

N61165.AR.003401
CNC CHARLESTON
5090.3a

RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT
ADDENDUM AREA OF CONCERN 579 (AOC 579) ZONE E CNC CHARLESTON SC
3/28/2002
CH2M HILL

RFI REPORT ADDENDUM

Area of Concern 579. Zone E



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

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

CH2M-Jones

March 2002

Contract N62467-99-C-0960



CH2MHILL

CH2M HILL

115 Perimeter Center Place N.E.

Suite 700

Atlanta, GA 30346-1278

Tel 770.604.9095

Fax 770.604.9183

March 28, 2002

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

Re: RFI Report Addendum (Revision 0) – AOC 579, Zone E

Dear Mr. Scaturo:

Enclosed are two copies of the RFI Report Addendum (Revision 0) for AOC 579 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 Kris Garcia. Please contact her at 770/604-9095 should you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

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

RFI REPORT ADDENDUM

Area of Concern 579, Zone E



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

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

PREPARED BY
CH2M-Jones

March 2002

*Revision 0
Contract N62467-99-C-0960
158814.ZE.PR.11*

1 Contents

2	Acronyms and Abbreviations	vi
3	1.0 Introduction.....	1-1
4	1.1 Background	1-1
5	1.2 Purpose of the RFI Report Addendum	1-2
6	1.3 Report Organization	1-3
7	Figure 1-1 Zone E Within CNC.....	1-4
8	Figure 1-2 Site Map	1-5
9	Figure 1-3 Bags of White Powder Stored in Building 1035.....	1-6
10	2.0 Summary of RFI Conclusions for AOC 579.....	2-1
11	2.1 Soil Sampling and Analysis	2-1
12	2.1.1 Surface Soil Results	2-2
13	2.1.2 Subsurface Soil Results.....	2-2
14	2.2 Groundwater Sampling and Analysis.....	2-2
15	2.3 COPC/COC Summary	2-2
16	Figure 2-1 Soil Sample Locations.....	2-4
17	Figure 2-2 Shallow Groundwater Contours.....	2-5
18	3.0 Interim Measures and UST/AST Removals.....	3-1
19	4.0 Summary of Additional Investigations.....	4-1
20	4.1 Surface Soil Results	4-2
21	4.2 Subsurface Soil Results	4-2
22	4.3 Summary	4-3
23	Table 4-1 Lead Detected in Surface Soil - Additional Investigation, 2002	4-5
24	Table 4-2 Lead Detected in Subsurface Soil - Additional Investigation, 2002.....	4-6
25	Figure 4-1 Additional Sampling Locations	4-7
26	5.0 COPC/COC Refinement	5-1
27	5.1 COCs in Surface Soil at AOC 579.....	5-1
28	5.1.1 Rescreening of Surface Soil VOC Data Based on SSL (DAF=1).....	5-1
29	5.1.2 Antimony in Surface Soil	5-1
30	5.1.3 Arsenic in Surface Soil.....	5-2
31	5.1.4 Copper in Surface Soil	5-3
32	5.1.5 Mercury in Surface Soil	5-3
33	5.1.6 BEQs in Surface Soil.....	5-4
34	5.2 COCs in Subsurface Soil at AOC 579	5-5

1	5.2.1	Rescreening of Subsurface Soil VOC Data Based on SSL (DAF=1)	5-5
2	5.2.2	Antimony in Subsurface Soil	5-5
3	5.2.3	Arsenic in Subsurface Soil	5-5
4	5.2.4	Copper in Subsurface Soil	5-7
5	5.2.5	Mercury in Subsurface Soil	5-7
6	5.2.6	BEQs in Subsurface Soil	5-7
7	5.3	Summary	5-7
8	Table 5-1	COPCs in Surface Soil	5-8
9	Table 5-2	COPCs in Subsurface Soil	5-9
10	Figure 5-1	Antimony in Surface Soil	5-10
11	Figure 5-2	Arsenic in Surface Soil	5-11
12	Figure 5-3	Mercury in Surface Soil	5-12
13	Figure 5-4	Antimony in Subsurface Soil	5-13
14	Figure 5-5	Arsenic in Subsurface Soil	5-14
15	Figure 5-6	Mercury in Subsurface Soil	5-15
16	6.0	Summary of Information Related to Site Closeout Issues	6-1
17	6.1	Status of the RFI	6-1
18	6.2	Presence of Inorganics in Groundwater	6-1
19	6.3	Potential Linkage to SWMU 37, Investigated Sanitary Sewers at the CNC	6-1
20	6.4	Potential Linkage to AOC 699, Investigated Storm Sewers at the CNC	6-2
21	6.5	Potential Linkage to AOC 504, Investigated Railroad Lines at the CNC	6-2
22	6.6	Potential Migration Pathways to Surface Water Bodies at the CNC	6-2
23	6.7	Potential Contamination in Oil/Water Separators (OWSs)	6-3
24	6.8	Land Use Control Management Plan	6-3
25	7.0	Recommendations	7-1
26	8.0	References	8-1
27			
28	Appendices		
29	A	AOC 579 RFI Field Investigation Surface Soil and Subsurface Soil Analytical	
30		Results	
31	B	AOC 579 Additional Sampling Data Validation Report and Analytical Results	
32		(January 2002)	

1 Acronyms and Abbreviations

2	AOC	area of concern
3	AST	aboveground storage tank
4	BCT	BRAC Cleanup Team
5	BEQ	benzo(a)pyrene equivalent
6	BRAC	Base Realignment and Closure Act
7	BRC	background reference concentration
8	CA	corrective action
9	CMS	corrective measures study
10	CNC	Charleston Naval Complex
11	COC	chemical of concern
12	COPC	chemical of potential concern
13	CSI	confirmatory sampling investigation
14	DAF	dilution attenuation factor
15	EnSafe	EnSafe Inc.
16	EPA	U.S. Environmental Protection Agency
17	EPC	exposure point concentration
18	ft bls	feet below land surface
19	IM	interim measure
20	HHRA	human health risk assessment
21	HI	hazard index
22	MCL	maximum contaminant level
23	µg/L	microgram per liter
24	mg/kg	milligram per kilogram
25	NAVBASE	Naval Base
26	NFA	no further action
27	NFI	no further investigation
28	OWS	oil/water separator

1 **Acronyms and Abbreviations, Continued**

2	RBC	risk-based concentration
3	RCRA	Resource Conservation and Recovery Act
4	RFA	RCRA Facility Assessment
5	RFI	RCRA Facility Investigation
6	SCDHEC	South Carolina Department of Health and Environmental Control
7	SSL	soil screening level
8	SVOC	semivolatile organic compound
9	SWMU	solid waste management unit
10	UST	underground storage tank
11	VOC	volatile organic compound

1.0 Introduction

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

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

11 In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation
12 and remediation services at the CNC. This submittal has been prepared by CH2M-Jones to
13 complete the RCRA Facility Investigation (RFI) for Area of Concern (AOC) 579 in Zone E of
14 the CNC. The site is recommended for no further action (NFA). The area of the CNC in
15 which AOC 579 is located is zoned for future industrial use. Figure 1-1 illustrates the
16 location of AOC 579 within Zone E. Figure 1-2 is an aerial photograph of AOC 579 taken in
17 1997.

1.1 Background

19 AOC 579 is a former paint shop located in Building 1035 (see Figure 1-2). This is a small
20 metal structure located within the industrial part of Zone E between two large buildings
21 (Buildings 1178 and 0010). Built in 1919, Building 1035 was used for meat storage and
22 inspection until 1943. From 1943 to 1955, this unit was used as a cafeteria and storehouse.
23 From 1955 until approximately 1977, it was used to store paint. At the time the RCRA
24 Facility Assessment (RFA) was completed, the site was being used as an electrician's
25 storehouse. In November 2001, a site inspection revealed that the building is currently being
26 used for storage of large sacks containing a white powder – likely gypsum or kaolin (see
27 Figure 1-3). Railroad lines used to pass on the west, south, and east sides of Building 1035.
28 Historic engineering drawings indicate that the railroad lines were present between 1955
29 and 1962 and were removed or discontinued between 1977 and 1987.

30 Little information could be found regarding the design, operating practices, and waste
31 disposal methods associated with the paint shop.

1 Materials of concern for RCRA investigations at this unit are identified in the *Final Zone E*
2 *RFI Work Plan* (EnSafe Inc. [EnSafe]/Allen & Hoshall, 1995) and include paints and
3 solvents. To fulfill the confirmatory sampling investigation (CSI) objectives for AOC 579,
4 soil was sampled in accordance with the *Final Zone E RFI Work Plan* and Section 5.0 of the
5 *Zone E RFI Report, Revision 0* (EnSafe, 1997) to determine whether any contamination
6 resulted from onsite activities. Based on review of the RFI data, a supplemental sampling
7 event was conducted in January 2002.

8 **1.2 Purpose of the RFI Report Addendum**

9 This RFI Report Addendum provides information about AOC 579, including the
10 conclusions from the RFI report and the results of the additional sampling performed after
11 the RFI report was issued. The results of additional investigations are presented to complete
12 the nature and extent investigation for chemicals of potential concern (COPCs) previously
13 identified in surface soil and subsurface soil. AOC 579 is recommended for NFA.

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

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

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

27 Provided that the information presented in this report is adequate to address these site
28 closeout items, it is expected that the BCT will concur that NFA is appropriate for the site.
29 At that time, a Statement of Basis will be prepared and made available for public comment
30 in accordance with SCDHEC policy. This will allow for public participation in the final
31 remedy selection.

1 **1.3 Report Organization**

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

4 **1.0 Introduction** – Presents the purpose of and background information relating to this RFI
5 Report Addendum.

6 **2.0 Summary of RFI Conclusions for AOC 579** – Summarizes the conclusions from the RFI
7 investigations and risk evaluations for AOC 579.

8 **3.0 Interim Measures and UST/AST Removals** – Summarizes any interim measures (IMs)
9 or underground storage tank (UST)/aboveground storage tank (AST) removals conducted
10 at the site.

11 **4.0 Summary of Additional Investigations** – Summarizes the data collected after the
12 completion of the RFI report.

13 **5.0 COPC/COC Refinement** – Identifies and evaluates COPCs based on current screening
14 criteria using all RFI data.

15 **6.0 Summary of Information Related to Site Closeout Issues** – Discusses the various issues
16 that the BCT agreed to evaluate prior to site closeout.

