg	1.58	=			0.045	U		
Chromium, Total	mg/kg	11.7	=			6.24	=		
Cobalt	mg/kg	2.32	J			0.467	J		
Copper	mg/kg	210	=			3.41	J		
Lead	mg/kg	244	=			6	=		
Nickel	mg/kg	33.1	J			3.05	J		
Selenium	mg/kg	0.595	J			0.41	U		
Silver	mg/kg	0.148	J			0.131	U		
Thallium	mg/kg	0.697	U			0.734	U		
Vanadium	mg/kg	12.5	=			6.86	J		
Zinc	mg/kg	1490	=			53.1	=		
Mercury	mg/kg			0.158	=			0.022	J

	StationID	E546SB002		E546SB002		E546SB002		E546SB002	
	SampleID	546SB00201 (0-1ft)		546SB00201 (0-1ft)		546SB00202 (3-5ft)		546SB00202 (3-5ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/16/2002		12/18/2002		12/16/2002		12/18/2002	
	DateAnalyzed	12/18/2002		12/19/2002		12/18/2002		12/19/2002	
	SDGNumber	72086		72086		72086		72086	
Parameter	**Units**								
Tin (Sn)	mg/kg	135	=			1	J		
Antimony	mg/kg	8.95	J			0.657	U		
Arsenic	mg/kg	9.42	=			1.01	J		
Beryllium	mg/kg	1.18	=			0.144	J		
Cadmium	mg/kg	46	=			0.613	J		
Chromium, Total	mg/kg	12.3	=			5.45	=		
Cobalt	mg/kg	5.5	J			0.502	J		
Copper	mg/kg	78.9	=			21.4	=		
Lead	mg/kg	629	=			46.2	=		
Nickel	mg/kg	26.9	J			14.6	=		
Selenium	mg/kg	0.898	J			0.495	J		
Silver	mg/kg	0.13	U			0.116	U		
Thallium	mg/kg	0.732	U			0.651	U		
Vanadium	mg/kg	22.3	=			5.92	J		
Zinc	mg/kg	24800	=			159	=		
Mercury	mg/kg			0.066	J			0.015	J

	StationID	E546SB003		E546SB003		E546SB003		E546SB003	
	SampleID	546CB00302 (3-5ft)		546CB00302 (3-5ft)		546SB00301 (0-1ft)		546SB00301 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/16/2002		12/18/2002		12/16/2002		12/18/2002	
	DateAnalyzed	12/18/2002		12/19/2002		12/18/2002		12/19/2002	
	SDGNumber	72086		72086		72086		72086	
Parameter	**Units**								
Tin (Sn)	mg/kg	7.04	=			5.95	=		
Antimony	mg/kg	0.719	U			0.691	U		
Arsenic	mg/kg	2.32	=			1.88	J		
Beryllium	mg/kg	0.225	J			0.218	J		
Cadmium	mg/kg	1.56	=			1.21	=		
Chromium, Total	mg/kg	13.5	=			26.8	=		
Cobalt	mg/kg	1.68	J			1.95	J		
Copper	mg/kg	115	=			62.6	=		
Lead	mg/kg	61.2	=			73.2	=		
Nickel	mg/kg	31.8	=			25.4	=		
Selenium	mg/kg	0.398	U			1.4	=		
Silver	mg/kg	0.127	U			0.122	U		
Thallium	mg/kg	0.713	U			0.686	U		
Vanadium	mg/kg	12.2	=			23	=		
Zinc	mg/kg	401	=			425	=		
Mercury	mg/kg			0.077	J			0.103	J

	StationID	E546SB003		E546SB003		E546SB004		E546SB004	
	SampleID	546SB00302 (3-5ft)		546SB00302 (3-5ft)		546SB00401 (0-1ft)		546SB00401 (0-1ft)	
	DateCollected	12/12/2002		12/12/2002		12/12/2002		12/12/2002	
	DateExtracted	12/16/2002		12/18/2002		12/16/2002		12/18/2002	
	DateAnalyzed	12/18/2002		12/19/2002		12/18/2002		12/19/2002	
	SDGNumber	72086		72086		72086		72086	
Parameter	**Units**								
Tin (Sn)	mg/kg	5.88	=			0.458	U		
Antimony	mg/kg	0.735	U			0.809	U		
Arsenic	mg/kg	2.2	J			0.623	J		
Beryllium	mg/kg	0.231	J			0.126	J		
Cadmium	mg/kg	1.6	=			0.049	U		
Chromium, Total	mg/kg	14.4	=			7.58	=		
Cobalt	mg/kg	2.75	J			1.16	J		
Copper	mg/kg	83.5	=			14.5	=		
Lead	mg/kg	74.4	=			6.46	=		
Nickel	mg/kg	27.8	=			3.1	J		
Selenium	mg/kg	0.407	U			0.448	U		
Silver	mg/kg	0.13	U			0.143	U		
Thallium	mg/kg	0.729	U			0.802	U		
Vanadium	mg/kg	14.4	=			10.9	J		
Zinc	mg/kg	432	=			9.84	=		
Mercury	mg/kg			0.094	J			0.006	J

Attachment 1 - Chang Qualifiers and Results
Zone E, AOCs 546 42 - Data Validation

Parameter Class	Analytical Method	Parameter	SDG	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
ETAL	SW6010B	ANTIMONY	72086	546SB00101	72086002	SO	9.66	B	9.66	J	mg/kg	IB
ETAL	SW6010B	ANTIMONY	72086	546SB00201	72086004	SO	8.95	B	8.95	J	mg/kg	IB
ETAL	SW6010B	ARSENIC	72086	546SB00401	72086001	SO	0.623	B	0.623	J	mg/kg	IB
ETAL	SW6010B	ARSENIC	72086	546SB00102	72086003	SO	0.881	B	0.881	J	mg/kg	IB
ETAL	SW6010B	ARSENIC	72086	546SB00202	72086005	SO	1.01	B	1.01	J	mg/kg	IB
ETAL	SW6010B	ARSENIC	72086	546SB00301	72086006	SO	1.88	B	1.88	J	mg/kg	IB
ETAL	SW6010B	ARSENIC	72086	546SB00302	72086007	SO	2.2	B	2.2	J	mg/kg	IB
ETAL	SW6010B	BERYLLIUM	72086	546SB00401	72086001	SO	0.126	B	0.126	J	mg/kg	IB
ETAL	SW6010B	BERYLLIUM	72086	546SB00101	72086002	SO	0.357	B	0.357	J	mg/kg	IB
ETAL	SW6010B	BERYLLIUM	72086	546SB00102	72086003	SO	0.178	B	0.178	J	mg/kg	IB
ETAL	SW6010B	BERYLLIUM	72086	546SB00202	72086005	SO	0.144	B	0.144	J	mg/kg	IB
ETAL	SW6010B	BERYLLIUM	72086	546SB00301	72086006	SO	0.218	B	0.218	J	mg/kg	IB
ETAL	SW6010B	BERYLLIUM	72086	546SB00302	72086007	SO	0.231	B	0.231	J	mg/kg	IB
ETAL	SW6010B	BERYLLIUM	72086	546CB00302	72086008	SO	0.225	B	0.225	J	mg/kg	IB
ETAL	SW6010B	CADMIUM	72086	546SB00202	72086005	SO	0.613	B	0.613	J	mg/kg	IB
ETAL	SW6010B	COBALT	72086	546SB00401	72086001	SO	1.16	B*	1.16	J	mg/kg	MS
ETAL	SW6010B	COBALT	72086	546SB00101	72086002	SO	2.32	B*	2.32	J	mg/kg	MS
ETAL	SW6010B	COBALT	72086	546SB00102	72086003	SO	0.467	B*	0.467	J	mg/kg	MS
ETAL	SW6010B	COBALT	72086	546SB00201	72086004	SO	5.5	B*	5.5	J	mg/kg	MS
ETAL	SW6010B	COBALT	72086	546SB00202	72086005	SO	0.502	B*	0.502	J	mg/kg	MS
ETAL	SW6010B	COBALT	72086	546SB00301	72086006	SO	1.95	B*	1.95	J	mg/kg	MS
ETAL	SW6010B	COBALT	72086	546SB00302	72086007	SO	2.75	B*	2.75	J	mg/kg	MS
ETAL	SW6010B	COBALT	72086	546CB00302	72086008	SO	1.68	B*	1.68	J	mg/kg	MS
TAL	SW6010B	COPPER	72086	546SB00102	72086003	SO	3.41	B*	3.41	J	mg/kg	IB
TAL	SW7471A	MERCURY	72085	542SB01203	72085015	SO	5.16	B*	5.16	J	mg/kg	IB
TAL	SW7471A	MERCURY	72086	546SB00401	72086001	SO	0.006	B	0.006	J	mg/kg	IB
TAL	SW7471A	MERCURY	72086	546SB00102	72086003	SO	0.022	B	0.022	J	mg/kg	IB
TAL	SW7471A	MERCURY	72086	546SB00201	72086004	SO	0.066	B	0.066	J	mg/kg	IB
TAL	SW7471A	MERCURY	72086	546SB00202	72086005	SO	0.015	B	0.015	J	mg/kg	IB
TAL	SW7471A	MERCURY	72086	546SB00301	72086006	SO	0.103	B	0.103	J	mg/kg	IB

Fraction Code	Analytical Method	Parameter	Sdg	Sample ID	Lab Sample ID	Matrix	Result	Lab Qual	Final Result	Final Qual	Units	Reasons
ETAL	SW7471A	MERCURY	72086	546SB00302	72086007	SO	0.094	B	0.094	J	mg/kg	IB
ETAL	SW7471A	MERCURY	72086	546CB00302	72086008	SO	0.077	B	0.077	J	mg/kg	IB
ETAL	SW6010B	NICKEL	72086	546SB00401	72086001	SO	3.1	B	3.1	J	mg/kg	IB
ETAL	SW6010B	NICKEL	72086	546SB00101	72086002	SO	33.1	B	33.1	J	mg/kg	IB
ETAL	SW6010B	NICKEL	72086	546SB00102	72086003	SO	3.05	B	3.05	J	mg/kg	IB
ETAL	SW6010B	NICKEL	72086	546SB00201	72086004	SO	26.9	B	26.9	J	mg/kg	IB
ETAL	SW6010B	SELENIUM	72086	546SB00101	72086002	SO	0.595	B	0.595	J	mg/kg	IB
ETAL	SW6010B	SELENIUM	72086	546SB00201	72086004	SO	0.898	B	0.898	J	mg/kg	IB
ETAL	SW6010B	SELENIUM	72086	546SB00202	72086005	SO	0.495	B	0.495	J	mg/kg	IB
ETAL	SW6010B	SILVER	72086	546SB00101	72086002	SO	0.148	B	0.148	J	mg/kg	IB
ETAL	SW6010B	Tin (Sn)	72086	546SB00102	72086003	SO	0.427	B	0.427	J	mg/kg	IB
ETAL	SW6010B	Tin (Sn)	72086	546SB00202	72086005	SO	1	B	1	J	mg/kg	IB
ETAL	SW6010B	VANADIUM	72086	546SB00401	72086001	SO	10.9	B	10.9	J	mg/kg	IB
ETAL	SW6010B	VANADIUM	72086	546SB00102	72086003	SO	6.86	B	6.86	J	mg/kg	IB
ETAL	SW6010B	VANADIUM	72086	546SB00202	72086005	SO	5.92	B	5.92	J	mg/kg	IB
/OA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	72086	546SB00401	72086001	SO	2000	U	2000	UJ	ug/kg	IC
/OA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	72086	546SB00101	72086002	SO	1720	U	1720	UJ	ug/kg	IC
/OA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	72086	546SB00102	72086003	SO	1840	U	1840	UJ	ug/kg	IC
/OA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	72086	546SB00201	72086004	SO	1860	U	1860	UJ	ug/kg	IC
/OA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	72086	546SB00202	72086005	SO	1700	U	1700	UJ	ug/kg	IC
/OA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	72086	546SB00301	72086006	SO	1760	U	1760	UJ	ug/kg	IC
/OA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	72086	546SB00302	72086007	SO	1810	U	1810	UJ	ug/kg	IC
/OA	SW8270C	4,6-DINITRO-2-METHYLPHENOL	72086	546CB00302	72086008	SO	1820	U	1820	UJ	ug/kg	IC
/OA	SW8270C	4-NITROANILINE	72086	546SB00401	72086001	SO	2000	U	2000	UJ	ug/kg	CC
/OA	SW8270C	4-NITROANILINE	72086	546SB00101	72086002	SO	1720	U	1720	UJ	ug/kg	CC
/OA	SW8270C	4-NITROANILINE	72086	546SB00102	72086003	SO	1840	U	1840	UJ	ug/kg	CC
/OA	SW8270C	4-NITROANILINE	72086	546SB00201	72086004	SO	1860	U	1860	UJ	ug/kg	CC
/OA	SW8270C	4-NITROANILINE	72086	546SB00202	72086005	SO	1700	U	1700	UJ	ug/kg	CC
/OA	SW8270C	4-NITROANILINE	72086	546SB00301	72086006	SO	1760	U	1760	UJ	ug/kg	CC
/OA	SW8270C	4-NITROANILINE	72086	546SB00302	72086007	SO	1810	U	1810	UJ	ug/kg	CC

Parameter Class	Analytical Method	Parameter	SDG	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
OA	SW8270C	4-NITROANILINE	72086	546CB00302	72086008	SO	1820	U	1820	UJ	ug/kg	CC
OA	SW8270C	Benzoic acid	72086	546SB00401	72086001	SO	2000	U	2000	UJ	ug/kg	IC
OA	SW8270C	Benzoic acid	72086	546SB00101	72086002	SO	1720	U	1720	UJ	ug/kg	IC
OA	SW8270C	Benzoic acid	72086	546SB00102	72086003	SO	1840	U	1840	UJ	ug/kg	IC
OA	SW8270C	Benzoic acid	72086	546SB00201	72086004	SO	1860	U	1860	UJ	ug/kg	IC
OA	SW8270C	Benzoic acid	72086	546SB00202	72086005	SO	1700	U	1700	UJ	ug/kg	IC
OA	SW8270C	Benzoic acid	72086	546SB00301	72086006	SO	1760	U	1760	UJ	ug/kg	IC
OA	SW8270C	Benzoic acid	72086	546SB00302	72086007	SO	1810	U	1810	UJ	ug/kg	IC
OA	SW8270C	Benzoic acid	72086	546CB00302	72086008	SO	1820	U	1820	UJ	ug/kg	IC
OA	SW8270C	Bis(2-Chloroisopropyl)Ether	72086	546SB00401	72086001	SO	412	U	412	UJ	ug/kg	CC
OA	SW8270C	Bis(2-Chloroisopropyl)Ether	72086	546SB00101	72086002	SO	354	U	354	UJ	ug/kg	CC
OA	SW8270C	Bis(2-Chloroisopropyl)Ether	72086	546SB00102	72086003	SO	381	U	381	UJ	ug/kg	CC
OA	SW8270C	Bis(2-Chloroisopropyl)Ether	72086	546SB00201	72086004	SO	383	U	383	UJ	ug/kg	CC
OA	SW8270C	Bis(2-Chloroisopropyl)Ether	72086	546SB00202	72086005	SO	351	U	351	UJ	ug/kg	CC
OA	SW8270C	Bis(2-Chloroisopropyl)Ether	72086	546SB00301	72086006	SO	362	U	362	UJ	ug/kg	CC
OA	SW8270C	Bis(2-Chloroisopropyl)Ether	72086	546SB00302	72086007	SO	374	U	374	UJ	ug/kg	CC
OA	SW8270C	Bis(2-Chloroisopropyl)Ether	72086	546CB00302	72086008	SO	377	U	377	UJ	ug/kg	CC
OA	SW8270C	HEXACHLOROCYCLOPENTADIENE	72086	546SB00401	72086001	SO	412	U	412	UJ	ug/kg	IC
OA	SW8270C	HEXACHLOROCYCLOPENTADIENE	72086	546SB00101	72086002	SO	354	U	354	UJ	ug/kg	IC
OA	SW8270C	HEXACHLOROCYCLOPENTADIENE	72086	546SB00102	72086003	SO	381	U	381	UJ	ug/kg	IC
OA	SW8270C	HEXACHLOROCYCLOPENTADIENE	72086	546SB00201	72086004	SO	383	U	383	UJ	ug/kg	IC
OA	SW8270C	HEXACHLOROCYCLOPENTADIENE	72086	546SB00202	72086005	SO	351	U	351	UJ	ug/kg	IC
OA	SW8270C	HEXACHLOROCYCLOPENTADIENE	72086	546SB00301	72086006	SO	362	U	362	UJ	ug/kg	IC
OA	SW8270C	HEXACHLOROCYCLOPENTADIENE	72086	546SB00302	72086007	SO	374	U	374	UJ	ug/kg	IC
OA	SW8270C	HEXACHLOROCYCLOPENTADIENE	72086	546CB00302	72086008	SO	377	U	377	UJ	ug/kg	IC
OA	SW8270C	PENTACHLOROPHENOL	72086	546SB00401	72086001	SO	2000	U	2000	UJ	ug/kg	IC
OA	SW8270C	PENTACHLOROPHENOL	72086	546SB00101	72086002	SO	1720	U	1720	UJ	ug/kg	IC
OA	SW8270C	PENTACHLOROPHENOL	72086	546SB00102	72086003	SO	1840	U	1840	UJ	ug/kg	IC
OA	SW8270C	PENTACHLOROPHENOL	72086	546SB00201	72086004	SO	1860	U	1860	UJ	ug/kg	IC
OA	SW8270C	PENTACHLOROPHENOL	72086	546SB00202	72086005	SO	1700	U	1700	UJ	ug/kg	IC

Analytical Method	Analyte	SDG	Sample	Sample Number	Matrix	Result	Qual	Final Result	Final Qual	Units	Reasons
OA	SW8270C	PENTACHLOROPHENOL	72086	546SB00301	72086006	SO	1760	U	1760	UJ	ug/kg	IC
OA	SW8270C	PENTACHLOROPHENOL	72086	546SB00302	72086007	SO	1810	U	1810	UJ	ug/kg	IC
OA	SW8270C	PENTACHLOROPHENOL	72086	546CB00302	72086008	SO	1820	U	1820	UJ	ug/kg	IC
OA	SW8270C	PYRENE	72086	546SB00401	72086001	SO	76.1	J	76.1	J	ug/kg	CC
OA	SW8270C	PYRENE	72086	546SB00101	72086002	SO	122	J	122	J	ug/kg	CC
OA	SW8270C	PYRENE	72086	546SB00102	72086003	SO	381	U	381	UJ	ug/kg	CC
OA	SW8270C	PYRENE	72086	546SB00201	72086004	SO	69.2	J	69.2	J	ug/kg	CC
OA	SW8270C	PYRENE	72086	546SB00202	72086005	SO	351	U	351	UJ	ug/kg	CC
OA	SW8270C	PYRENE	72086	546SB00301	72086006	SO	1300	=	1300	J	ug/kg	CC
OA	SW8270C	PYRENE	72086	546SB00302	72086007	SO	717	=	717	J	ug/kg	CC
OA	SW8270C	PYRENE	72086	546CB00302	72086008	SO	178	J	178	J	ug/kg	CC
A	SW8260B	1,1,2,2-TETRACHLOROETHANE	72086	546SB00101	72086002	SO	5.2	U	5.2	UJ	ug/kg	IS
A	SW8260B	1,1-DICHLOROETHENE	72086	546SB00101	72086002	SO	1.1	J	1.1	J	ug/kg	SS
A	SW8260B	1,1-DICHLOROETHENE	72086	546SB00102	72086003	SO	0.71	J	0.71	J	ug/kg	SS
A	SW8260B	1,1-DICHLOROETHENE	72086	546SB00302	72086007	SO	1.1	J	1.1	J	ug/kg	SS
A	SW8260B	1,1-DICHLOROETHENE	72086	546CB00302	72086008	SO	1.5	J	1.5	J	ug/kg	SS
A	SW8260B	1,2,3-Trichlorobenzene	72086	546SB00101	72086002	SO	5.2	U	5.2	UJ	ug/kg	IS
A	SW8260B	1,2,4-TRICHLOROBENZENE	72086	546SB00101	72086002	SO	5.2	U	5.2	UJ	ug/kg	IS
A	SW8260B	1,2-DICHLOROBENZENE	72086	546SB00101	72086002	SO	5.2	U	5.2	UJ	ug/kg	IS
A	SW8260B	1,3-DICHLOROBENZENE	72086	546SB00101	72086002	SO	5.2	U	5.2	UJ	ug/kg	IS
A	SW8260B	1,4-DICHLOROBENZENE	72086	546SB00101	72086002	SO	5.2	U	5.2	UJ	ug/kg	IS
A	SW8260B	2-Chloroethyl vinyl ether	72086	546SB00401	72086001	SO	11.5	U	11.5	UJ	ug/kg	CC
A	SW8260B	2-Chloroethyl vinyl ether	72086	546SB00101	72086002	SO	10.3	U	10.3	UJ	ug/kg	CC,BS
A	SW8260B	2-Chloroethyl vinyl ether	72086	546SB00102	72086003	SO	10.9	U	10.9	UJ	ug/kg	CC
A	SW8260B	2-Chloroethyl vinyl ether	72086	546SB00201	72086004	SO	12.9	U	12.9	UJ	ug/kg	CC,BS
A	SW8260B	2-Chloroethyl vinyl ether	72086	546SB00202	72086005	SO	10.6	U	10.6	UJ	ug/kg	CC,BS
A	SW8260B	2-Chloroethyl vinyl ether	72086	546SB00301	72086006	SO	10.6	U	10.6	UJ	ug/kg	CC,BS
A	SW8260B	2-Chloroethyl vinyl ether	72086	546SB00302	72086007	SO	10.5	U	10.5	UJ	ug/kg	CC
A	SW8260B	2-Chloroethyl vinyl ether	72086	546CB00302	72086008	SO	10.4	U	10.4	UJ	ug/kg	CC,BS
A	SW8260B	2-HEXANONE	72086	546SB00401	72086001	SO	11.5	U	11.5	UJ	ug/kg	CC