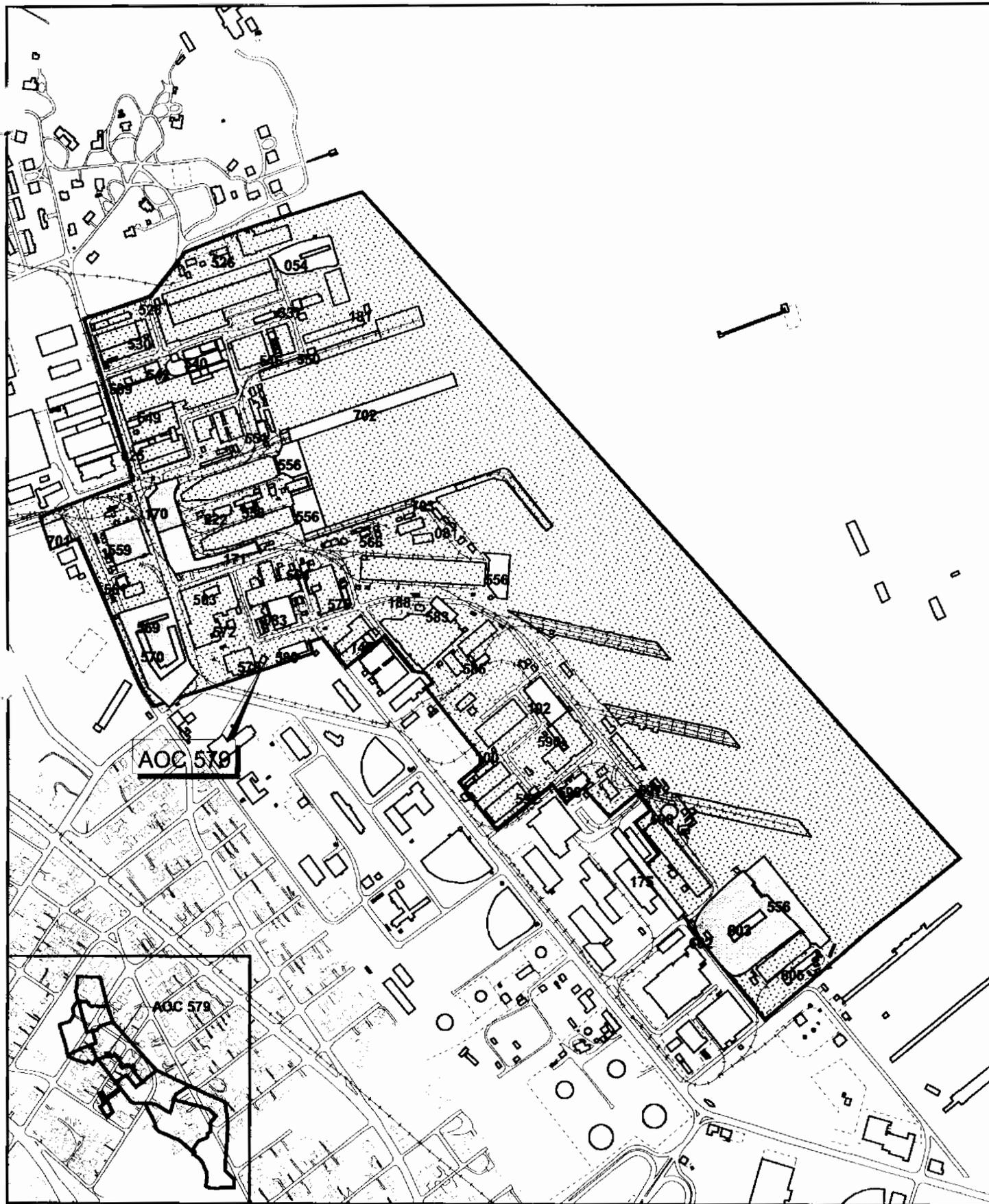
17 **7.0 Recommendations** – Provides recommendations for proceeding with site closure.

18 **8.0 References** – Lists the references used in this document.

19 **Appendix A** contains summary tables of all constituents detected in surface and subsurface
20 soils as a result of the RFI field investigation.

21 **Appendix B** contains analytical data and data validation report summaries from CH2M-
22 Jones' sampling subsequent to the RFI report.

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



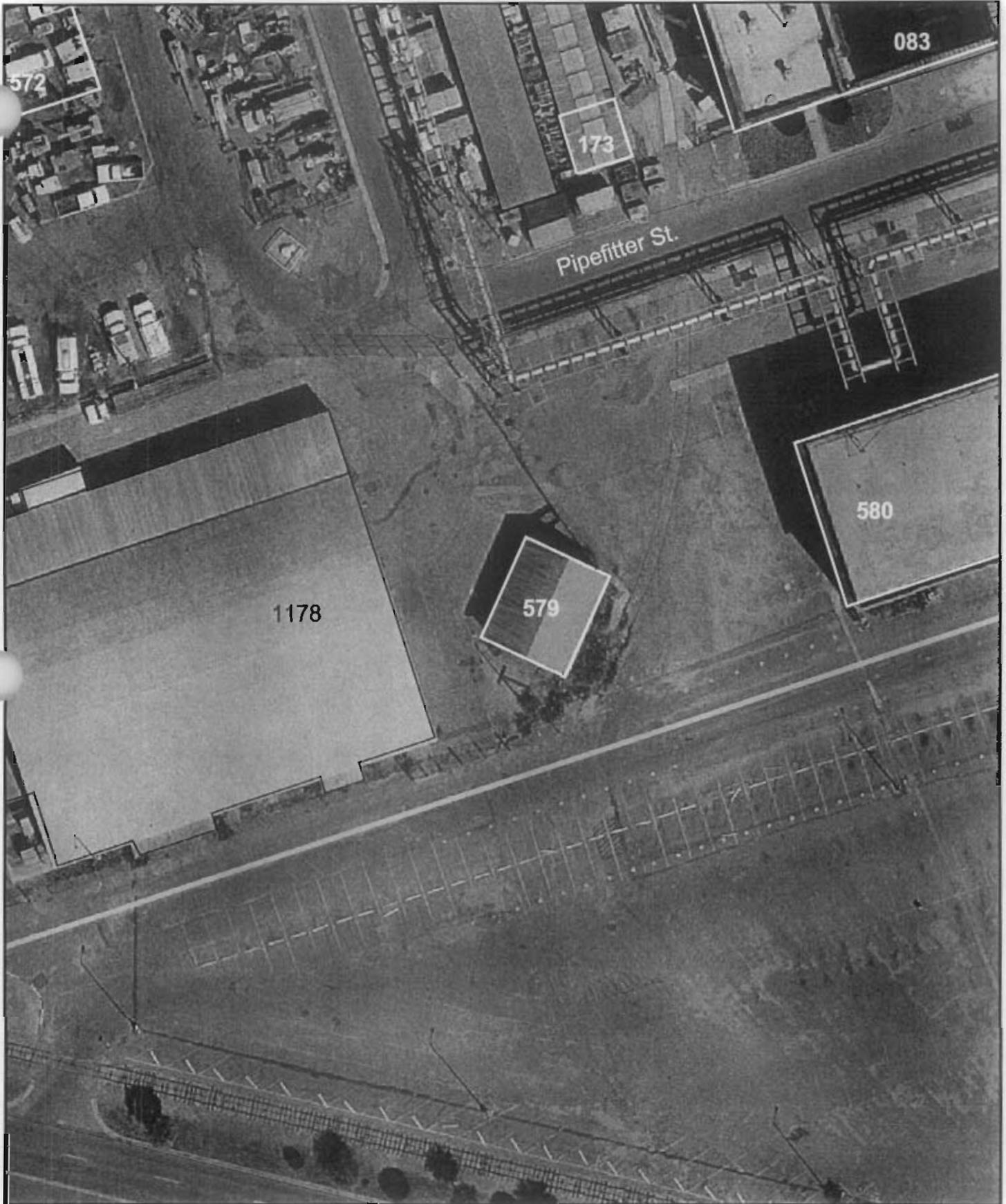
 Zone E Boundary
 SWMU/AOC Within Zone E Boundary



0 800 1600 Feet

1 inch = 800 feet

Figure 1-1
 Zone E Within CNC
 AOC 579, Zone E
 Charleston Naval Complex



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



1 inch = 50 feet

Figure 1-2
 Site Map
 AOC 579, Zone E
 Charleston Naval Complex



Figure 1-3
Bags of White Powder Stored in Building 1035
AOC 579, Zone E
Charleston Naval Complex

CH2MHILL

1 **2.0 Summary of RFI Conclusions for AOC 579**

2 As part of the CNC Zone E RFI, soil investigations were conducted in the area immediately
3 surrounding Building 1035. Figure 2-1 illustrates the site features and RFI sampling
4 locations.

5 Samples were collected in two sampling events at AOC 579. In September 1995, four soil
6 borings (E579SB001 through E579SB004) were installed at AOC 579 to determine if the paint
7 and solvent storage activities had impacted surrounding surface soil (0 to 1 foot below land
8 surface [ft bls]) and subsurface soil (3 to 5 ft bls). In accordance with the approved RFI work
9 plan, these samples were analyzed for volatile organic compounds (VOCs), semivolatile
10 organic compounds (SVOCs), and metals.

11 A second sampling event was conducted in September 1996, when two additional surface
12 soil and two collocated subsurface soil samples were collected (E579SB005 and E579SB006).
13 These samples were analyzed for SVOCs and metals, only.

14 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) presented the analytical results for these six
15 surface and six subsurface soil samples, data evaluation, and conclusions concerning
16 contamination and risk. Conclusions from the RFI report are summarized below.

17 **2.1 Soil Sampling and Analysis**

18 In the RFI report, the results of surface soil analyses were compared to the applicable
19 screening criteria: the U.S. Environmental Protection Agency (EPA) Region III residential
20 land use and industrial risk-based concentrations (RBCs) and the generic soil-to-
21 groundwater migration soil screening levels (SSLs) (with dilution attenuation factor
22 [DAF]=10 and DAF=1). The soil data were also evaluated to assess the potential of soil
23 contamination to migrate into surface water and air, neither of which were determined to
24 be significant migration pathways.

25 The evaluation also included a comparison of inorganic constituents to Zone E background
26 reference concentrations (BRCs) for surface and subsurface soil.

27 Analytes that exceeded the screening criteria were considered to be COPCs in the RFI and
28 were retained for further evaluation in the risk assessment to determine which were
29 considered chemicals of concern (COCs). Analytical data collected during the RFI field
30 investigation are included in Appendix A of this RFI Report Addendum.

1 **2.1.1 Surface Soil Results**

2 The RFI report (Section 10.39.5) presented the following conclusions regarding the surface
3 soil samples collected and analyzed at AOC 579:

- 4 • Benzo(a)pyrene equivalents (BEQs) and arsenic were identified as COCs because these
5 constituents were present at concentrations exceeding their respective residential land
6 use RBCs in surface soil samples.
- 7 • Antimony, copper, and mercury were identified as COCs because these constituents
8 were present at concentrations exceeding their respective residential land use RBCs in
9 one surface soil sample.

10 The RFI report included several potential options for corrective action, including no action,
11 intrinsic remediation, containment, excavation, in situ treatment, and ex situ treatment.

12 **2.1.2 Subsurface Soil Results**

13 The RFI report (Section 10.39.3.1 and 10.39.3.2) evaluated the analytical results for the soil to
14 groundwater pathway and the soil to groundwater to surface pathways for subsurface soil,
15 using BRCs, SSLs and, as needed, surface water dilution factors. Based on this evaluation,
16 no COPCs were identified in subsurface soil that posed a threat to human health or the
17 environment. There were no organic or inorganic COPCs identified for subsurface soil in
18 the RFI report.

19 **2.2 Groundwater Sampling and Analysis**

20 Shallow groundwater in the vicinity of AOC 579 generally flows northeast toward Dry
21 Dock 5 (see Figure 2-2). There is a small localized groundwater depression toward the east,
22 beneath Building 10, but groundwater ultimately flows regionally toward the Cooper River.
23 Groundwater was not sampled at AOC 579 as part of the RFI.

24 **2.3 COPC/COC Summary**

25 The RFI report concluded that, based on the analytical results and the human health risk
26 assessment (HHRA), the following COCs were identified for surface soil at AOC 579 under
27 a residential land use scenario:

- 28 • Antimony
- 29 • Arsenic
- 30 • Copper

1 • Mercury

2 • BEQs

3 No constituents were identified as COCs under an industrial land use (site worker)
4 scenario. The RFI report recommended a corrective measures study (CMS) to address
5 antimony, arsenic, copper, mercury, and BEQs in surface soil.

6 No COCs were identified for subsurface soil at AOC 579, as none of the six subsurface soil
7 samples had constituents present at concentrations above the screening criteria for
8 migration into groundwater, surface water, or air. The COCs identified for surface soil are
9 discussed relative to the subsurface soil in Section 5.0 of this RFI Report Addendum.