Parameter Class	Analytical Method	Parameter	Spec	Sample ID	Lab Sample ID	Matrix	Lab Result	Lab Qual	Final Result	Final Qual	Units	Reasons
A	SW8260B	2-HEXANONE	72086	546SB00101	72086002	SO	10.3	U	10.3	UJ	ug/kg	CC
A	SW8260B	2-HEXANONE	72086	546SB00102	72086003	SO	10.9	U	10.9	UJ	ug/kg	CC
A	SW8260B	2-HEXANONE	72086	546SB00201	72086004	SO	12.9	U	12.9	UJ	ug/kg	CC
A	SW8260B	2-HEXANONE	72086	546SB00202	72086005	SO	10.6	U	10.6	UJ	ug/kg	CC
A	SW8260B	2-HEXANONE	72086	546SB00301	72086006	SO	10.6	U	10.6	UJ	ug/kg	CC
A	SW8260B	2-HEXANONE	72086	546SB00302	72086007	SO	10.5	U	10.5	UJ	ug/kg	CC
A	SW8260B	2-HEXANONE	72086	546CB00302	72086008	SO	10.4	U	10.4	UJ	ug/kg	CC
A	SW8260B	ACETONE	72086	546SB00401	72086001	SO	30.7	=	30.7	U	ug/kg	BL
A	SW8260B	ACETONE	72086	546SB00102	72086003	SO	11.7	=	11.7	U	ug/kg	BL
A	SW8260B	ACETONE	72086	546SB00201	72086004	SO	14.4	=	14.4	U	ug/kg	BL
A	SW8260B	ACETONE	72086	546SB00202	72086005	SO	17.6	=	17.6	U	ug/kg	BL
A	SW8260B	ACETONE	72086	546SB00301	72086006	SO	41.4	=	41.4	U	ug/kg	BL
A	SW8260B	CHLOROMETHANE	72086	546SB00401	72086001	SO	11.5	U	11.5	UJ	ug/kg	CC
A	SW8260B	CHLOROMETHANE	72086	546SB00101	72086002	SO	10.3	U	10.3	UJ	ug/kg	CC
A	SW8260B	CHLOROMETHANE	72086	546SB00102	72086003	SO	10.9	U	10.9	UJ	ug/kg	CC
A	SW8260B	CHLOROMETHANE	72086	546SB00201	72086004	SO	12.9	U	12.9	UJ	ug/kg	CC
A	SW8260B	CHLOROMETHANE	72086	546SB00202	72086005	SO	10.6	U	10.6	UJ	ug/kg	CC
A	SW8260B	CHLOROMETHANE	72086	546SB00301	72086006	SO	10.6	U	10.6	UJ	ug/kg	CC
A	SW8260B	CHLOROMETHANE	72086	546SB00302	72086007	SO	10.5	U	10.5	UJ	ug/kg	CC
A	SW8260B	CHLOROMETHANE	72086	546CB00302	72086008	SO	10.4	U	10.4	UJ	ug/kg	CC
A	SW8260B	m+p Xylene	72086	546SB00401	72086001	SO	0.88	J	0.88	J	ug/kg	MS,SS
A	SW8260B	m+p Xylene	72086	546SB00101	72086002	SO	1.6	J	1.6	J	ug/kg	SS
A	SW8260B	m+p Xylene	72086	546SB00102	72086003	SO	0.83	J	0.83	J	ug/kg	SS
A	SW8260B	m+p Xylene	72086	546SB00201	72086004	SO	1.2	J	1.2	J	ug/kg	SS
A	SW8260B	m+p Xylene	72086	546SB00202	72086005	SO	1.2	J	1.2	J	ug/kg	SS
A	SW8260B	m+p Xylene	72086	546SB00301	72086006	SO	1.1	J	1.1	J	ug/kg	SS
A	SW8260B	m+p Xylene	72086	546CB00302	72086008	SO	0.72	J	0.72	J	ug/kg	SS
A	SW8260B	2-BUTANONE (MEK)	72086	546SB00401	72086001	SO	11.5	U	11.5	UJ	ug/kg	CC
A	SW8260B	2-BUTANONE (MEK)	72086	546SB00101	72086002	SO	10.3	U	10.3	UJ	ug/kg	CC
A	SW8260B	2-BUTANONE (MEK)	72086	546SB00102	72086003	SO	10.9	U	10.9	UJ	ug/kg	CC

Class	Analytical Method	Parameter	SDG	Sample ID	Sample ID	Matrix	Result	Qual	Result	Qual	Units	Reasons
A	SW8260B	2-BUTANONE (MEK)	72086	546SB00201	72086004	SO	12.9	U	12.9	UJ	ug/kg	CC
A	SW8260B	2-BUTANONE (MEK)	72086	546SB00202	72086005	SO	10.6	U	10.6	UJ	ug/kg	CC
A	SW8260B	2-BUTANONE (MEK)	72086	546SB00301	72086006	SO	10.6	U	10.6	UJ	ug/kg	CC
A	SW8260B	2-BUTANONE (MEK)	72086	546SB00302	72086007	SO	10.5	U	10.5	UJ	ug/kg	CC
A	SW8260B	2-BUTANONE (MEK)	72086	546CB00302	72086008	SO	10.4	U	10.4	UJ	ug/kg	CC
A	SW8260B	4-METHYL-2-PENTANONE (MIBK)	72086	546SB00201	72086004	SO	5.3	J	5.3	J	ug/kg	SS
A	SW8260B	TOLUENE	72086	546SB00201	72086004	SO	0.81	J	6.4	U	ug/kg	BL
A	SW8260B	TOLUENE	72086	546SB00202	72086005	SO	0.37	J	5.3	U	ug/kg	BL
A	SW8260B	Vinyl acetate	72086	546SB00401	72086001	SO	11.5	U	11.5	R	ug/kg	MS
A	SW8260B	Vinyl acetate	72086	546SB00101	72086002	SO	10.3	U	10.3	UJ	ug/kg	CC
A	SW8260B	Vinyl acetate	72086	546SB00102	72086003	SO	10.9	U	10.9	UJ	ug/kg	CC
A	SW8260B	Vinyl acetate	72086	546SB00201	72086004	SO	12.9	U	12.9	UJ	ug/kg	CC
A	SW8260B	Vinyl acetate	72086	546SB00202	72086005	SO	10.6	U	10.6	UJ	ug/kg	CC
A	SW8260B	Vinyl acetate	72086	546SB00301	72086006	SO	10.6	U	10.6	UJ	ug/kg	CC
A	SW8260B	Vinyl acetate	72086	546SB00302	72086007	SO	10.5	U	10.5	UJ	ug/kg	CC
A	SW8260B	Vinyl acetate	72086	546CB00302	72086008	SO	10.4	U	10.4	UJ	ug/kg	CC
A	SW8260B	XYLENES, TOTAL	72086	546SB00401	72086001	SO	0.88	J	0.88	J	ug/kg	MS,SS
A	SW8260B	XYLENES, TOTAL	72086	546SB00101	72086002	SO	1.6	J	1.6	J	ug/kg	SS
A	SW8260B	XYLENES, TOTAL	72086	546SB00102	72086003	SO	0.83	J	0.83	J	ug/kg	SS
A	SW8260B	XYLENES, TOTAL	72086	546SB00201	72086004	SO	1.2	J	1.2	J	ug/kg	SS
A	SW8260B	XYLENES, TOTAL	72086	546SB00202	72086005	SO	1.2	J	1.2	J	ug/kg	SS
A	SW8260B	XYLENES, TOTAL	72086	546SB00301	72086006	SO	1.1	J	1.1	J	ug/kg	SS
A	SW8260B	XYLENES, TOTAL	72086	546CB00302	72086008	SO	0.72	J	0.72	J	ug/kg	SS

Appendix E

Appendix E Table 1
COPC Selection for Surface Soils, SWMU 67 RFIRA, Zone E, CNC

				Detected Concentration				Background Range		
Paramname	ParamClass	N	Detected	Minimum Detected	Maximum Detected	RES SOIL RBC	EXCEEDS RBC	SS Min	SS Max	COPC
Aluminum	METAL	19	19	2,280	6,520	7,821	FALSE	261	20,500	FALSE
Antimony	METAL	23	13	3.8	41	3.1	TRUE	0.50	7.4	TRUE
Arsenic	METAL	23	22	0.62	18	0.43	TRUE	0.95	68	FALSE
Barium	METAL	19	19	5.4	61	548	FALSE	1.8	1,980	FALSE
Beryllium	METAL	23	22	0.13	1.2	16	FALSE	0.13	1.6	FALSE
Cadmium	METAL	23	15	0.20	46	3.9	TRUE	0.060	1.5	TRUE
Calcium	METAL	19	19	1,360	30,700		TBD			FALSE
Chromium, Total	METAL	23	23	2.6	45	23	TRUE	2.3	567	FALSE
Cobalt	METAL	23	23	0.22	34	469	FALSE	0.35	111	FALSE
Copper	METAL	23	23	1.1	4,590	313	TRUE	0.47	866	TRUE
Iron	METAL	19	19	1,690	23,000	2,346	TRUE	1,050	30,600	FALSE
Lead	METAL	23	23	2.1	629	400	TRUE	1.0	400	TRUE
Magnesium	METAL	19	19	145	748		TBD	31	14,800	FALSE
Manganese	METAL	19	19	12	140	156	FALSE	0.93	508	FALSE
Mercury	METAL	33	22	0.0060	45	2.3	TRUE	0.030	2.7	TRUE
Nickel	METAL	23	23	1.5	65	156	FALSE	0.60	72	FALSE
Potassium	METAL	19	10	132	456		TBD	46	2,620	FALSE
Selenium	METAL	23	10	0.37	1.4	39	FALSE	0.57	4.0	FALSE
Silver	METAL	23	1	0.15	0.15	39	FALSE	0.75	0.91	FALSE
Sodium	METAL	19	9	111	226		TBD	12	28,200	FALSE
Thallium	METAL	23	1	0.65	0.65	0.55	TRUE	0.61	2.8	FALSE
Tin (Sn)	METAL	23	15	2.6	516	4,693	FALSE	0.77	45	FALSE
Vanadium	METAL	23	23	3.2	23	55	FALSE	1.1	60	FALSE
Zinc	METAL	23	23	4.8	24,800	2,346	TRUE	1.9	855	TRUE
PCB-1254 (Arochlor 1254)	PCB	15	6	0.066	1.2	0.32	TRUE			TRUE
Aldrin	PEST	15	1	0.0088	0.0088	0.038	FALSE			FALSE
Alpha BHC (Alpha Hexachlorocyclohexane)	PEST	15	1	0.0054	0.0054	0.10	FALSE			FALSE
Alpha-chlordane	PEST	15	12	0.0041	0.85	1.8	FALSE			FALSE
Beta BHC (Beta Hexachlorocyclohexane)	PEST	15	1	0.0040	0.0040	0.35	FALSE			FALSE
Delta BHC (Delta Hexachlorocyclohexane)	PEST	15	1	0.0034	0.0034		TBD			FALSE
Dieldrin	PEST	15	6	0.0049	0.014	0.040	FALSE			FALSE
Endosulfan I	PEST	15	1	0.0051	0.0051	47	FALSE			FALSE
Endosulfan II	PEST	15	3	0.0051	0.010	47	FALSE			FALSE
Endosulfan Sulfate	PEST	15	1	0.0051	0.0051	47	FALSE			FALSE
Endrin	PEST	15	8	0.0031	0.19	2.3	FALSE			FALSE
Endrin Aldehyde	PEST	15	5	0.0039	0.015	2.3	FALSE			FALSE
Endrin Ketone	PEST	15	1	0.0031	0.0031	2.3	FALSE			FALSE
Gamma BHC (Lindane)	PEST	15	2	0.0014	0.0051	0.49	FALSE			FALSE
Gamma-chlordane	PEST	15	12	0.0047	1.1	1.8	FALSE			FALSE
Heptachlor	PEST	15	7	0.0014	0.083	0.14	FALSE			FALSE
Heptachlor Epoxide	PEST	15	5	0.0026	0.037	0.070	FALSE			FALSE
Methoxychlor	PEST	15	1	0.022	0.022	39	FALSE			FALSE
p,p'-DDD	PEST	15	5	0.0031	0.017	2.7	FALSE			FALSE

Appendix E Table 1
COPC Selection for Surface Soils, SWMU 67 RFIRA, Zone E, CNC

				Detected Concentration				Background Range		
Paramname	ParamClass	N	Detected	Minimum Detected	Maximum Detected	RES SOIL RBC	EXCEEDS RBC	SS Min	SS Max	COPC
p,p'-DDE	PEST	15	9	0.0053	0.096	1.9	FALSE			FALSE
p,p'-DDT	PEST	14	8	0.0030	0.066	1.9	FALSE			FALSE
2-Methylnaphthalene	SVOA	22	5	0.029	0.14	156	FALSE			FALSE
4-Chloro-3-methylphenol	SVOA	22	1	0.042	0.042		TBD			FALSE
Acenaphthene	SVOA	22	6	0.025	1.9	469	FALSE			FALSE
Acenaphthylene	SVOA	22	3	0.047	2.1		TBD			FALSE
Anthracene	SVOA	22	9	0.019	12	2,346	FALSE			FALSE
Benzo(a)Anthracene	SVOA	22	13	0.031	44	0.87	TRUE			TBD*
Benzo(a)Pyrene	SVOA	22	13	0.059	49	0.087	TRUE			TBD*
Benzo(b)Fluoranthene	SVOA	22	11	0.075	36	0.87	TRUE			TBD*
Benzo(g,h,i)Perylene	SVOA	22	14	0.039	38	235	FALSE			FALSE
Benzo(k)Fluoranthene	SVOA	22	13	0.042	47	8.7	TRUE			TBD*
bis(2-Ethylhexyl) Phthalate	SVOA	22	6	0.052	0.92	46	FALSE			FALSE
Carbazole	SVOA	4	2	0.068	0.15		TBD			FALSE
Chrysene	SVOA	22	16	0.022	46	87	FALSE			FALSE
Dibenz(a,h)anthracene	SVOA	22	8	0.091	13	0.087	TRUE			TBD*
Dibenzofuran	SVOA	22	2	0.037	0.049	31	FALSE			FALSE
Fluoranthene	SVOA	22	15	0.071	100	313	FALSE			FALSE
Fluorene	SVOA	22	6	0.039	2.0	313	FALSE			FALSE
Indeno(1,2,3-c,d)pyrene	SVOA	22	11	0.059	30	0.87	TRUE			TBD*
Naphthalene	SVOA	22	4	0.030	0.14	156	FALSE			FALSE
Phenanthrene	SVOA	22	14	0.043	46	235	FALSE			FALSE
Phenol	SVOA	22	1	0.038	0.038	4,693	FALSE			FALSE
Pyrene	SVOA	22	16	0.069	100	235	FALSE			FALSE
1,1-Dichloroethene	VOA	23	1	0.0011	0.0011	1.1	FALSE			FALSE
Acetone	VOA	23	3	0.037	0.044	782	FALSE			FALSE
m+p Xylene	VOA	4	4	8.80E-04	0.0016		TBD			FALSE
Methyl isobutyl ketone (4-Methyl-2-pentanon	VOA	23	1	0.0053	0.0053	626	FALSE			FALSE
Toluene	VOA	23	2	0.0020	0.0020	1,564	FALSE			FALSE
Xylenes, Total	VOA	23	5	8.80E-04	0.0020	15,643	FALSE			FALSE

*See BEQ screening table

Appendix E, Table 2
COPC Selection for Subsurface Soils, SWMU 67 RFIRA, Zone E, CNC

Paramname	ParamClass	N	Detects	Minimum Detect	Maximum Detect	RES SOIL RBC	EXCEEDS RBC	SB Min	SB Max	COPC
Aluminum	METAL	12	12	3,150	8,230	7,821	TRUE	1220	29900	FALSE
Antimony	METAL	15	2	6.4	16	3.1	TRUE	0.52	1.6	TRUE
Arsenic	METAL	15	13	0.69	20	0.43	TRUE	0.83	26	FALSE
Barium	METAL	12	12	6.0	56	548	FALSE	6.1	91	FALSE
Beryllium	METAL	15	13	0.14	1.2	16	FALSE	0.15	1.6	FALSE
Cadmium	METAL	15	6	0.23	5.8	3.9	TRUE	0.13	0.96	TRUE
Calcium	METAL	12	12	255	46,100		TBD			FALSE
Chromium, Total	METAL	15	15	1.8	36	23	TRUE	1.6	75	FALSE
Cobalt	METAL	15	13	0.26	2.8	469	FALSE	0.41	15	FALSE
Copper	METAL	15	13	1.1	136	313	FALSE	1.3	192	FALSE
Iron	METAL	12	12	1,580	60,500	2,346	TRUE	924	35800	FALSE
Lead	METAL	15	15	2.4	133	400	FALSE	1.8	322	FALSE
Magnesium	METAL	12	11	88	785		TBD	77	9140	FALSE
Manganese	METAL	12	12	5.5	79	156	FALSE	4.9	625	FALSE
Mercury	METAL	30	18	0.015	7.3	2.3	TRUE	0.04	0.9	TRUE
Nickel	METAL	15	12	1.3	27.8	156	FALSE	0.85	20	FALSE
Potassium	METAL	12	7	63	298		TBD	106	3440	FALSE
Selenium	METAL	15	3	0.50	1.9	39	FALSE	0.59	2.4	FALSE
Sodium	METAL	12	3	191	374		TBD	21	1430	FALSE
Tin (Sn)	METAL	15	4	0.4	5.9	4,693	FALSE	2.8	24	FALSE
Vanadium	METAL	15	15	1.7	59	55	TRUE	1.6	71	FALSE
Zinc	METAL	15	15	2.3	1,550	2,346	FALSE	5.8	438	FALSE
PCB-1254 (Arochlor 1254)	PCB	8	1	0.15	0.15	0.32	FALSE			FALSE
Alpha BHC (Alpha Hexachloroc	PEST	8	1	0.0033	0.0033	0.10	FALSE			FALSE
Alpha-chlordane	PEST	8	3	0.0084	1.4	1.8	FALSE			FALSE
Endrin	PEST	8	3	0.0068	0.29	2.3	FALSE			FALSE
Endrin Aldehyde	PEST	8	2	0.0047	0.017	2.3	FALSE			FALSE
Gamma-chlordane	PEST	8	3	0.013	1.8	1.8	FALSE			FALSE
Heptachlor	PEST	8	2	0.0015	0.0081	0.14	FALSE			FALSE
Heptachlor Epoxide	PEST	8	1	0.043	0.043	0.070	FALSE			FALSE
p,p'-DDE	PEST	8	1	0.0060	0.0060	1.9	FALSE			FALSE
p,p'-DDT	PEST	8	1	0.0047	0.0047	1.9	FALSE			FALSE
2-Methylnaphthalene	SVOA	15	5	0.024	15	156	FALSE			FALSE
4-Chloro-3-methylphenol	SVOA	15	1	0.043	0.043		TBD			FALSE
Acenaphthene	SVOA	15	6	0.041	1.4	469	FALSE			FALSE
Anthracene	SVOA	15	4	0.12	0.25	2,346	FALSE			FALSE
Benzo(a)Anthracene	SVOA	15	5	0.18	0.69	0.87	FALSE			FALSE
Benzo(a)Pyrene	SVOA	15	5	0.19	0.74	0.087	TRUE			TBD*
Benzo(b)Fluoranthene	SVOA	15	3	0.16	0.87	0.87	FALSE			FALSE
Benzo(g,h,i)Perylene	SVOA	15	5	0.13	0.57	235	FALSE			FALSE
Benzo(k)Fluoranthene	SVOA	15	4	0.23	0.72	8.7	FALSE			FALSE

Appendix E, Table 2
COPC Selection for Subsurface Soils, SWMU 67 RFIRA, Zone E, CNC

Paramname	ParamClass	N	Detects	Minimum Detect	Maximum Detect	RES SOIL RBC	EXCEEDS RBC	SB Min	SB Max	COPC
bis(2-Ethylhexyl) Phthalate	SVOA	15	4	0.066	0.54	46	FALSE			FALSE
Carbazole	SVOA	3	1	0.11	0.11		TBD			FALSE
Chrysene	SVOA	15	6	0.16	0.69	87.497	FALSE			FALSE
Dibenz(a,h)anthracene	SVOA	15	2	0.18	0.2	0	TRUE			TBD*
Dibenzofuran	SVOA	15	3	0.034	1.1	31	FALSE			FALSE
Fluoranthene	SVOA	15	7	0.09	1.3	313	FALSE			FALSE
Fluorene	SVOA	15	5	0.06	1.70	312.86	FALSE			FALSE
Indeno(1,2,3-c,d)pyrene	SVOA	15	5	0.110	0.43	1	FALSE			FALSE
Naphthalene	SVOA	15	3	0.026	0.3	156	FALSE			FALSE
Phenanthrene	SVOA	15	7	0.086	2.6	235	FALSE			FALSE
Pyrene	SVOA	15	8	0.092	1.60	235	FALSE			FALSE
1,1-Dichloroethene	VOA	14	2	7.10E-04	0.0011	1.1	FALSE			FALSE
Acetone	VOA	14	3	0.036	0.10	782	FALSE			FALSE
m+p Xylene	VOA	3	2	8.30E-04	0.0012		TBD			FALSE
Xylenes, Total	VOA	14	2	8.30E-04	0.0012	15,643	FALSE			FALSE

*See BEQ screening table

Appendix E, Table 3

BEQ Screening Table - SWMU 67 RFIRA, Zone E, CNC

SampleID	DateCollected	BEQ	RBC*	BACKGROUND	COPC
Surface Soil (0-1 ft)					
RFI Rev0					
037SB005E1	06/07/1997	1.07975	0.087	1.304	FALSE
037SB006E1	06/07/1997	0.9782	0.087	1.304	FALSE
037SB007E1	06/07/1997	1.23389	0.087	1.304	FALSE
037SB008E1	06/09/1997	0.45825	0.087	1.304	FALSE
037SB009E1	05/20/1997	1.48672	0.087	1.304	**TRUE**
037SB010E1	06/09/1997	1.37513	0.087	1.304	**TRUE**
037SB011E1	06/09/1997	0.59197	0.087	1.304	FALSE
538SB00401	08/28/1995	0.843515	0.087	1.304	FALSE
538SB00501	08/28/1995	0.820405	0.087	1.304	FALSE
538SB00601	08/28/1995	1.27105	0.087	1.304	FALSE
541SB00101a	08/30/1995	0.8496	0.087	1.304	FALSE
542SB00101	08/29/1995	0.427535	0.087	1.304	FALSE
542SB00201	08/29/1995	0.404425	0.087	1.304	FALSE
542SB00301a	08/30/1995	0.81822	0.087	1.304	FALSE
542SB00501	08/29/1995	1.706	0.087	1.304	**TRUE**
542SB00601	08/29/1995	0.403066	0.087	1.304	FALSE
542SB00701	08/30/1995	0.843515	0.087	1.304	FALSE
December-02					
546SB00101	12/12/2002	0.295717	0.087	1.304	FALSE
546SB00201	12/12/2002	0.2828745	0.087	1.304	FALSE
546SB00301	12/12/2002	1.27603	0.087	1.304	FALSE
546SB00401	12/12/2002	0.4583818	0.087	1.304	FALSE
Subsurface Soil (1-5 ft)					
RFI Rev0					
037SB008E2	06/09/1997	0.96981	0.087	1.4	FALSE
037SB009E2	05/20/1997	1.61716	0.087	1.4	**TRUE**
037SB010E2	06/09/1997	0.6375	0.087	1.4	FALSE
037SB011E2	06/09/1997	0.90129	0.087	1.4	FALSE
538SB00402	08/28/1995	0.83196	0.087	1.4	FALSE
538SB00502	08/28/1995	0.797295	0.087	1.4	FALSE
538SB00602	08/28/1995	0.820405	0.087	1.4	FALSE
542SB00102	08/29/1995	0.427535	0.087	1.4	FALSE
542SB00202	08/29/1995	0.80885	0.087	1.4	FALSE
542SB00302a	08/30/1995	0.714	0.087	1.4	FALSE
542SB00502	08/29/1995	1.05939	0.087	1.4	FALSE
542SB00602	08/29/1995	0.450645	0.087	1.4	FALSE
December-02					
546SB00102	12/12/2002	0.4402455	0.087	1.4	FALSE
546SB00202	12/12/2002	0.4055805	0.087	1.4	FALSE
546SB00302	12/12/2002	0.913125	0.087	1.4	FALSE

* As Benzo(a)pyrene

SOFINDWK.XLS - Soil Hypothetical Future Industrial Worker Scenario [illegible]ation Spreadsheet

Use this spreadsheet qrysUCL_AOC_Summary query listing from the Ri[illegible]SSE.MDB data base.