- Soil Sample
- ⋈ Fence
- ≡ Railroads
- ≡ Roads
- ▭ AOC Boundary
- ▭ Zone Boundary



0 30 60 Feet

1 inch = 25 feet

Figure 2-1
Soil Sample Locations
AOC 579, Zone E
Charleston Naval Complex



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

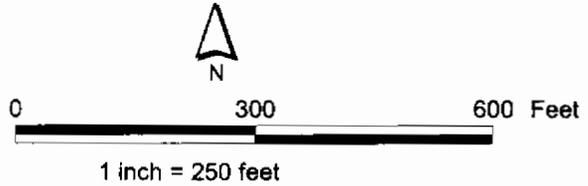


Figure 2-2
 Shallow Groundwater Contours
 AOC 579, Zone E
 Charleston Naval Complex

1 **3.0 Interim Measures and UST/AST Removals**

2 There are no known USTs or ASTs associated with AOC 579.

3 No IMs have been conducted at AOC 579 to date.

4 Visual inspections made by CH2M-Jones during 2001 indicated that no physical evidence of
5 the former paint and solvent storage operations (conducted 25 to 47 years ago) remains at
6 the site.

4.0 Summary of Additional Investigations

In January 2002, additional field activities were conducted in the vicinity of AOC 579 by the CH2M-Jones team to complete the delineation of the nature and extent of constituents detected in the surface and subsurface soils. The field activities were conducted in accordance with the *Areas of Concern 579 and 580 Sampling and Analysis Plan, Revision 0* (CH2M-Jones, 2001) and the *Zone E RFI Work Plan* (EnSafe, 1995).

As part of this effort, a total of three surface soil and four subsurface soil samples were collected and analyzed. Two sets of surface and subsurface soil samples were analyzed for antimony, arsenic, and mercury (E579SB00701/02 and E579SB00901/02) to complete the final delineation of the extent of these constituents. In addition, another pair of surface and subsurface soil samples (E579SB00801/02) were collected from the same location as RFI samples E579SB00201 and E579SB00202 and analyzed for antimony, arsenic, and mercury to provide confirmation of the concentrations observed in the RFI samples. Also for confirmation purposes, a subsurface soil sample (E579SB01002) was collected at RFI sample location E579SB006. Additional sample locations are shown in Figure 4-1. The data validation report and analytical data for these samples are presented in Appendix B of this RFI Report Addendum.

Although soil samples collected from the 0 to 1 ft bls interval are referred to as surface soil samples, most of the surrounding area is paved with asphalt, with the exposed soil limited to a small overgrown landscaped grass strip located along the southeastern corner of Building 1035. Thus, surface soils are primarily representative of the soils beneath the asphalt pavement and only two of the surface soil sample locations (E579SB002/008 and E579SB006) were in the grassy area. There is very limited direct access for contact (ingestion and dermal) or leachability potential for the constituents reported around AOC 579 at the present time. The screening criteria used to identify COPCs represent a conservative analysis for future human health protection in the event that the asphalt cover is removed. This approach is consistent for all sites across the CNC.

Surface soil sampling results were screened against EPA Region III RBCs (non-carcinogen at hazard index [HI]=0.1) and the generic soil-to-groundwater SSLs (DAF=1 for VOCs, DAF=10 for all other parameters). Results for inorganic constituents were also compared to the range of these chemical concentrations detected in surface soil samples collected at grid

locations in Zone E. COCs are discussed further in Section 5.0 of this RFI Report Addendum.

Similarly, subsurface soil results were compared to SSLs and the range of chemicals detected in subsurface soil samples collected at grid locations in Zone E.

4.1 Surface Soil Results

The analytical results for the samples collected in January 2002 are presented in Table 4-1. Values that exceed the COPC screening criteria are in bold text and outlined in the table. Each of the COPCs is discussed briefly below and in more detail in Section 5.0.

Antimony in Surface Soil

Antimony was detected in all three surface soil samples at concentrations ranging from 1.13 milligrams per kilogram (mg/kg) to 6.11 mg/kg, which does not exceed the Zone E background range of 0.5 mg/kg to 7.4 mg/kg.

Arsenic in Surface Soil

Arsenic was detected in all three surface soil samples at concentrations ranging from 3.03 mg/kg to 149 mg/kg. Arsenic concentrations in two of these samples exceeded the Zone E background range of 0.95 mg/kg to 68 mg/kg, as well as the EPA Region III residential RBC and SSL.

Mercury in Surface Soil

Mercury was detected in surface soil samples collected from all three locations at concentrations ranging from 1.7 mg/kg to 19.2 mg/kg. The lowest concentration was reported in the duplicate sample collected from sample location E579SB009, where the maximum concentration (19.2 mg/kg) was also detected (see Table 4-1). Mercury concentrations in three of the four samples exceeded the Zone E background range of 0.03 mg/kg to 2.7 mg/kg, as well as the EPA Region III residential RBC (at HI = 0.1), but the concentrations were not above the industrial RBC.

4.2 Subsurface Soil Results

The analytical results for the subsurface soil samples collected in 2002 are presented in Table 4-2. Values that exceed the COPC screening criteria are in bold text and outlined in the table. Each of the chemicals identified as exceeding the criteria (i.e., COPCs) is discussed briefly below and in more detail in Section 5.0.

Antimony in Subsurface Soil

Antimony was detected in one of three subsurface soil samples at a concentration of 1.52 J mg/kg, which does not exceed the Zone E background range of 0.52 mg/kg to 1.6 mg/kg for antimony.

Arsenic in Subsurface Soil

Arsenic was detected in all four subsurface soil samples at concentrations ranging from 3.27 mg/kg to 178 mg/kg. Arsenic concentrations in two of the samples exceeded the Zone E background range of 0.83 mg/kg to 26 mg/kg, and arsenic concentrations in three of the samples exceeded the SSL value for arsenic of 14.5 mg/kg (DAF=10).

Mercury in Subsurface Soil

Mercury was detected in three subsurface soil samples at concentrations ranging from 0.0429J mg/kg to 0.631 mg/kg. Mercury concentrations in all three samples were within the Zone E background range of 0.04 mg/kg to 0.90 mg/kg and below the SSL value of 1 mg/kg.

4.3 Summary

Based on these additional samples, antimony, arsenic, and mercury are identified as COPCs in surface soil. Arsenic is also identified as a COPC in subsurface soil. The nature and extent of all COPCs have now been delineated.

TABLE 4-1
 Lead Detected in Surface Soil - Additional Investigation, 2002
 RFI Report Addendum, AOC 579, Zone E, Charleston Naval Complex

Sample Station	ID	Date	Antimony Result (mg/kg)	Qualifier	Arsenic Result (mg/kg)	Qualifier	Mercury Result (mg/kg)	Qualifier
			Res RBC	3.1		0.43	23*	
			Ind RBC	820		3.8	610	
			SSL	2.5		14.5	1	
			Bkgd	7.4		68	2.7	
579SB007	579SB00701	01/11/2002	3.63	J	149	=	2.86	=
579SB008	579SB00801	01/11/2002	6.11	J	71.6	=	7.65	=
579SB009	579SB00901	01/11/2002	1.13	J	9.56	=	19.2	=
579SB009	579SB00901-D	01/11/2002	1.9	J	3.03	=	1.7	=

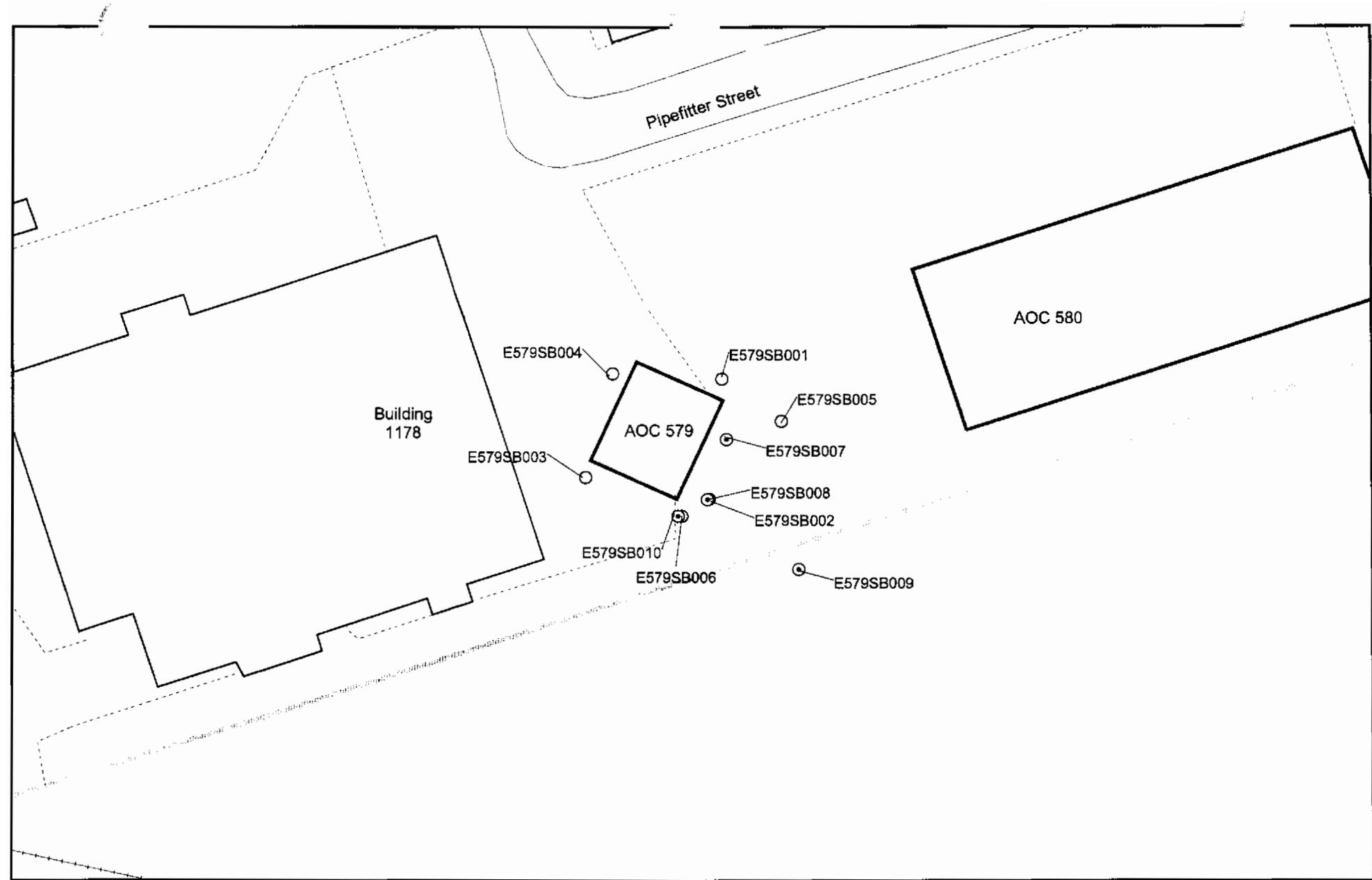
NA = Not Analyzed

* = The residential RBC for mercury is based on an HI = 1.

TABLE 4-2
 Lead Detected in Subsurface Soil - Additional Investigation, 2002
 RFI Report Addendum, AOC 579, Zone E, Charleston Naval Complex

Sample Station	ID	Date		Antimony Result (mg/kg)	Qualifier	Arsenic Result (mg/kg)	Qualifier	Mercury Result (mg/kg)	Qualifier
			Res RBC	3.1		0.43		NA	
			Ind RBC	820		3.8		NA	
			SSL	2.5		14.5		NA	
			Bkgd	1.6		26		0.9	
579SB007	579SB00702	01/11/2002		1.52	J	27.4	=	0.631	=
579SB008	579SB00802	01/11/2002		0.0858	U	3.27	=	0.0429	J
579SB009	579SB00902	01/11/2002		0.434	U	22.1	=	0.477	=
579SB010	579SB01001	01/11/2002		NA		178	=	NA	

NA = Not Analyzed



- Soil Sample
- ⊙ Additional Soil Sample
- Fence
- Roads
- ▭ AOC Boundary
- Zone Boundary

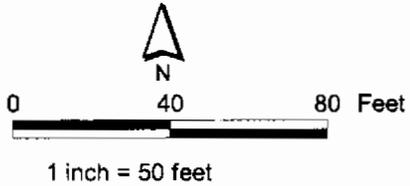


Figure 4-1
 Additional Sampling Locations
 AOC 579, Zone E
 Charleston Naval Complex

Section 5.0

1 5.0 COPC/COC Refinement

2 This section discusses compounds that were identified as COCs for AOC 579 in the *Zone E*
3 *RFI Report, Revision 0* (EnSafe, 1997), as well as compounds identified as COPCs based on
4 additional sampling in 2002.