Procedur

1. *Fill-out the information for the current scenario.*
2. *Open the RISKASSE.MDB data base.*
3. *Run the qrysUCL_AOC_Summary query.*
4. *Select the Area of Concern (AOC) to report.*
5. *Copy the entire listing to the Windows Clipboard.*
6. *Open this spreadsheet again.*
7. *Place the cursor on cell B50 of the Data sheet.*
8. *Press Ctrl-V to paste the Clipboard there.*
9. *Review the Carcinogenic and NonCarcinogenic sheets.*
10. *Adjust the Page Setups and print each sheet.*
11. *Save the spreadsheet with a unique name (Save As ...).*

Scenario Information:		**Carcinogenic**	**NonCarcinogenic**
	Titles:	Surface Soil-Hy	Surface Soil-Hypothetical Future Industrial Worker Non-carcinogenic Scenario
		Charlestc Charleston Nav	*Charleston Navy Complex - Zone E, SWMU 67*
Ingestion	**CDI = (Cs * IR * FI * EF * ED * CF) / (BW * AT)**		
	Cs (mg/kg):	EPC	EPC
	IR (mg/day):	50	50
	FI (unitless):	1	1
	EF (day/yr):	250	250
	ED (yr):	25	25
	CF (kg/mg):	1.00E-06	1.00E-06
	BW (kg):	70	70
	AT (day):	25550	9125
Dermal:	**CDI = (Cs * SA * AF * ABS * ET * EF * ED * CF) / (BW * AT)**		
	Cs (mg/kg):	EPC	EPC
	SA (cm^2):	2679	2679
	AF (mg/cm^2):	0.03	0.03
	ABS (unitless):	(See Below)	(See Below)
	ET (hrs/8 hr workday):	1	1
	EF (day/yr):	250	250
	ED (yr):	25	25
	CF (kg/mg):	1.00E-06	1.00E-06
	BW (kg):	70	70
	AT (day):	25550	9125
Inhalation	**CDI = (Cs * (1/PEF) * IR * ET * EF * ED) / (BW * AT)**		
	Cs (mg/kg):	EPC	EPC
	PEF (m3/kg):	1.32E+09	1.32E+09
	VF (m3/kg):	(See Below)	(See Below)
	IR (m3/day):	20	20
	ET (hrs/8 hr workday):	1	1
	EF (day/yr):	250	250
	ED (yr):	25	25
	BW (kg):	70	70
	AT (day):	25550	9125

Green cells require an entry		
Blue cells require an entry		
Gray cells refer to other cells		
ABS:	0.01	Inorganic Parameters
	0.1	Semivolatile Organics
	0.25	Volatile Organics
ABS:	0.01	Inorganic Parameters

Fill-in

DE	ABS	Units	Name	NoAnalysis	Detects	MeanVal	MaxDet	UCL_NORM	UCL_LOG	RME	Weight-of-Evidence Class	Oral SF kg-day/mg	Inhal SF kg-day/mg	mg/kg-day	C Inhal RfD mg/kg-day
2%	0.1%	mg/kg	Antimony	23	13	10	41			14				4.00E-04	
1%	0.1%	mg/kg	Cadmium	23	15	3.2	46			6.7	B1		1.90E+00	1.00E-03	5.70E-05
0.3	0.001	mg/kg	Copper	23	23	296	4,590			1,173	D			0.04	
15%	0.1%	mg/kg	Lead	23	23	112	629			156	B2				
7%	0.1%	mg/kg	Mercury	33	22	2.8	45			5.1	D			3.00E-04	8.60E-05
20%	0.1%	mg/kg	Zinc	23	6	1,466	24,800			6,152	D			3.00E-01	
0.9	0.06	mg/kg	PCB1254	15	23	0.21	1.2			0.35	B2	2.00E+00	2.00E+00	2.00E-05	
0.31	0.01	mg/kg	Benzo(a)pyrene equivale	21	21	0.9	2			1.0	B2	7.30E+00	3.10E+00		

Surface Soil -Hypothetical Future Industrial Worker Scenario
Charleston Navy Complex - Zone E, SWMU 67

		Carcinogenic	Noncarcinogenic
Ingestion:			
CDI =	$\frac{Cs * IR * FI * EF * ED * CF}{BW * AT}$		
Cs =	Concentration in soil (mg/kg)	EPC	EPC
IR =	Ingestion Rate (mg/day)	50 a	50 a
FI =	Fraction Ingested (unitless)	1	1
EF =	Exposure Frequency (day/year)	250 a	250 a
ED =	Exposure Duration (year)	25 a	25 a
CF =	Conversion Factor (kg/mg)	1.00E-06	1.00E-06
BW =	Body Weight (kg)	70 a	70 a
AT =	Averaging Time (days)	25550 a	9125 a
Dermal:			
CDI =	$\frac{Cs * SA * AF * ABS * ET * EF * ED * CF}{BW * AT}$		
Cs =	Concentration in soil (mg/kg)	EPC	EPC
SA =	Surface Area (cm^2)	2679 c,d	2679 c,d
AF =	Soil-Skin Adherence Factor (mg/cm^2)	0.03 c,e	0.03 c,e
ABS =	Absorption Factor (unitless)	(Chemical Specific) f	(Chemical Specific) f
ET =	Exposure Time (8 hours per 8 hour workday)	1 b	1 b
EF =	Exposure Frequency (day/year)	250 a	250 a
ED =	Exposure Duration (year)	25 a	25 a
CF =	Conversion Factor (kg/mg)	1.00E-06	1.00E-06
BW =	Body Weight (kg)	70 a	70 a
AT =	Averaging Time (days)	25550 a	9125 a
Inhalation:		*for volatiles:*	
CDI =	$\frac{Cs * (1/PEF) * IR * ET * EF * ED}{BW * AT}$	$\frac{Cs * ((1/VFind)+(1/PEF)) * IR * ET * EF * ED}{BW * AT}$	
Cs =	Concentration in soil (mg/kg)	EPC	EPC
PEF =	Particulate Emission Factor (m^3/kg)	1.32E+09 g	1.32E+09 g
VFind =	Volatilization Factor (m^3/kg)	(Chemical Specific) h	(Chemical Specific) h
IR =	Inhalation Rate (m^3/day)	20 a	20 a
ET =	Exposure Time (8 hours per 8 hour workday)	1 b	1 b
EF =	Exposure Frequency (day/year)	250 a	250 a
ED =	Exposure Duration (year)	25 a	25 a
BW =	Body Weight (kg)	70 a	70 a
AT =	Averaging Time (days)	25550 a	9125 a

References:

a = U.S. EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

b = Time spent outdoors in the contaminated areas using best professional judgement, based on the nature of the activity.

c = U.S. EPA Exposure Factors Handbook, August 1997.

d = Surface area of 1/2 head, forearms and the hands of an adult worker.

e = Groundskeeper No2 (exposure scenario similar to urban horticulture center, campus grounds, arboreum), Exposure Factors Handbook, August 1996

f = In the absence of chemical specific data, EPA Region IV default values: 1% for organics, 0.1% for inorganics

g = Particulate emission factor (PEF), adapted from U.S.EPA, Soil Screening Guidance: Technical Background Document, May 1996.

h = Industrial volatilization factor (VFind) adapted from FDEP Brownfields Table 4, Chapter 62-777, F.A.C.,

Surface Soil -Hypothetical Future Industrial Worker Carcinogenic Scenario

Charleston Navy Complex - Zone E, SWMU 67

										Ingestion		Dermal		Inhalation	
Units	**Chemical**	**WOE**	**SFo**	**SFd**	**SFi**	**VFind**	**EPC**	**ABSgi**	**DABS**	**CDI**	**ELCR**	**CDI**	**ELCR**	**CDI**	**ELCR**
mg/kg	Antimony						1.41E+01	2.0%	0.001	2.47E-06		3.97E-09		7.49E-10	
mg/kg	Cadmium	B1			1.90E+00		6.72E+00	1.0%	0.001	1.17E-06		1.89E-09		3.56E-10	6.8E-10
mg/kg	Copper	D					1.17E+03	30.0%	0.001	2.05E-04		3.29E-07		6.21E-08	
mg/kg	Lead	B2					1.56E+02	15.00%	0.001	2.73E-05		4.39E-08		8.28E-09	
mg/kg	Mercury	D					5.07E+00	7.00E-02	0.001	8.86E-07		1.42E-09		2.68E-10	
mg/kg	Zinc	D					6.15E+03	2.00E-01	0.001	1.07E-03		1.73E-06		3.26E-07	
mg/kg	PCB1254	B2	2.00E+00	2.22E+00	2.00E+00		3.53E-01	9.00E-01	0.06	6.16E-08	1.2E-07	5.94E-09	1.3E-08	1.87E-11	3.7E-11
mg/kg	Benzo(a)pyrene equivalents (BEQ)	B2	7.30E+00	2.35E+01	3.10E+00		1.01E+00	3.10E-01	0.01	1.77E-07	1.3E-06	2.84E-09	6.7E-08	5.36E-11	1.7E-10
	Total Risk										**1E-06**		**8E-08**		**7E-10**
												Total Risk =		**1E-06**	

Notes: WOE = Weight of Evidence; CDI = Chronic Daily Intake; EPC = Exposure Point Concentration; ELCR = Excess Lifetime Cancer Exposure

Surface Soil -Hypothetical Future Industrial Worker Non-carcinogenic Scenario

Charleston Navy Complex - Zone E, SWMU 67

										Ingestion		Dermal		Inhalation	
Units	**Chemical**	**WOE**	**RfDo**	**RfDd**	**RfDi**	**VFind**	**EPC**	**ABSgi**	**DABS**	**CDI**	**HQ**	**CDI**	**HQ**	**CDI**	**HQ**
mg/kg	Antimony		4.00E-04	8.00E-06			1.41E+01	2%	0.001	6.92E-06	0.01730	1.11E-08	1.39E-03	2.10E-09	
mg/kg	Cadmium	B1	1.00E-03	1.00E-05	5.70E-05		6.72E+00	1%	0.001	3.29E-06	0.0033	5.29E-09	5.29E-04	9.97E-10	0.00002
mg/kg	Copper	D	4.00E-02	1.20E-02			1.17E+03	30%	0.001	5.74E-04	0.014	9.22E-07	7.69E-05	1.74E-07	
mg/kg	Lead	B2					1.56E+02	15%	0.001	7.65E-05		1.23E-07		2.32E-08	
mg/kg	Mercury	D	3.00E-04	2.10E-05	8.60E-05		5.07E+00	7%	0.001	2.48E-06	0.0083	3.99E-09	1.90E-04	7.52E-10	0.0000
mg/kg	Zinc	D	3.00E-01	6.00E-02			6.15E+03	20%	0.001	3.01E-03	0.0100	4.84E-06	8.06E-05	9.12E-07	
mg/kg	PCB1254	B2	2.00E-05	1.80E-05			3.53E-01	90%	0.06	1.72E-07	0.0086	1.66E-08	9.24E-04	5.23E-11	
mg/kg	Benzo(a)pyrene equivalents (BEQ)	B2					1.01E+00	3.10E-01	0.01	4.95E-07		7.96E-09		1.50E-10	
	Hazard Index										**0.062**		**0.0032**		**0.00003**
													Total HI=	**0.065**	

Notes: WOE = Weight of Evidence; CDI = Chronic Daily Intake; EPC = Exposure Point Concentration; HQ = Hazard Quotient; HI = Hazard Index

F_RES_A.XLS - Soil Future Residential Adult Scenario Calculation Spreadsheet

Use this spreadsheet qrysUCL_AOC_Summary query listing from the RISKASSE.MDB data base.

Procedure:

1. *Fill-out the information for the current scenario.*
2. *Open the RISKASSE.MDB data base.*
3. *Run the qrysUCL_AOC_Summary query.*
4. *Select the Area of Concern (AOC) to report.*
5. *Copy the entire listing to the Windows Clipboard.*
6. *Open this spreadsheet again.*
7. *Place the cursor on cell B50 of the Data sheet.*
8. *Press Ctrl-V to paste the Clipboard there.*
9. *Review the Carcinogenic and NonCarcinogenic sheets.*
10. *Adjust the Page Setups and print each sheet.*
11. *Save the spreadsheet with a unique name (Save As ...).*

Scenario Information:		Carcinogenic	NonCarcinogenic	Intake		
	Titles:	Surface Soil - F	Surface Soil - Future	SurfaceSoil	- Future Residential Ac	
		Charleston Nav	Charleston Navy Co	Charleston	Navy Complex - Zone E	
Ingestion:	CDI = (Cs * IR * FI * ET * EF * ED * CF) / (BW * AT)					
	Cs (mg/kg):	RME	RME			Green cell
	IR (mg/day):	114	100			Blue cells
	FI (unitless):	1	1			Gray cells
	EF (day/yr):	350	350			
	ED (yr):	30	30			
	CF (kg/mg):	1.00E-06	1.00E-06			
	BW (kg):	70	70			
	AT (day):	25550	10950			
Dermal:	CDI = (Cs * SA * AF * ABS * ET * EF * ED * CF) / (BW * AT)					
	Cs (mg/kg):	RME	RME			
	SA (cm^2):	4086	7612			
	AF (mg/cm^2):	0.03	0.03			
	ABS (unitless):	(See Below)	(See Below)			
	EF (day/yr):	350	350			
	ED (yr):	30	30			
	CF (kg/mg):	1.00E-06	1.00E-06			
	BW (kg):	70	70			
	AT (day):	25550	10950			
Inhalation:	CDI = (Cs * ((1/PEF)+(1/VF)) * IR * ET * EF * ED) / (BW * AT)					
	Cs (mg/kg):	RME	RME			
	PEF (m3/kg):	1.32E+09	1.32E+09			
	IR (m3/day):	13	20			
	VF (m^3/kg):	(See Below)	(See Below)			
	EF (day/yr):	350	350			
	ED (yr):	30	30			
	BW (kg):	70	70			
	AT (day):	25550	10950			

ABS	Data Area:	ParmName	NoAnalyses	NoDetects	Mean Val	MaxDet	UCLNorm	UCLLogNo
XXXXXXXX	Units	ParmName	NoAnalyses	NoDetects	(blank)	MaxDet	UCLNorm	UCLLogNo

SurfaceSoil - Future Residential Adult Scenario
Charleston Navy Complex - Zone E, SWMU 67

Ingestion:

Intake for non-carcinogenic compounds:

$$CDI = \frac{Cs * IR * FI * EF * ED * CF}{BW * AT}$$

Age-adjusted intake for carcinogenic compounds only:

$$CDI_{adj} = \frac{Cs * IR_{adj} * FI * EF * CF}{AT}$$

		Carcinogenic	Noncarcinogenic
Cs =	Concentration in soil (mg/kg)	RME	RME
IR =	Ingestion Rate (mg/day)	--	100 a
IRadj =	Age-adjusted Ingestion Rate [(mg-yr)/(kg-day)]	114 a	--
FI =	Fraction Ingested (unitless)	100%	100%
EF =	Exposure Frequency (day/year)	350 a	350 a
ED =	Exposure Duration (year)	30 a	30 a
CF =	Conversion Factor (kg/mg)	1.00E-06	1.00E-06
BW =	Body Weight (kg)	70 a	70 a
AT =	Averaging Time (days)	25550 a	10950 a

Dermal:

Intake for non-carcinogenic compounds:

$$CDI = \frac{Cs * SA * AF * ABS * EF * ED * CF}{BW * AT}$$

Age-adjusted dose for carcinogenic compounds only:

$$CDI_{adj} = \frac{Cs * SA^{adj} * AF * ABS * EF * CF}{BW}$$

Cs =	Concentration in soil (mg/kg)	RME	RME
SA =	Surface Area (cm^2)	--	7612 c
SAadj =	Age-adjusted Skin Surface Area [(cm^2-yr)/(kg-day)]	4086 c	--
AF =	Soil-Skin Adherence Factor (mg/cm^2)	0.03 d	0.03 d
ABS =	Absorption Factor (unitless)	(Chemical Specific) e	(Chemical Specific) e
EF =	Exposure Frequency (day/year)	350 a	350 a
ED =	Exposure Duration (year)	30 a	30 a
CF =	Conversion Factor (kg/mg)	1.00E-06	1.00E-06
BW =	Body Weight (kg)	70 a	70 a
AT =	Averaging Time (days)	25550 a	10950 a

Particulate/Volatile Inhalation:

Intake for non-carcinogenic compounds:

$$CDI = \frac{Cs * ((1/PEF)+(1/VF)) * IR * EF * ED}{BW * AT}$$

Age-adjusted intake for carcinogenic compounds only:

$$CDI_{adj} = \frac{Cs * ((1/PEF)+(1/VF)) * IR_{adj} * EF}{BW}$$

Cs =	Concentration in soil (mg/kg)	RME	RME
PEF =	Particulate Emission Factor (m^3/kg)	1.32E+09 f	1.32E+09 f
VF =	Volatilization Factor (m^3/kg)	(Chemical Specific) g	(Chemical Specific) g
IR =	Inhalation Rate (m^3/day)	--	20 a
IR_{adj} =	Age-adjusted Inhalation Rate [(m^3-yr)/(kg-day)]	13 a	--
EF =	Exposure Frequency (day/year)	350 a	350 a
ED =	Exposure Duration (year)	30 a	30 a
BW =	Body Weight (kg)	70 a	70 a
AT =	Averaging Time (days)	25550 a	10950 a

References:

a = U.S. EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

c = Surface area of hands, arms and legs of an adult (average of male and female mean SA), adapted from U.S.EPA, Exposure Factors Handbook, Vol. I,II,III, August 1996.

d = Groundskeeper No2 (exposure scenario similar to urban horticulture center, campus grounds, arboreum), Exposure Factors Handbook, August 1996

e = In the absence of chemical specific data, EPA Region IV default values: 1% organics, 0.1% inorganics

f = Particulate emission factor (PEF), adapted from U.S.EPA, Soil Screening Guidance: Technical Background Document, May 1996.

g = Residential volatilization factor (VFres) adapted from FDEP Brownfields Table 4, Chapter 62-777, F.A.C., December 1998.

Surface Soil - Future Residential Adult Carcinogenic Scenario

Charleston Navy Complex - Zone E, SWMU 67

										Ingestion		Dermal		Inhalation	
Units	**Chemical**	**WOE**	**SFo**	**SFd**	**SFI**	**RME**	**DE**	**ABS**	**VFres**	**CDI**	**ELCR**	**CDI**	**ELCR**	**CDI**	**ELCR**
mg/kg	Antimony					1.41E+01	2%	0.001		2.21E-05		2.37E-08		1.91E-09	
mg/kg	Cadmium	B1			1.90E+00	6.72E+00	1%	0.001		1.05E-05		1.13E-08		9.07E-10	1.7E-09
mg/kg	Copper	D				1.17E+03	30%	0.001		1.84E-03		1.97E-06		1.58E-07	
mg/kg	Lead	B2				1.56E+02	15.00%	0.001		2.45E-04		2.63E-07		2.11E-08	
mg/kg	Mercury	D				5.07E+00	7%	0.001		7.94E-06		3.65E-09		2.93E-10	
mg/kg	Zinc	D				6.15E+03	20%	0.001		9.63E-03		4.43E-06		3.56E-07	
mg/kg	PCB1254	B2	2.00E+00	2.22E+00	2.00E+00	3.53E-01	90%	0.06		5.52E-07	1.1E-06	1.52E-08	3.4E-08	2.04E-11	4.1E-11
mg/kg	Benzo(a)pyrene equivalents (BEQ)	B2	7.30E+00	2.35E+01	3.10E+00	1.01E+00	31%	0.01		1.58E-06	1.2E-05	7.28E-09	1.7E-07	5.85E-11	1.8E-10
	Total Risk										1.3E-05		2.1E-07		1.9E-09
													Total Risk =	**1E-05**	

Notes: WOE = Weight of Evidence; CDI = Chronic Daily Intake; RME = Reasonable Maximum Exposure Concentration; ELCR = Excess Lifetime Cancer Exposure

Surface Soil - Future Residential Adult Non-carcinogenic Scenario

Charleston Navy Complex - Zone E, SWMU 67

										Ingestion		Dermal		Inhalation	
Units	**Chemical**	**WOE**	**RfDo**	**RfDd**	**RfDI**	**RME**	**DE**	**ABS**	**VFres**	**CDI**	**HQ**	**CDI**	**HQ**	**CDI**	**HQ**
mg/kg	Antimony		4.00E-04	8.00E-06		1.41E+01	2%	0.001		1.94E-05	4.84E-02	4.42E-08	5.53E-03	2.94E-09	
mg/kg	Cadmium	B1	1.00E-03	1.00E-05	5.70E-05	6.72E+00	1%	0.001		9.21E-06	0.0092	2.10E-08	2.10E-03	1.40E-09	2.4E-05
mg/kg	Copper	D	4.00E-02	1.20E-02		1.17E+03	30%	0.001		1.61E-03	0.040	3.67E-06	0.0003	2.43E-07	
mg/kg	Lead	B2				1.56E+02	15.00%	0.001		2.14E-04		4.89E-07		3.25E-08	
mg/kg	Mercury	D	3.00E-04	2.10E-05	8.60E-05	5.07E+00	7%	0.001		6.94E-06	0.023	3.70E-08	0.0018	1.05E-09	0.0000
mg/kg	Zinc	D	3.00E-01	6.00E-02		6.15E+03	20%	0.001		8.43E-03	0.0281	4.49E-05	7.48E-04	1.28E-06	
mg/kg	PCB1254	B2	2.00E-05	1.80E-05		3.53E-01	90%	0.06		4.83E-07	0.0241	1.54E-07	0.0086	7.32E-11	
mg/kg	Benzo(a)pyrene equivalents (BEQ)	B2				1.01E+00	3.10E-01	0.01		1.39E-06		7.38E-08		2.10E-10	
	Hazard Index										0.17		0.0190		0.0000
													Total HI =	**0.19**	

Notes: WOE = Weight of Evidence; CDI = Chronic Daily Intake; RME = Reasonable Maximum Exposure Concentration; HQ = Hazard Quotient; HI = Hazard Index

F_RES_C.XLS - Soil Future Residential Child Scenario Calculation Spreadsheet

Use this spreadsheet qrysUCL_AOC_Summary query listing from the RISKASSE.MDB data base.