5 5.1 COCs in Surface Soil at AOC 579

6 The COCs identified in surface soil for AOC 579 in the RFI report included:

- 7 • Antimony
- 8 • Arsenic
- 9 • Copper
- 10 • Mercury
- 11 • BEQs

12 Analytical data for each of these constituents are presented in Table 5-1 and discussed in
13 detail below.

14 5.1.1 Rescreening of Surface Soil VOC Data Based on SSL (DAF=1)

15 No VOCs were detected in surface soil at the site,¹ so rescreening using SSLs with a DAF=1
16 was not necessary. No VOCs identified as COCs for surface or subsurface soil at AOC 579.

17 5.1.2 Antimony in Surface Soil

18 Antimony was detected in only one of the six RFI samples at a concentration of 7.7 mg/kg
19 (E579SB00201), which slightly exceeded the Zone E background range for antimony of
20 0.5 mg/kg to 7.4 mg/kg (see Table 5-1 and Figure 5-1). Based on this single exceedance,
21 confirmation and delineation samples were collected.

22 All of the additional samples were collected from within a short distance (10 feet and
23 40 feet) of sample location E579SB00201, where the single detection and exceedance had
24 occurred. The additional sample collected from E579SB00801 was collocated with RFI
25 sample location E579SB00201. The antimony concentration in E579SB00801 was 6.11
26 J mg/kg, which is comparable to the concentration reported in the original sample collected

¹ Acetone was identified in the RFI report as having been detected in one of the four RFI surface soil samples. However, review of the data summary tables provided in Appendix H of the RFI report does not indicate that acetone was actually detected. It appears that acetone was inadvertently included in the data evaluation discussions presented in Section 10.39 of the Zone E RFI Report, Revision 0.

1 at this location (7.7 mg/kg), but falls within the Zone E background range for antimony.
2 Antimony concentrations in all of the additional samples were within the Zone E
3 background range.

4 Given that antimony is a naturally occurring metal consistently found in soils throughout
5 Zone E and that the observed concentrations are within the background range, antimony is
6 not considered a COC in surface soil at AOC 579.

7 **5.1.3 Arsenic in Surface Soil**

8 Arsenic was detected in all six samples collected during the RFI investigation and all three
9 samples collected as part of the additional investigation (see Table 5-1 and Figure 5-2).
10 Three of the nine samples had arsenic concentrations that exceeded the Zone E arsenic
11 background range of 0.95 mg/kg to 68 mg/kg. Two of the three exceedances were collected
12 at collocated sample station (61.7 mg/kg at E579SB00201 and 71.6 mg/kg at E579SB00801),
13 which confirmed the RFI results. The third exceedance occurred at E579SB00701
14 (approximately 25 feet northeast of E579SB002/E579SB008) at a concentration of
15 149 mg/kg.

16 Although these three exceedances are above the Zone E background range, the two
17 locations where these samples were collected are immediately adjacent to the abandoned
18 railroad lines. As shown in Figure 2-2, impressions of the railroad lines remain visible in the
19 existing pavement. An additional background study conducted of the railroad lines
20 indicated the presence of arsenic in surface soil along the railroad lines at elevated
21 concentrations ranging between 2 to 92 mg/kg (CH2M-Jones, 2001). The elevated
22 concentrations along the railroad lines and in the small landscaped area along the
23 southeastern corner of Building 1035 are likely related to the routine application of arsenical
24 pesticides in these areas as part of facility maintenance. The concentrations detected are
25 similar to those detected elsewhere within Zone E. Additionally, the previously detected
26 maximum arsenic concentration of 61.7 mg/kg at E579SB00201 also had elevated copper at
27 686 mg/kg (see Table 5-1), indicating that the detected arsenic might be related to a copper-
28 chromium-arsenic (CCA)-type of pesticide application.

29 The average arsenic concentration at AOC 579 is estimated at 31 mg/kg. The surface soil in
30 this area is covered with asphalt, with the exception of the small area immediately
31 southeast of Building 1035, so direct contact-related exposures are likely to be limited. The
32 presence of asphalt also minimizes leachability from soil to groundwater. The arsenic
33 concentration was greater than the SSL value of 14.5 mg/kg (DAF=10) at two surface soil
34 sampling locations (E579SB002/008 and E579SB007). However, the corresponding

1 subsurface soil samples had arsenic concentrations that were within the Zone E background
2 range, indicating that arsenic is not very leachable (or has not been recently applied). Thus,
3 the arsenic in surface soil at AOC 579 is not readily leaching from surface soils into the
4 subsurface environment.

5 In addition, although there are no groundwater wells associated with AOC 579, there is a
6 monitoring well approximately 100 feet downgradient from the maximum arsenic detection
7 (E579GW002). Data were collected during four groundwater sampling events, and none of
8 the results indicated elevated arsenic levels.

9 Given that AOC 579 is located in an industrial area that will continue to be industrial in the
10 future with appropriate land use controls, the EPA Region IV guidance target concentration
11 for industrial scenarios (270 mg/kg) can be considered a target value for arsenic at this site
12 under the continued industrial land use exposure scenario. As can be seen from the values
13 presented in Table 5-1, the average arsenic concentration is 28.3 mg/kg, so the average
14 concentration of arsenic at this site is within the background range of 0.95 mg/kg to
15 68 mg/kg. For these reasons, arsenic is not considered a COC for surface soil at AOC 579.

16 **5.1.4 Copper in Surface Soil**

17 Copper was detected in all six samples collected during the RFI investigation at
18 concentrations ranging from 2.3 mg/kg (E579SB004) to 686 mg/kg (E579SB002) (see
19 Table 5-2). Copper was identified as a COC in the RFI report, because the copper
20 concentration of 686 mg/kg observed at E579SB002 exceeded the EPA Region III residential
21 RBC of 310 mg/kg (HI = 0.1). The occurrence of copper may be associated with the routine
22 historical application of a CCA-type of pesticide across the base, as similar concentrations
23 were detected across Zone E and in the background sampling along the railroad lines. The
24 maximum detected copper concentration occurred in the same sample as the maximum
25 detected arsenic concentration (see Table 5-1). When compared to the Zone E background
26 range for copper of 0.47 mg/kg to 866 mg/kg, the concentration of 686 mg/kg falls within
27 the background range. Copper concentrations at the site are well below the residential RBC
28 of 3,100 mg/kg (HI = 1.0). In addition, copper is not associated with site operations. For
29 these reasons, copper is not a COC at AOC 579.

30 **5.1.5 Mercury in Surface Soil**

31 Mercury was detected in five of the six surface soil samples collected during the RFI
32 investigation at concentrations ranging from 0.08 mg/kg to 8 mg/kg. Mercury was detected
33 in all three samples collected as part of the additional investigation at concentrations
34 ranging from 1.7 to 19.2 mg/kg. The only sample collected during the RFI field investigation

1 that exceeded the Zone E background range of 0.03 mg/kg to 2.7 mg/kg was from
2 E579SB002, where mercury was detected at a concentration of 8 mg/kg. The additional
3 sample collected at E579SB008, which was collocated with E579SB002, had a concentration
4 of 7.65 mg/kg, which confirms the findings of the RFI.

5 Both the SSL value of 1 mg/kg (DAF=10) and the Zone E background range for mercury
6 were exceeded in four of the nine samples collected. Of these four samples, two of them
7 were collocated (E579SB002/E579SB008).

8 The highest concentration of mercury detected was 19.2 mg/kg in the sample collected at
9 E579SB00901. However the duplicate sample collected from this location had a reported
10 concentration of 1.7 mg/kg.

11 The Zone E background range for mercury is greater than the SSL, so that the Zone E
12 background range is the appropriate screening value from a leachability perspective. None
13 of the samples collected exceeded the EPA Region III residential RBC of 23 mg/kg (HI = 1).
14 Since mercury is non-carcinogenic and the only COPC remaining to be evaluated for
15 surface soil, the total potential HI contribution in surface soil comes solely from the
16 presence of mercury. In accordance with the evaluation procedures identified by the BCT
17 for consideration of human health risks for non-carcinogenic chemicals from a single
18 constituent, it is appropriate to evaluate mercury relative to the EPA Region III residential
19 RBC of 23 mg/kg. None of the detected values of mercury in the surface soil exceeded the
20 EPA Region III residential RBC (see Table 5-1 and Figure 5-3). For these reasons, mercury is
21 not considered a COC at AOC 579.

22 Furthermore, a review of these sample locations shows they are located either adjacent to
23 the former railroad lines that ran within 10 feet of Building 1035 or lie beyond the other side
24 of the railroad lines. In addition, mercury is a volatile metal, which had exceedances in
25 surface soil, but not in subsurface soil (see Section 5.5.5, below). In surface soil environment,
26 mercury tends to volatilize over time. Given that AOC 579 is located in an industrial area
27 that will continue to be industrial in the future with appropriate land use controls, the EPA
28 Region III residential RBC of 23 mg/kg can be considered a target value for mercury at this
29 site. Mercury is not considered a COC for surface soil at AOC 579.

30 **5.1.6 BEQs in Surface Soil**

31 BEQs were detected in five of the six surface soil samples collected during the RFI
32 investigation at concentrations ranging from 0.291 mg/kg (E579SB005) to 1.216 mg/kg
33 (E579SB002) (see Table 5-1). BEQs were identified as a COC in the RFI report, because the
34 BEQ values observed at E579SB002 exceeded the EPA Region III residential RBC of 0.088

1 mg/kg. However, when compared to the sitewide reference concentration for BEQs in
2 surface soil of 1.304 mg/kg, there are no exceedances. For this reason, BEQs are not
3 identified as a COC for surface soil at AOC 579.

4 **5.2 COCs in Subsurface Soil at AOC 579**

5 No COPCs, and consequently no COCs, were identified for subsurface soil at AOC 579.
6 Therefore, CH2M-Jones screened subsurface soil analytical results for all surface soil COCs
7 identified in the RFI report against current COPC screening criteria.

8 The COCs identified in surface soil which were evaluated as subsurface soil COPCs for
9 AOC 579 in the RFI report included:

- 10 • Antimony
- 11 • Arsenic
- 12 • Copper
- 13 • Mercury
- 14 • BEQs

15 Analytical data for each of these constituents are presented in Table 5-2 and discussed in
16 detail below.

17 **5.2.1 Rescreening of Subsurface Soil VOC Data Based on SSL (DAF=1)**

18 The only VOC detected in subsurface soil at AOC 579 was naphthalene, which was detected
19 at a concentration of 0.063 J mg/kg in a single sample (E579SB00602). The detected value of
20 naphthalene is well below the SSL value of 4 mg/kg (DAF=1). Therefore, naphthalene is not
21 a COC for subsurface soil at this site. No VOCs are identified as COCs for this site.

22 **5.2.2 Antimony in Subsurface Soil**

23 Antimony was detected in two of the six samples collected during the RFI investigation and
24 in one of the three subsurface soil samples collected as part of the additional investigation.
25 Concentrations of antimony in the subsurface soil ranged from 0.65 J mg/kg (E579SB002) to
26 1.52 J mg/kg (E579SB007) (see Table 5-2). None of the detected values exceeded either the
27 Zone E background range of 0.52 mg/kg to 1.6 mg/kg or the SSL of 2.5 mg/kg. For these
28 reasons, antimony is not considered a COC in subsurface soil at AOC 579.