Procedure:

1. *Fill-out the information for the current scenario.*
2. *Open the RISKASSE.MDB data base.*
3. *Run the qrysUCL_AOC_Summary query.*
4. *Select the Area of Concern (AOC) to report.*
5. *Copy the entire listing to the Windows Clipboard.*
6. *Open this spreadsheet again.*
7. *Place the cursor on cell B50 of the Data sheet.*
8. *Press Ctrl-V to paste the Clipboard there.*
9. *Review the Carcinogenic and NonCarcinogenic sheets.*
10. *Adjust the Page Setups and print each sheet.*
11. *Save the spreadsheet with a unique name (Save As ...).*

Scenario Information:		Carcinogenic	NonCarcinogenic	Intake		
	Titles:	Surface Soil - F	Surface Soil - Futur	Surface Soil	- Future Residential C	
		Charleston Nav	Charleston Navy Co	Charleston	Navy Complex - Zone E	
Ingestion:	**CDI = (Cs * IR * FI * ET * EF * ED * CF) / (BW * AT)**					
	Cs (mg/kg):	RME	RME			Green cells
	IR (mg/day):	200	200			Blue cells
	FI (unitless):	1	1			Gray cells
	EF (day/yr):	350	350			
	ED (yr):	6	6			
	CF (kg/mg):	1.00E-06	1.00E-06			
	BW (kg):	15	15			
	AT (day):	25550	2190			
Dermal:	**CDI = (Cs * SA * AF * ABS * ET * EF * ED * CF) / (BW * AT)**					
	Cs (mg/kg):	RME	RME			
	SA (cm^2):	3690	3690			
	AF (mg/cm^2):	0.15	0.15			
	ABS (unitless):	(See Below)	(See Below)		ABS:	0.01
	EF (day/yr):	350	350			0.1
	ED (yr):	6	6			0.25
	CF (kg/mg):	1.00E-06	1.00E-06			
	BW (kg):	15	15			
	AT (day):	25550	2190			
Inhalation:	**CDI = (Cs * ((1/PEF)+(1/VF)) * IR * ET * EF * ED) / (BW * AT)**					
	Cs (mg/kg):	RME	RME			
	PEF (m3/kg):	1.32E+09	1.32E+09			
	IR (m3/day):	15	15			
	VF (m^3/kg):	(See Below)	(See Below)			
	EF (day/yr):	350	350			
	ED (yr):	6	6			
	BW (kg):	15	15			
	AT (day):	25550	2190			

ABS	Data Area:	ParmName	NoAnalyses	NoDetects	Mean Val	MaxDet	UCLNorm	UCLLogNo
XXXXXXXX	Units	ParmName	NoAnalyses	NoDetects	(blank)	MaxDet	UCLNorm	UCLLogNo

Surface Soil - Future Residential Child Scenario
Charleston Navy Complex - Zone E, SWMU 67

Ingestion:

$$CDI = \frac{Cs * IR * FI * EF * ED * CF}{BW * AT}$$

		Carcinogenic	Noncarcinogenic
Cs =	Concentration in soil (mg/kg)	RME	RME
IR =	Ingestion Rate (mg/day)	200 a	200 a
FI =	Fraction Ingested (unitless)	100%	100%
EF =	Exposure Frequency (day/year)	350 a	350 a
ED =	Exposure Duration (year)	6 a	6 a
CF =	Conversion Factor (kg/mg)	1.00E-06	1.00E-06
BW =	Body Weight (kg)	15 a	15 a
AT =	Averaging Time (days)	25550 a	2190 a

Dermal:

$$CDI = \frac{Cs * SA * AF * ABS * EF * ED * CF}{BW * AT}$$

Cs =	Concentration in soil (mg/kg)	RME	
SA =	Surface Area (cm^2)	3690 c	3690 c
AF =	Soil-Skin Adherence Factor (mg/cm^2)	0.15 d	0.15 d
ABS =	Absorption Factor (unitless)	(Chemical Specific) e	(Chemical Specific) e
EF =	Exposure Frequency (day/year)	350 a	350 a
ED =	Exposure Duration (year)	6 a	6 a
CF =	Conversion Factor (kg/mg)	1.00E-06	1.00E-06
BW =	Body Weight (kg)	15 a	15 a
AT =	Averaging Time (days)	25550 a	2190 a

Particulate/Volatile Inhalation:

$$CDI = \frac{Cs * ((1/PEF)+(1/VF)) * IR * EF * ED}{BW * AT}$$

Cs =	Concentration in soil (mg/kg)	RME	RME
PEF =	Particulate Emission Factor (m^3/kg)	1.32E+09 f	1.32E+09 f
VF =	Volatilization Factor (m^3/kg)	(Chemical Specific) g	(Chemical Specific) g
IR =	Inhalation Rate (m^3/day)	15 a	15 a
EF =	Exposure Frequency (day/year)	350 a	350 a
ED =	Exposure Duration (year)	6 a	6 a
BW =	Body Weight (kg)	15 a	15 a
AT =	Averaging Time (days)	25550 a	2190 a

References:

a = U.S. EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

c = Surface area of hands, arms, legs, and feet of a child (1-6 year average), adapted from U.S.EPA, Exposure Factors Handbook, Vol. I,II,III, August 1996.

d = Daycare Kids No1b (indoor exposure to linoleum, outdoor exposure to grass, bare earth, no shoes), Exposure Factors Handbook, August 1996

e = In the absence of chemical specific data, EPA Region IV default values: 1% for organics, 0.1% inorganics

f = Particulate emission factor (PEF), adapted from U.S.EPA, Soil Screening Guidance: Technical Background Document, May 1996.

g = Residential child volatilization factor (VFchild) adapted from FDEP Brownfields Table 4, Chapter 62-777, F.A.C., December 1998.

Surface Soil - Future Residential Child Non-carcinogenic Scenario

Charleston Navy Complex - Zone E, SWMU 67

										Ingestion		Dermal		Inhalation	
Units	**Chemical**	**WOE**	**RfDo**	**RfDd**	**RfDi**	**RME**	**DE**	**ABS**	**VF CHILD**	**CDI**	**HQ**	**CDI**	**HQ**	**CDI**	**HQ**
mg/kg	Antimony		4.00E-04	8.00E-06		1.41E+01	2%	0.001		1.81E-04	0.45	5.00E-07	6.26E-02	1.03E-08	
mg/kg	Cadmium	B1	1.00E-03	1.00E-05	5.70E-05	6.72E+00	1%	0.001		8.59E-05	0.09	2.38E-07	2.38E-02	4.88E-09	8.57E-05
mg/kg	Copper	D	4.00E-02	1.20E-02		1.17E+03	30%	0.001		1.50E-02	0.37	4.15E-05	0.003	8.52E-07	
mg/kg	Lead	B2				1.56E+02	15%	0.001		2.00E-03		5.54E-06		1.14E-07	
mg/kg	Mercury	D	3.00E-04	2.10E-05	8.60E-05	5.07E+00	7%	0.001		6.48E-05	0.2	1.79E-07	0.009	3.68E-09	0.000
mg/kg	Zinc	D	3.00E-01	6.00E-02		6.15E+03	20%	0.001		7.87E-02	0.262	2.18E-04	3.63E-03	4.47E-06	
mg/kg	PCB1254	B2	2.00E-05	1.80E-05		3.53E-01	90%	0.06		4.51E-06	0.225	7.48E-07	0.042	2.56E-10	
mg/kg	Benzo(a)pyrene equivalents (BEQ)	B2				1.01E+00	3.10E-01	0.01		1.29E-05		3.58E-07		7.35E-10	
	Hazard Index										1.6		0.144		0.0001
													Total HI =	1.8	

Notes: WOE = Weight of Evidence; CDI = Chronic Daily Intake; RME = Reasonable Maximum Exposure Concentration; HQ = Hazard Quotient; HI = Hazard Index

SOFINDWK.XLS - Soil Hypothetical Future Industrial Worker Scenario Calculation Spreadsheet

Use this spreadsheet qrysUCL_AOC_Summary query listing from the RISKASSE.MDB data base.

Procedure:

1. *Fill-out the information for the current scenario.*
2. *Open the RISKASSE.MDB data base.*
3. *Run the qrysUCL_AOC_Summary query.*
4. *Select the Area of Concern (AOC) to report.*
5. *Copy the entire listing to the Windows Clipboard.*
6. *Open this spreadsheet again.*
7. *Place the cursor on cell B50 of the Data sheet.*
8. *Press Ctrl-V to paste the Clipboard there.*
9. *Review the Carcinogenic and NonCarcinogenic sheets.*
10. *Adjust the Page Setups and print each sheet.*
11. *Save the spreadsheet with a unique name (Save As ...).*

Scenario Information:		Carcinogenic	NonCarcinogenic			
	Titles:	Surface Soil -Surface Soil -Hy	Surface Soil -Hypothetical Future Utility Worker Non-car			
		Charleston N Charleston Nav	Charleston Navy Complex - Zone E, SWMU 67			
Ingestion:	**CDI = (Cs * IR * FI * EF * ED * CF) / (BW * AT)**					
	Cs (mg/kg):	EPC	EPC			Green cells
	IR (mg/day):	480	480			Blue cells
	FI (unitless):	1	1			Gray cells
	EF (day/yr):	250	250			
	ED (yr):	1	1			
	CF (kg/mg):	1.00E-06	1.00E-06			
	BW (kg):	70	70			
	AT (day):	25550	365			
Dermal:	**CDI = (Cs * SA * AF * ABS * ET * EF * ED * CF) / (BW * AT)**					
	Cs (mg/kg):	EPC	EPC			
	SA (cm^2):	2679	2679			
	AF (mg/cm^2):	0.1	0.1			
	ABS (unitless):	(See Below)	(See Below)		ABS:	0.01
	ET (hrs/8 hr workday):	1	1			
	EF (day/yr):	250	250			0.1
	ED (yr):	1	1			0.25
	CF (kg/mg):	1.00E-06	1.00E-06			
	BW (kg):	70	70			
	AT (day):	25550	365			
Inhalation:	**CDI = (Cs * (1/PEF) * IR * ET * EF * ED) / (BW * AT)**					
	Cs (mg/kg):	EPC	EPC			
	PEF (m3/kg):	1.32E+09	1.32E+09			
	VF (m3/kg):	(See Below)	(See Below)		ABS:	0.01
	IR (m3/day):	20	20			
	ET (hrs/8 hr workday):	1	1			
	EF (day/yr):	250	250			
	ED (yr):	1	1			
	BW (kg):	70	70			
	AT (day):	25550	365			

Fill-In

ABS	Units	Name	NoAnalysis	Detects	MeanVal	MaxDet	UCL_NORM	UCL_LOG

Surface Soil -Hypothetical Future Utility Worker Scenario
Charleston Navy Complex - Zone E, SWMU 67

		Carcinogenic	Noncarcinogenic
Ingestion:			
CDI =	$\frac{Cs * IR * FI * EF * ED * CF}{BW * AT}$		
Cs =	Concentration in soil (mg/kg)	EPC	EPC
IR =	Ingestion Rate (mg/day)	480 a	480 a
FI =	Fraction Ingested (unitless)	1	1
EF =	Exposure Frequency (day/year)	250 a	250 a
ED =	Exposure Duration (year)	1 a	1 a
CF =	Conversion Factor (kg/mg)	1.00E-06	1.00E-06
BW =	Body Weight (kg)	70 a	70 a
AT =	Averaging Time (days)	25550 a	365 a
Dermal:			
CDI =	$\frac{Cs * SA * AF * ABS * ET * EF * ED * CF}{BW * AT}$		
Cs =	Concentration in soil (mg/kg)	EPC	EPC
SA =	Surface Area (cm^2)	2679 c,d	2679 c,d
AF =	Soil-Skin Adherence Factor (mg/cm^2)	0.1 c,e	0.1 c,e
ABS =	Absorption Factor (unitless)	(Chemical Specific) f	(Chemical Specific) f
ET =	Exposure Time (8 hours per 8 hour workday)	1 b	1 b
EF =	Exposure Frequency (day/year)	250 a	250 a
ED =	Exposure Duration (year)	1 a	1 a
CF =	Conversion Factor (kg/mg)	1.00E-06	1.00E-06
BW =	Body Weight (kg)	70 a	70 a
AT =	Averaging Time (days)	25550 a	365 a
Inhalation:		*for volatiles:*	
CDI =	$\frac{Cs * (1/PEF) * IR * ET * EF * ED}{BW * AT}$	$\frac{Cs * ((1/VFind)+(1/PEF)) * IR * ET * EF * ED}{BW * AT}$	
Cs =	Concentration in soil (mg/kg)	EPC	EPC
PEF =	Particulate Emission Factor (m^3/kg)	1.32E+09 g	1.32E+09 g
VFind =	Volatilization Factor (m^3/kg)	(Chemical Specific) h	(Chemical Specific) h
IR =	Inhalation Rate (m^3/day)	20 a	20 a
ET =	Exposure Time (8 hours per 8 hour workday)	1 b	1 b
EF =	Exposure Frequency (day/year)	250 a	250 a
ED =	Exposure Duration (year)	1 a	1 a
BW =	Body Weight (kg)	70 a	70 a
AT =	Averaging Time (days)	25550 a	365 a

References:

a = U.S. EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

b = Time spent outdoors in the contaminated areas using best professional judgement, based on the nature of the activity.

c = U.S. EPA Exposure Factors Handbook, August 1997.

d = Surface area of 1/2 head, forearms and the hands of an adult worker.

e = Groundskeeper No2 (exposure scenario similar to urban horticulture center, campus grounds, arboreum), Exposure Factors Handbook, August 1996

f = In the absence of chemical specific data, EPA Region IV default values: 1% for organics, 0.1% for inorganics

g = Particulate emission factor (PEF), adapted from U.S.EPA, Soil Screening Guidance: Technical Background Document, May 1996.

h = Industrial volatilization factor (VFind) adapted from FDEP Brownfields Table 4, Chapter 62-777, F.A.C.,

Surface Soil -Hypothetical Future Utility Worker Carcinogenic Scenario

Charleston Navy Complex - Zone E, SWMU 67

										Ingestion		Dermal		Inhalation	
Units	Chemical	WOE	SFo	SFd	SFi	VFind	EPC	ABSgi	DABS	CDI	ELCR	CDI	ELCR	CDI	ELCR
mg/kg	Antimony						9.76E+00	2.0%	0.001	6.55E-07		3.65E-10		2.07E-11	
mg/kg	Cadmium	B1			1.90E+00		4.27E+00	1.0%	0.001	2.87E-07		1.60E-10		9.05E-12	1.7E-11
mg/kg	Copper	D					3.88E+02	30.0%	0.001	2.60E-05		1.45E-08		8.21E-10	
mg/kg	Lead	B2					1.11E+02	15.00%	0.001	7.47E-06		4.17E-09		2.36E-10	
mg/kg	Mercury	D					3.31E+00	7.00E-02	0.001	2.22E-07		1.24E-10		7.02E-12	
mg/kg	Zinc	D					2.12E+03	2.00E-01	0.001	1.42E-04		7.92E-08		4.48E-09	
mg/kg	PCB1254	B2	2.00E+00	2.22E+00	2.00E+00		2.46E-01	9.00E-01	0.06	1.65E-08	3.3E-08	5.53E-10	1.2E-09	5.21E-13	1.0E-12
mg/kg	Benzo(a)pyrene equivalents (BEQ)	B2	7.30E+00	2.35E+01	3.10E+00		9.66E-01	3.10E-01	0.01	6.48E-08	4.7E-07	3.62E-10	8.5E-09	2.05E-12	6.3E-12
	Total Risk										**5E-07**		**1E-08**		**2E-11**
												Total Risk =		**5E-07**	

Notes: WOE = Weight of Evidence; CDI = Chronic Daily Intake; EPC = Exposure Point Concentration; ELCR = Excess Lifetime Cancer Exposure

Surface Soil -Hypothetical Future Utility Worker Non-carcinogenic Scenario

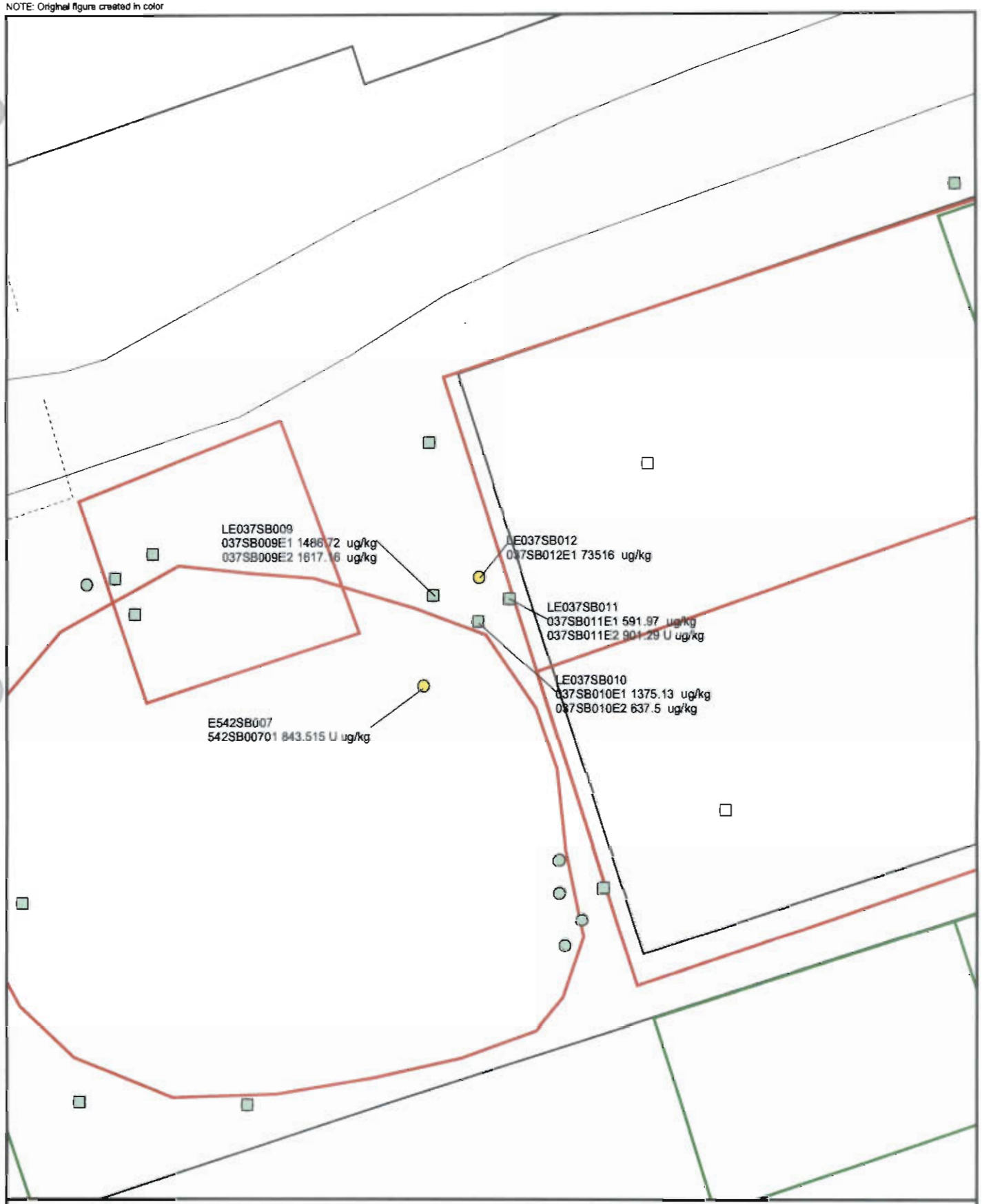
Charleston Navy Complex - Zone E, SWMU 67

										Ingestion		Dermal		Inhalation	
Units	Chemical	WOE	RfDo	RfDd	RfDi	VFind	EPC	ABSgi	DABS	CDI	HQ	CDI	HQ	CDI	HQ
mg/kg	Antimony		4.00E-04	8.00E-06			9.76E+00	2%	0.001	4.58E-05	0.11457	2.56E-08	3.20E-03	1.45E-09	
mg/kg	Cadmium	B1	1.00E-03	1.00E-05	5.70E-05		4.27E+00	1%	0.001	2.01E-05	0.0201	1.12E-08	1.12E-03	6.33E-10	0.00001
mg/kg	Copper	D	4.00E-02	1.20E-02			3.88E+02	30%	0.001	1.82E-03	0.046	1.02E-06	8.47E-05	5.75E-08	
mg/kg	Lead	B2					1.11E+02	15%	0.001	5.23E-04		2.92E-07		1.65E-08	
mg/kg	Mercury	D	3.00E-04	2.10E-05	8.60E-05		3.31E+00	7%	0.001	1.56E-05	0.0519	8.69E-09	4.14E-04	4.91E-10	0.0000
mg/kg	Zinc	D	3.00E-01	6.00E-02			2.12E+03	20%	0.001	9.94E-03	0.0331	5.55E-06	9.24E-05	3.14E-07	
mg/kg	PCB1254	B2	2.00E-05	1.80E-05			2.46E-01	90%	0.06	1.16E-06	0.0578	3.87E-08	2.15E-03	3.65E-11	
mg/kg	Benzo(a)pyrene equivalents (BEQ)	B2					9.66E-01	3.10E-01	0.01	4.54E-06		2.53E-08		1.43E-10	
	Hazard Index										**0.323**		**0.0071**		**0.00002**
													Total HI=	**0.330**	

Notes: WOE = Weight of Evidence; CDI = Chronic Daily Intake; EPC = Exposure Point Concentration; HQ = Hazard Quotient; HI = Hazard Index

Appendix F

NOTE: Original figure created in color



N

0 20 40 Feet

1 inch = 26.7427 feet

Figure 1
Soil BEQs at SWMU 67
Near Sample LE037SB012
Charleston Naval Complex

File Path: c:\18gis\cnc\cnc-egis.apr, Date: 20 Aug 2003 8:30, User: DWILLIAM, EGIS: Charleston Naval Complex - Figure 1 Soil BEQs at SWMU 67