29 **5.2.3 Arsenic in Subsurface Soil**

30 Arsenic was detected in all six samples collected during the RFI investigation and in all four
31 samples collected as part of the additional investigation (see Table 5-2 and Figure 5-4). The

1 Zone E background range for arsenic is 0.83 mg/kg to 26 mg/kg and the SSL value is
2 14.5 mg/kg (DAF = 10). The applicable COPC screening criteria is the background
3 concentration range. Three samples (one from the RFI field investigation and two from the
4 additional sampling event) had arsenic concentrations that exceeded the Zone E arsenic
5 background range. Of these three exceedances, the sample collected from E579SB01002 was
6 collocated with RFI sample location E579SB00602 and confirmed the RFI results. The
7 exceedance at E579SB00702 (27.4 mg/kg) was located near the northeast corner of Building
8 1035.

9 Although these three exceedances are above the Zone E background range, both locations
10 are immediately adjacent to the abandoned railroad line east of Building 1035 and detected
11 concentrations are thought to be related to the application of arsenic-containing pesticides
12 for weed control. As shown in Figure 2-1 and discussed in Section 5.1.3, there is a clear
13 impression in the pavement showing where this railroad line passed by the eastern side of
14 Building 1035.

15 The average arsenic levels in subsurface soil are estimated at 29.6 mg/kg (see Table 5-2),
16 which is above an SSL of 14.5 mg/kg (DAF=10), but is close to the range of Zone E
17 background samples and consistent with the EPA SSL of 29 mg/kg (DAF=20). Considering
18 most of the area is paved, this higher SSL should be considered applicable. Since there are
19 no wells within this small site, adjacent downgradient wells were checked to see if arsenic
20 was elevated in any them. Although it is not ideal to evaluate wells from adjacent sites,
21 there are no wells associated with AOC 579. For this reason, the nearest well was evaluated:
22 580GW00201, which is 100 feet downgradient from AOC 579. This well had arsenic levels
23 that ranged between 8.3 to 15.5 micrograms per liter ($\mu\text{g/L}$) in the four sampling events,
24 with the latest sampling showing 8.6 $\mu\text{g/L}$. Since local groundwater had arsenic levels well
25 below the maximum contaminant level (MCL) of 50 $\mu\text{g/L}$, arsenic does not appear to be
26 leaching to groundwater.

27 Although it is elevated in some of the subsurface soil samples, its presence is not related to
28 site operations; similar concentrations are observed across CNC at other sites, railroad lines
29 and paved areas; and site-wide averages are similar to the screening criteria.

30 Given that AOC 579 is currently located in an industrial area that will continue to be
31 industrial in the future with appropriate land use controls, the EPA Region IV guidance
32 target concentration for industrial scenarios (270 mg/kg) can be considered a target value
33 for arsenic at this site under the continued industrial land use exposure scenario. For these
34 reasons, arsenic is not considered a COC for subsurface soil at AOC 579.

1 **5.2.4 Copper in Subsurface Soil**

2 Copper was detected in all six samples collected during the RFI investigation at
3 concentrations ranging from 0.7 mg/kg (E579SB003) to 37.1 mg/kg (E579SB006) (see Table
4 5-2). None of the concentrations exceeded the Zone E background range for copper of
5 1.3 mg/kg to 192 mg/kg. For this reason, copper is not considered a COC for subsurface
6 soil at AOC 579.

7 **5.2.5 Mercury in Subsurface Soil**

8 Mercury was detected in three of the six subsurface soil samples collected during the RFI
9 field investigation at concentrations ranging from 0.07 mg/kg to 0.14 mg/kg. Mercury was
10 detected in all three of the samples collected as part of the additional investigation at
11 concentrations ranging from 0.0429 J to 0.631 mg/kg (see Table 5-2). None of the detected
12 values exceeded the Zone E background range of 0.4 mg/kg to 0.90 mg/kg or the SSL value
13 of 1 mg/kg (DAF=10). In addition, the average mercury concentration in subsurface soil is
14 estimated at 0.20 mg/kg, which is well within the background range for mercury in
15 subsurface soil. For these reasons, mercury is not considered to be a COC for subsurface soil
16 at AOC 579.

17 **5.2.6 BEQs in Subsurface Soil**

18 BEQs were detected in five of the six subsurface soil samples collected during the RFI
19 investigation at concentrations ranging from 0.286 mg/kg (E579SB002) to 0.623 mg/kg
20 (E579SB005) (see Table 5-2). BEQs were identified in the RFI report as COCs for surface soil.
21 However, none of the BEQ concentrations exceeded the BEQ sitewide reference
22 concentration for subsurface soil of 1.400 mg/kg. For this reason, BEQs are not considered
23 COCs for subsurface soil at AOC 579.

24 **5.3 Summary**

25 Sampling of surface and subsurface soils at AOC 579 as part of the RFI field investigation
26 and by CH2M-Jones during 2002 revealed that VOCs, antimony, arsenic, mercury, copper
27 and BEQs are not considered COCs for either surface or subsurface soils. Based on the
28 review and refinement of the COPCs identified in the RFI report, there are no COCs
29 identified for AOC 579.

TABLE 5-1
 COPCs in Surface Soil
 RFI Report Addendum, AOC 579, Zone E, Charleston Naval Complex

Sample Station	ID	Date	Antimony		Arsenic		Copper		Mercury		BEQs			
			Result (mg/kg)	Qualifier	Result (mg/kg)	Qualifier	Result (mg/kg)	Qualifier	Result (mg/kg)	Qualifier	Result (mg/kg)	Qualifier		
			Res RBC	3.1	0.43	=	310		23		NA			
			Ind RBC	820	3.8	=	8,200		610		NA			
			SSL	2.5	14.5	=	NA		1		NA			
			Bkgd	7.4	68	=	866		2.7		1.3 ¹			
E579SB001	579SB00101	09/12/1995		0.47	U		2.0	=	14.6	J	0.08	=	0.31	=
E579SB002	579SB00201	09/12/1995		7.7	=		61.7	=	686	=	8.00	=	1.216	=
E579SB003	579SB00301	09/12/1995		0.47	U		5.1	=	17.8	=	0.06	=	0.46	=
E579SB004	579SB00401	09/12/1995		0.46	U		2.1	=	2.3	J	0.16	=	0.439	U
E579SB005	579SB00501b	09/14/1996		0.35	U		1.4	=	8.5	=	0.04	U	0.291	=
E579SB006	579SB00601	09/14/1996		0.36	U		8.1	=	34.6	=	0.47	=	0.434	=
E579SB007	E579SB00701	01/11/2002		3.63	J		149	=	NS		2.86	=	NS	
E579SB008	E579SB00801	01/11/2002		6.11	J		71.6	=	NS		7.65	=	NS	
E579SB009	E579SB00901	01/11/2002		1.13	J		9.56	=	NS		19.2	=	NS	
E579CB009	E579CB00901	01/11/2002		1.90	J		3.03	=	NS		1.7	=	NS	

¹ CH2M-Jones. *Background PAHs Study Report – Technical Information for Development of Background BEQ Values, Revision 0*. February 2001.

NA = Not Available

NS = Not Sampled

* = The residential RBC for mercury is based on an HI = 1.

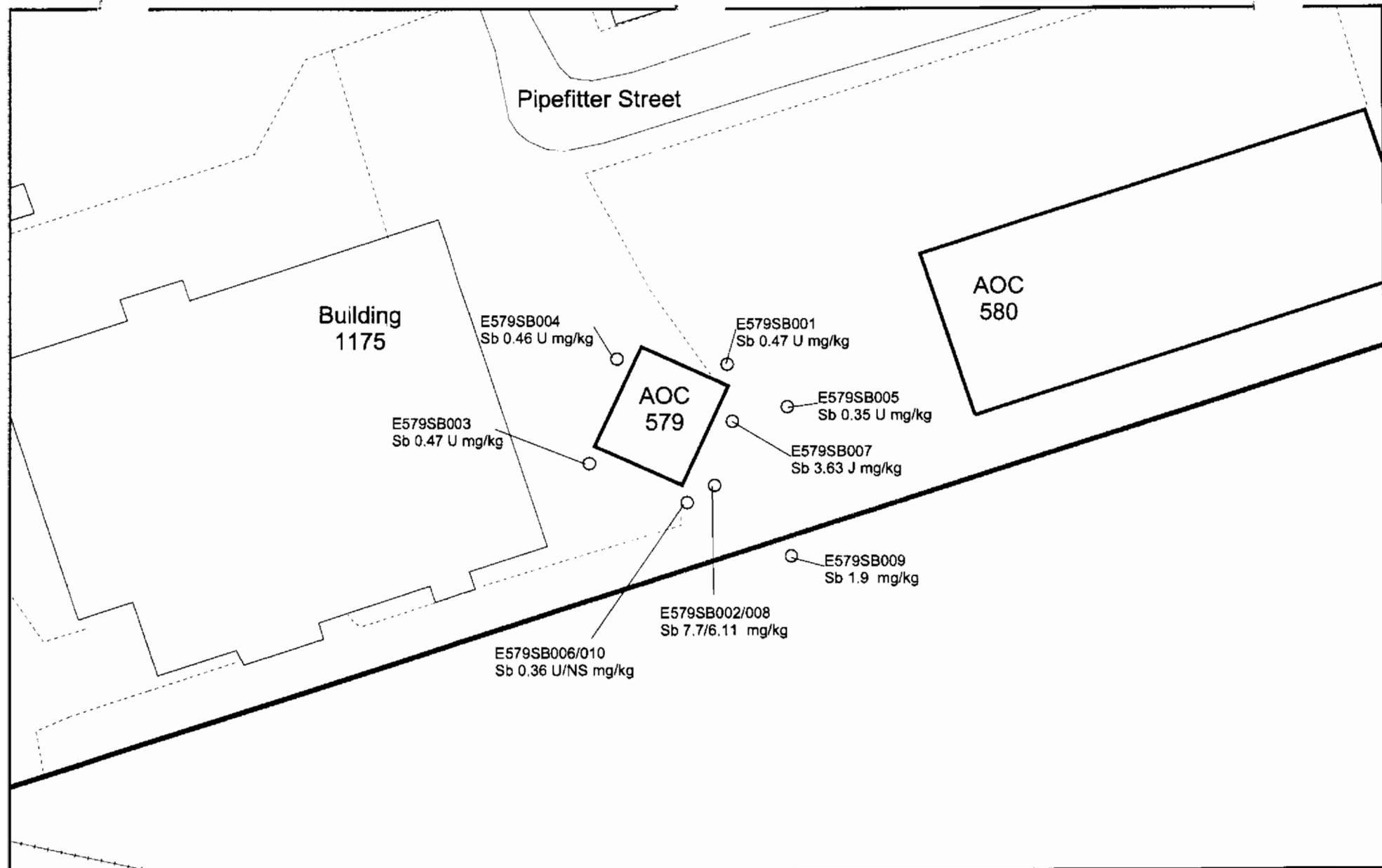
TABLE 5-2
 COPCs in Subsurface Soil
 RFI Report Addendum, AOC 579, Zone E, Charleston Naval Complex

Sample Station	ID	Date	Antimony		Arsenic		Copper		Mercury		BEQs		
			Result (mg/kg)	Qualifier									
			SSL	2.50		14.5		NA		1		NA	
			Bkgd	1.60		26		192		0.90		1.4 ¹	
E579SB001	579SB00102	09/12/1995		1.10	J	3.2	=	3.1	=	0.02	U	0.451	U
E579SB002	579SB00202	09/12/1995		0.65	J	10.7	=	20.5	=	0.13	=	0.286	=
E579SB003	579SB00302	09/12/1995		0.44	U	0.62	J	0.7	=	0.02	U	0.427	U
E579SB004	579SB00402	09/12/1995		0.45	U	0.68	J	0.79	J	0.14	=	0.439	U
E579SB005	579SB00502b	09/14/1996		0.49	U	7.2	=	4.9	=	0.07	=	0.623	U
E579SB006	579SB00602	09/14/1996		0.43	U	42.7	=	37.1	=	0.31	=	0.341	=
E579SB007	E579SB00702	01/11/2002		1.52	J	27.4	=	NS		0.631	=	NS	
E579SB008	E579SB00802	01/11/2002		0.0825	U	3.27	=	NS		0.0429	J	NS	
E579SB009	E579SB00902	01/11/2002		0.434	U	22.1	=	NS		0.477	=	NS	
E579SB010	E579SB01002	01/11/2002		NS		178	=	NS		NS		NS	

¹ CH2M-Jones. *Background PAHs Study Report – Technical Information for Development of Background BEQ Values, Revision 0*. February 2001.

NA = Not Available

NS = Not Sampled



- Surface Soil Sample
- - - Fence
- ≡ Railroads
- ≡ Roads
- ▭ AOC Boundary
- ▭ Buildings
- ▭ Zone Boundary

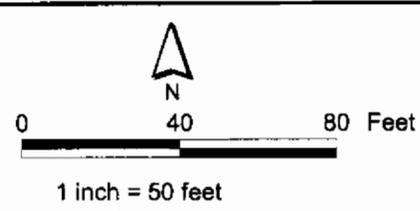
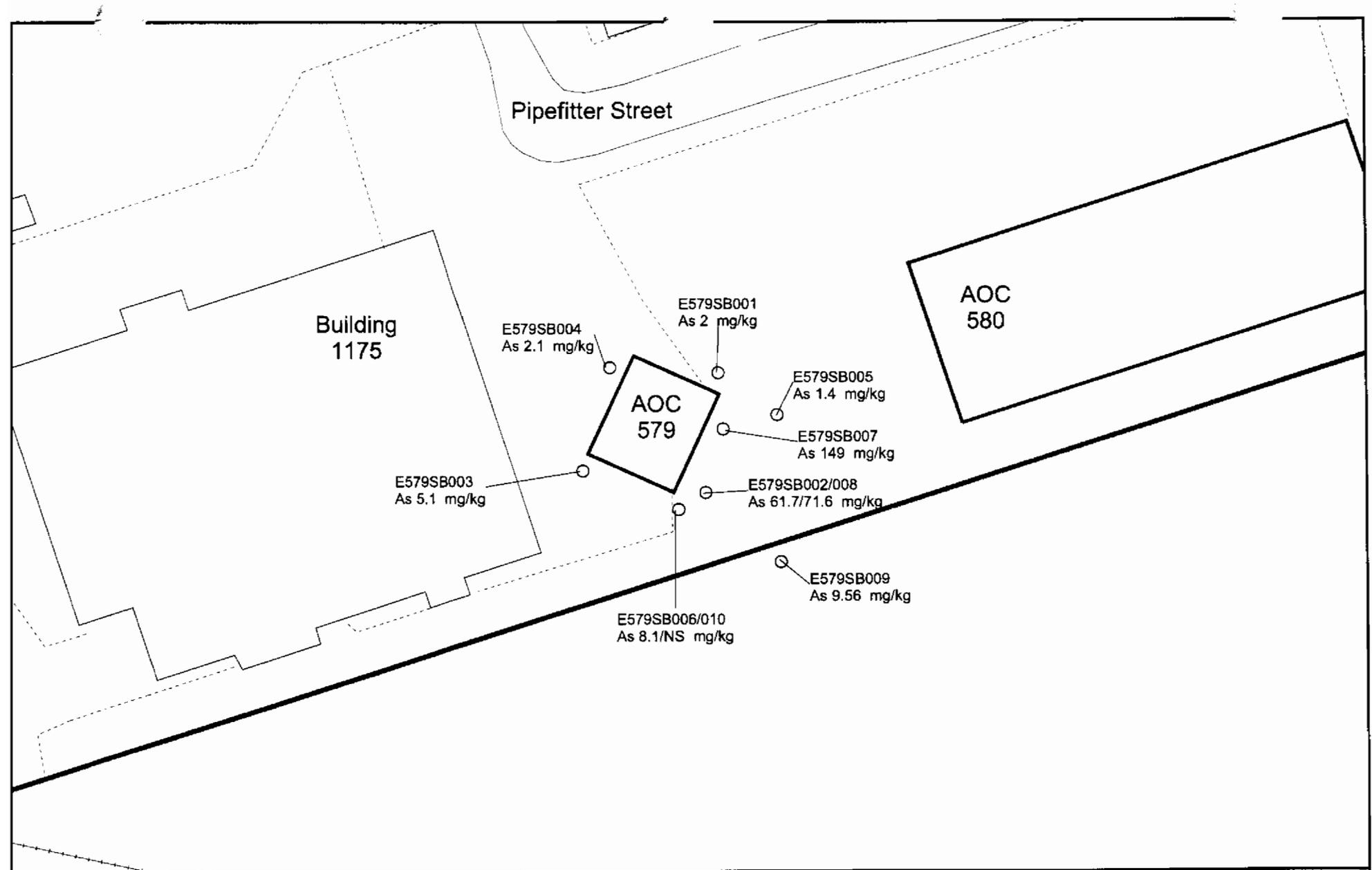


Figure 5-1
 Antimony in Surface Soil
 AOC 579, Zone E
 Charleston Naval Complex

File Path: C:\18gisl\Projects\Zone_E\AOC579\aac579.apr, Date: 20 Mar 2002 11:24, User: NMOUDRY, Figure 5-1 Antimony in Surface Soil



- Surface Soil Sample
- - - Fence
- ≡ Railroads
- ≡ Roads
- ▭ AOC Boundary
- ▭ Buildings
- ▭ Zone Boundary

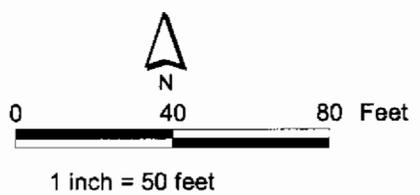
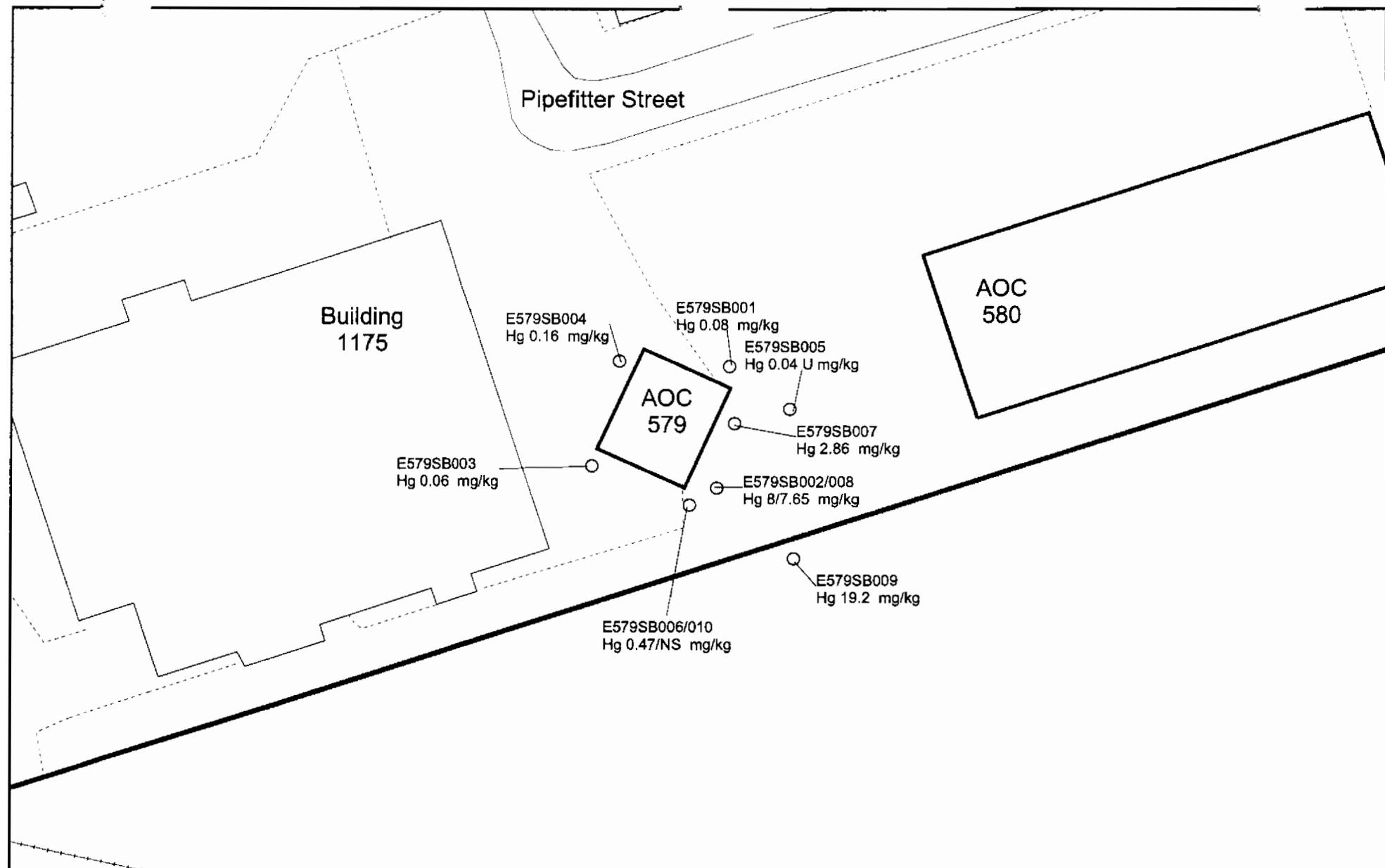


Figure 5-2
 Arsenic in Surface Soil
 AOC 579, Zone E
 Charleston Naval Complex

File Path: C:\18gis\Projects\Zone_E\AOC579\AOC579.apr, Date: 20 Mar 2002 12:04, User: NMOUDRY, Figure 5-2 Arsenic in Surface Soil



- Surface Soil Sample
- - - Fence
- ≡ Railroads
- ≡ Roads
- ▭ AOC Boundary
- ▭ Buildings
- ▭ Zone Boundary

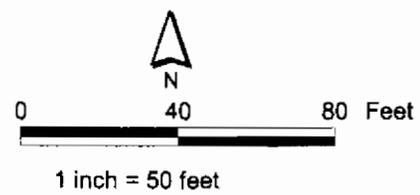
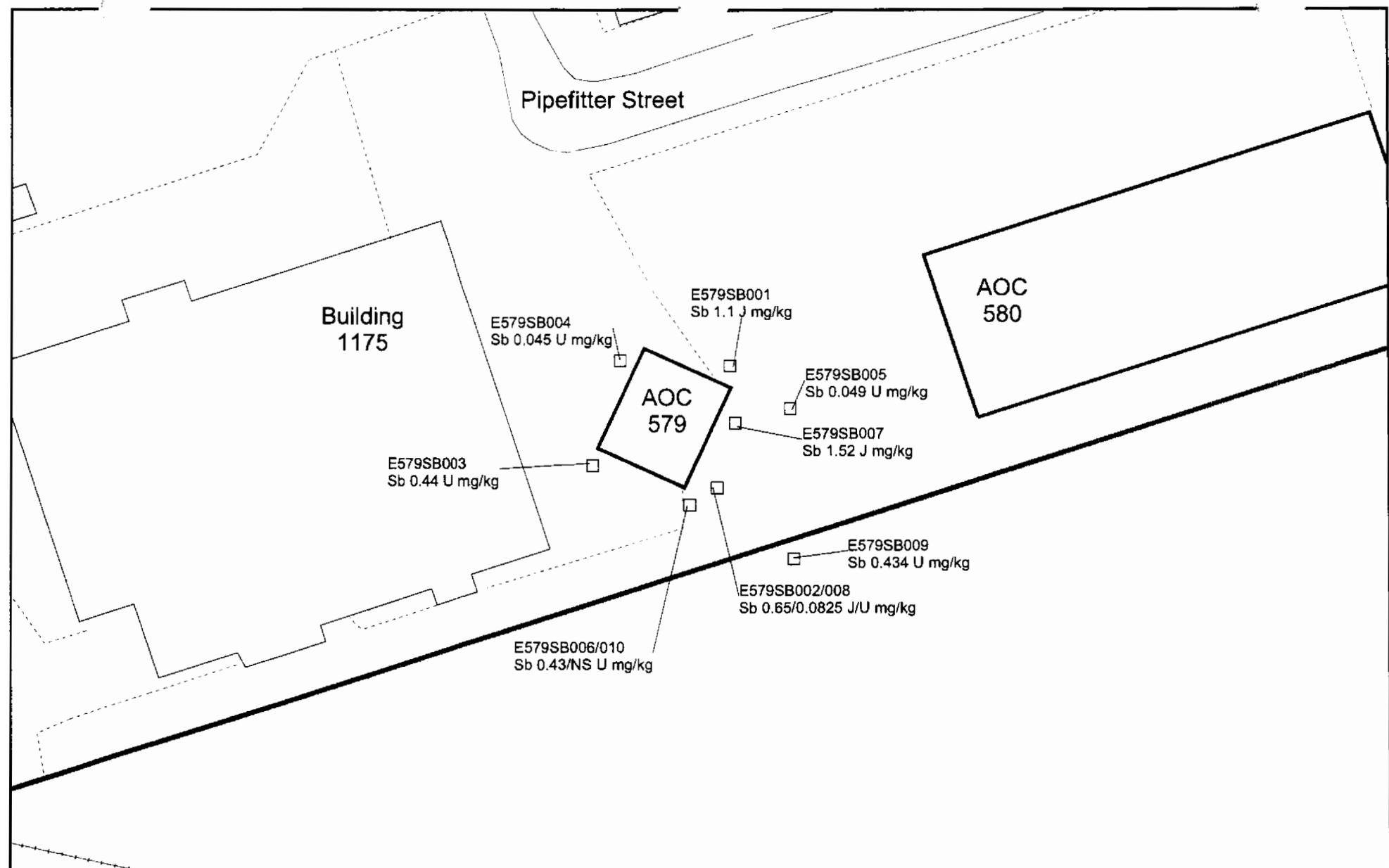


Figure 5-3
 Mercury in Surface Soil
 AOC 579, Zone E
 Charleston Naval Complex



- Subsurface Soil Sample
- - - Fence
- ≡ Railroads
- ≡ Roads
- ▭ AOC Boundary
- ▭ Buildings
- ▭ Zone Boundary

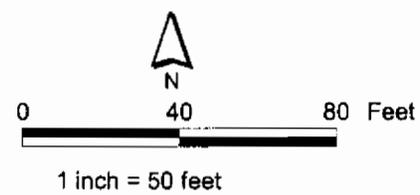
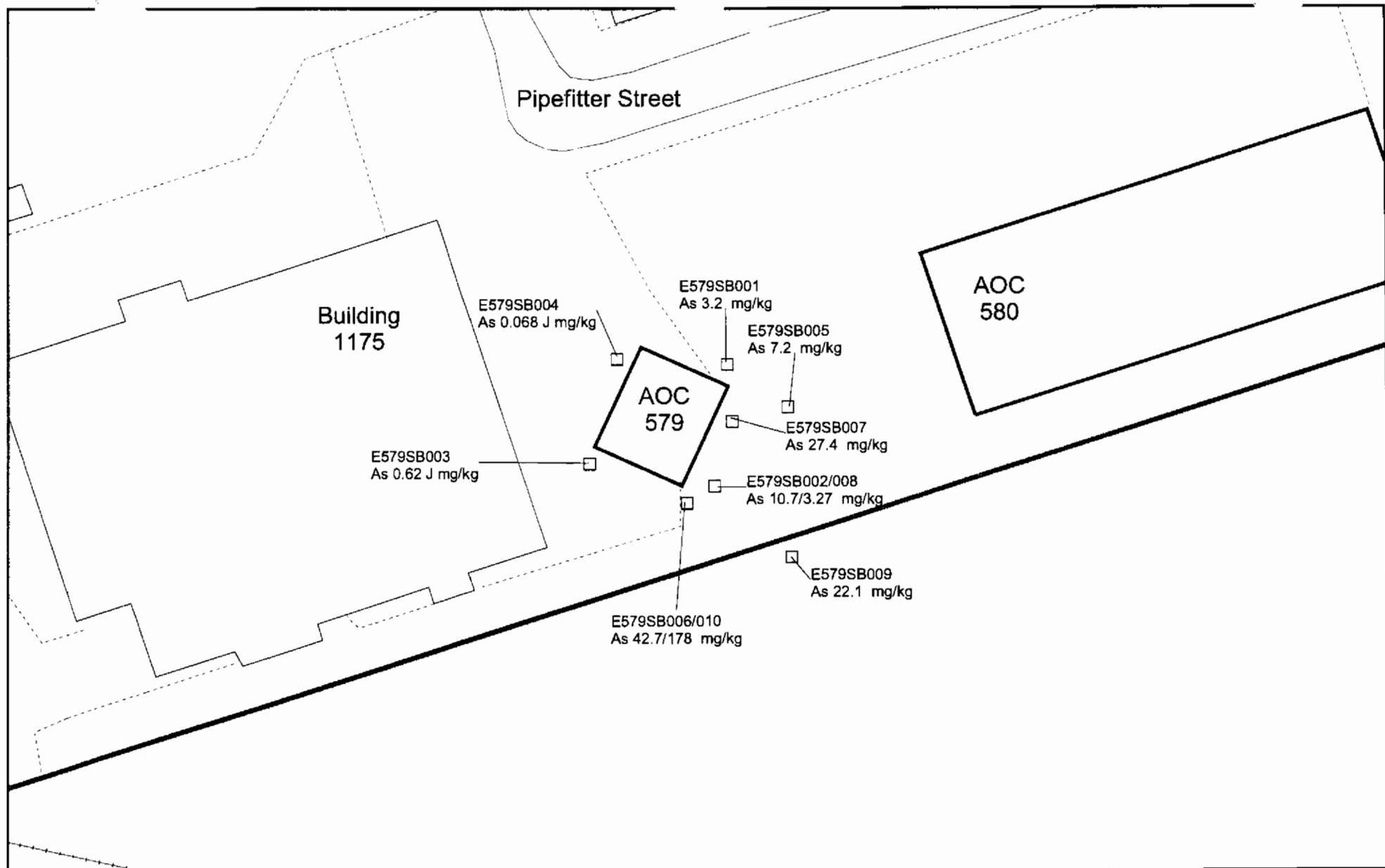


Figure 5-4
 Antimony in Subsurface Soil
 AOC 579, Zone E
 Charleston Naval Complex



- Subsurface Soil Sample
- Fence
- Railroads
- Roads
- AOC Boundary
- Buildings
- Zone Boundary

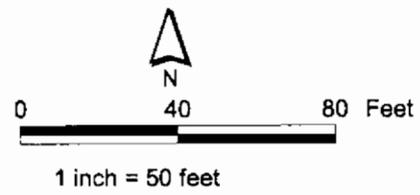
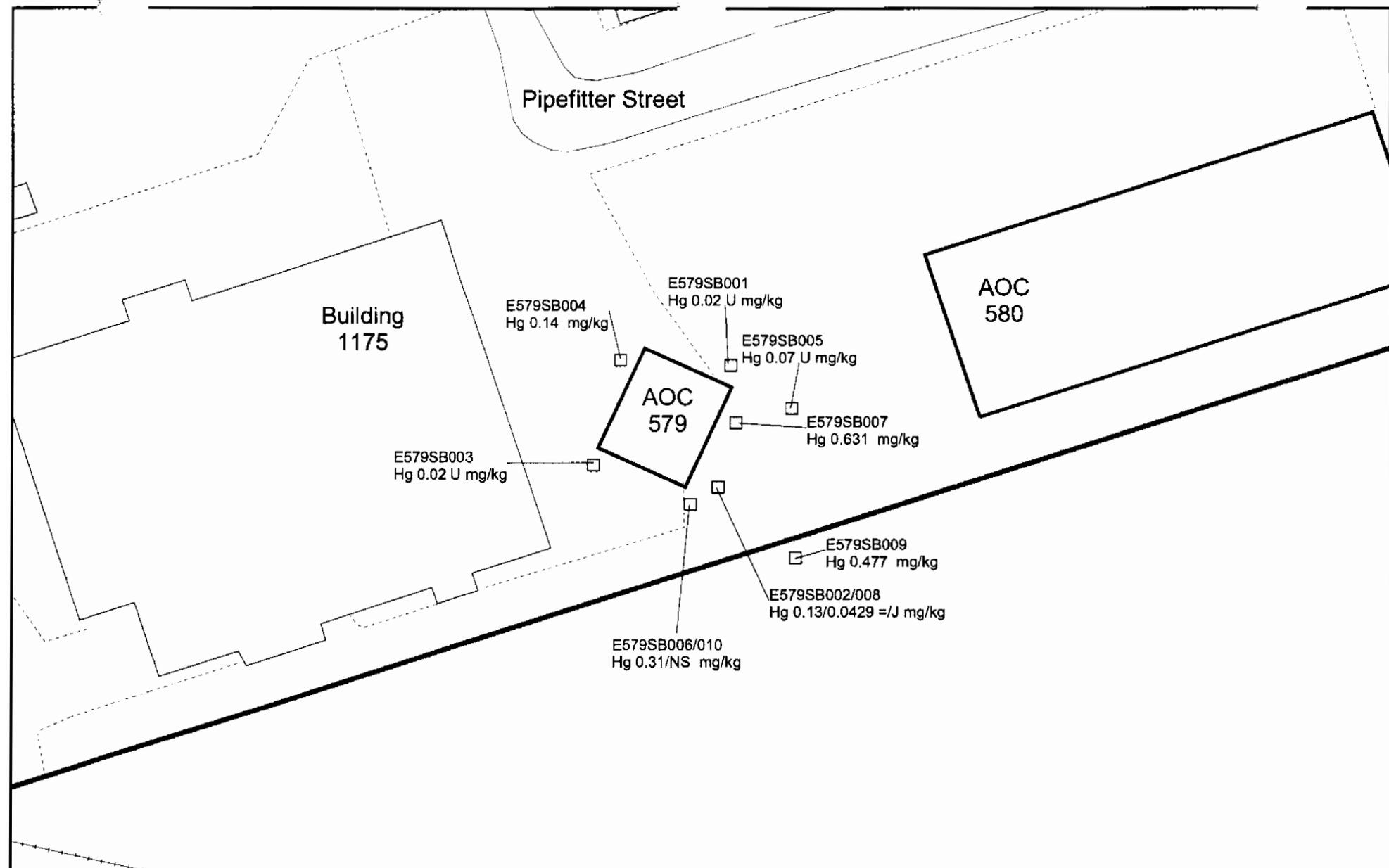


Figure 5-5
Arsenic in Subsurface Soil
AOC 579, Zone E
Charleston Naval Complex



- Subsurface Soil Sample
- - - Fence
- ≡ Railroads
- ≡ Roads
- ▭ AOC Boundary
- ▭ Buildings
- ▭ Zone Boundary

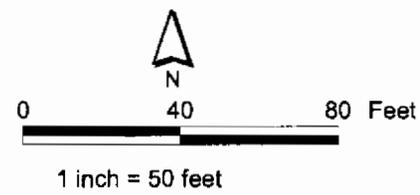


Figure 5-6
Mercury in Subsurface Soil
AOC 579, Zone E
Charleston Naval Complex

File Path: C:\18gisl\Projects\Zone_E\AOC579\aac579.apr, Date: 20 Mar 2002 11:24, User: NMCUDRY, Figure 5-1 Antimony in Surface Soil

6.0 Summary of Information Related to Site Closeout Issues

6.1 Status of the RFI

The Zone E RFI field work and RFI report (EnSafe, 1997) were completed using the best information available at the time regarding the site location and characteristics. No Further Investigation (NFI) of AOC 579 was proposed in the *Zone E RFI Work Plan Addendum* (EnSafe, 1999). CH2M-Jones proposed and completed additional sampling to complete delineation of COPCs in surface and subsurface soils. Supporting data indicate that there are no COCs for this site and that its nature and extent have been adequately delineated. No further sampling or investigation is proposed or necessary at AOC 579, and a recommendation for NFA is proposed.

The remaining subsections address the issues that 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. Groundwater was not a medium of concern at AOC 579. No additional evaluation of this issue is warranted.

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

The sanitary sewer investigation was designed to include segments of the sewer where releases of contamination were known or considered likely to have occurred. No investigations related to SWMU 37 were conducted at AOC 579. No known or suspected linkage between SWMU 37 and AOC 579 exists. The nearest sanitary sewer manhole is located approximately 80 feet northwest of AOC 579. Further evaluation of this issue is not warranted.

1 **6.4 Potential Linkage to AOC 699, Investigated Storm Sewers**
2 **at the CNC**

3 Investigated segments of the storm sewer were identified in the *Zone L RFI Report, Revision 0*
4 (EnSafe, 1998). The nearest sewer drain is located approximately 25 feet to the northwest of
5 AOC 579. The sections of the stormwater sewer system in the vicinity of the site were not
6 investigated as part of the AOC 699 investigations. There are no data or information to
7 suggest that AOC 579 has impacted the storm sewer system. Further investigation of a
8 linkage between the storm sewer system and AOC 579 is not warranted.

9 **6.5 Potential Linkage to AOC 504, Investigated Railroad Lines**
10 **at the CNC**

11 AOC 579 (Building 1035) is bounded on the west, south, and east sides by abandoned
12 railroad lines. The nearest active railroad line is approximately 190 feet to the south in Zone
13 F. There is no known linkage between AOC 579 and the investigated railroad lines of AOC
14 504. The potential impacts associated with the abandoned railroad lines at this unit are
15 discussed in detail in Section 5.0 of this RFI Report Addendum. Further evaluation of this
16 issue is not warranted.

17 **6.6 Potential Migration Pathways to Surface Water Bodies at**
18 **the CNC**

19 Two potential migration pathways from the site to surface water are overland flow via
20 stormwater runoff, and subsurface flow via groundwater. The nearest surface water body to
21 AOC 579 is the Cooper River, which lies approximately 760 feet to the northeast. There were
22 no COCs identified for subsurface soil. Therefore, the only potential migration pathway
23 from the site to surface water is via overland flow via stormwater runoff. Since the entire
24 site is covered with buildings and pavement, which eliminates contact of surface soil with
25 stormwater, further evaluation of a potential pathway for contaminant migration via
26 stormwater runoff is not warranted. Similarly, runoff directed to the storm sewer system,
27 which discharges to the Cooper River, does not contact the surface soil.

28 Groundwater was not a medium of concern at this unit. Further evaluation of potential
29 migration of contaminated groundwater to a surface water body is not warranted.

1 **6.7 Potential Contamination in Oil/Water Separators (OWSs)**

2 There are no OWSs known to be associated with this site. In addition, there is no reference
3 made to an OWS at this facility in the *Oil Water Separator Data* report (Department of the
4 Navy, September 2000). Further evaluation of OWSs is not warranted.

5 **6.8 Land Use Control Management Plan**

6 The COC refinement did not identify any COCs at AOC 579. This evaluation was based on
7 an unrestricted land use scenario. Therefore, land use controls are not necessary.

Section 7.0

1 **7.0 Recommendations**

2 AOC 579 is a former paint shop located in Building 1035, which was built in 1919. This is a
3 small metal structure located within the industrial part of Zone E between two large
4 buildings (Buildings 1178 and 0010). Building 1035 was used for meat storage and
5 inspection until 1943. From 1943 to 1955, this unit was used as a cafeteria and storehouse.
6 From 1955 until approximately 1977, it was used to store paint. At the time the RFA was
7 completed, the site was being used as an electrician's storehouse. In November 2001, a site
8 inspection revealed that the building is currently being used for storage of large sacks
9 containing a white powder – likely gypsum or kaolin. Railroad lines used to pass on the
10 west, south, and east sides of Building 1035. Historic engineering drawings indicate that the
11 railroad lines were present between 1955 and 1962 and were removed or discontinued
12 between 1977 and 1987.

13 Based on the original field activities conducted as part of the RFI and the subsequent
14 sampling and analysis presented in Section 4.0 of the RFI Report Addendum, the RFI is
15 considered complete. No COCs are identified at AOC 579 and no actions are required to
16 control exposures or risks under current or future unrestricted land use scenarios. The site is
17 recommended for NFA. A Statement of Basis should be prepared that will be made
18 available for public comment in accordance with SCDHEC policy. This will allow for public
19 participation in the final remedy selection.

1 8.0 References

- 2 CH2M-Jones. *Background PAHs Study Report – Technical Information for Development of*
3 *Background BEQ Values, Revision 0.* February 2001.
- 4 CH2M-Jones. *Sampling and Analysis Plan – AOCs 579 and 580, Zone E, U.S. Navy Southern*
5 *Division, Naval Facilities Engineering Command.* November 2001.
- 6 EnSafe Inc./Allen & Hoshall. *Final RCRA Facility Assessment Naval Base Charleston Volume II.*
7 June 6, 1995.
- 8 EnSafe Inc./Allen & Hoshall. *Final Zone E RFI Work Plan, Revision 1.* June 2, 1995.
- 9 EnSafe Inc. *Zone E RCRA Facility Investigation Report, Revision 0.* November 1997.
- 10 EnSafe Inc. *Zone L RCRA Facility Investigation Report, Revision 0.* December 18, 1998.
- 11 EnSafe Inc. *Zone E RCRA Facility Investigation Work Plan Addendum.* January 17, 2000.
- 12 U.S. Environmental Protection Agency (EPA). *Soil Screening Guidance: Technical Background*
13 *Document.* May 1996.
- 14 U.S. Environmental Protection Agency (EPA). *EPA Region III Risk-Based Concentration Table.*
15 October 2000.
- 16 U.S. Navy. *Oil Water Separator Data.* September 2000.

Appendix A-1

Constituents detected in Surface Soils

Charleston Naval Complex, AOC 579, Zone E

STATION	SAMPLE	DATE_COL	CHEM_NAME	RESULT	QUALIFIER	UNIT
E579SB002	579SB00201	09/12/1995	2-Methylnaphthalene	0.08	J	mg/kg
E579SB002	579SB00201	09/12/1995	Acenaphthene	0.17	J	mg/kg
E579SB001	579SB00101	09/12/1995	Aluminum	5030	=	mg/kg
E579SB002	579SB00201	09/12/1995	Aluminum	4280	=	mg/kg
E579SB003	579SB00301	09/12/1995	Aluminum	7310	=	mg/kg
E579SB004	579SB00401	09/12/1995	Aluminum	3590	=	mg/kg
E579SB005	579SB00501b	09/14/1996	Aluminum	2430	=	mg/kg
E579SB006	579SB00601	09/14/1996	Aluminum	6980	=	mg/kg
E579SB002	579SB00201	09/12/1995	Antimony	7.7	=	mg/kg
E579SB001	579SB00101	09/12/1995	Arsenic	2.0	=	mg/kg
E579SB002	579SB00201	09/12/1995	Arsenic	61.7	=	mg/kg
E579SB003	579SB00301	09/12/1995	Arsenic	5.1	=	mg/kg
E579SB004	579SB00401	09/12/1995	Arsenic	2.1	=	mg/kg
E579SB005	579SB00501b	09/14/1996	Arsenic	1.4	=	mg/kg
E579SB006	579SB00601	09/14/1996	Arsenic	8.1	=	mg/kg
E579SB001	579SB00101	09/12/1995	Barium	21.1	J	mg/kg
E579SB002	579SB00201	09/12/1995	Barium	76.6	=	mg/kg
E579SB003	579SB00301	09/12/1995	Barium	53.6	=	mg/kg
E579SB004	579SB00401	09/12/1995	Barium	6.9	J	mg/kg
E579SB005	579SB00501b	09/14/1996	Barium	5.3	J	mg/kg
E579SB006	579SB00601	09/14/1996	Barium	46	=	mg/kg
E579SB001	579SB00101	09/12/1995	Benzo(a)Anthracene	0.059	J	mg/kg
E579SB002	579SB00201	09/12/1995	Benzo(a)Anthracene	0.62	J	mg/kg
E579SB003	579SB00301	09/12/1995	Benzo(a)Anthracene	0.24	J	mg/kg
E579SB005	579SB00501b	09/14/1996	Benzo(a)Anthracene	0.048	J	mg/kg
E579SB006	579SB00601	09/14/1996	Benzo(a)Anthracene	0.22	J	mg/kg
E579SB001	579SB00101	09/12/1995	Benzo(a)Pyrene	0.076	J	mg/kg
E579SB002	579SB00201	09/12/1995	Benzo(a)Pyrene	0.67	J	mg/kg
E579SB003	579SB00301	09/12/1995	Benzo(a)Pyrene	0.2	J	mg/kg
E579SB005	579SB00501b	09/14/1996	Benzo(a)Pyrene	0.072	J	mg/kg
E579SB006	579SB00601	09/14/1996	Benzo(a)Pyrene	0.27	J	mg/kg
E579SB003	579SB00301	09/12/1995	Benzo(b)Fluoranthene	0.18	J	mg/kg
E579SB006	579SB00601	09/14/1996	Benzo(b)Fluoranthene	0.26	J	mg/kg
E579SB001	579SB00101	09/12/1995	Benzo(g,h,i)Perylene	0.046	J	mg/kg
E579SB002	579SB00201	09/12/1995	Benzo(g,h,i)Perylene	0.47	J	mg/kg
E579SB003	579SB00301	09/12/1995	Benzo(g,h,i)Perylene	0.13	J	mg/kg
E579SB005	579SB00501b	09/14/1996	Benzo(g,h,i)Perylene	0.046	J	mg/kg
E579SB006	579SB00601	09/14/1996	Benzo(g,h,i)Perylene	0.21	J	mg/kg
E579SB001	579SB00101	09/12/1995	Benzo(k)Fluoranthene	0.082	J	mg/kg
E579SB002	579SB00201	09/12/1995	Benzo(k)Fluoranthene	2.0	=	mg/kg
E579SB003	579SB00301	09/12/1995	Benzo(k)Fluoranthene	0.2	J	mg/kg
E579SB005	579SB00501b	09/14/1996	Benzo(k)Fluoranthene	0.11	J	mg/kg
E579SB006	579SB00601	09/14/1996	Benzo(k)Fluoranthene	0.23	J	mg/kg
E579SB001	579SB00101	09/12/1995	Beryllium	0.17	J	mg/kg
E579SB002	579SB00201	09/12/1995	Beryllium	0.28	J	mg/kg
E579SB003	579SB00301	09/12/1995	Beryllium	0.7	=	mg/kg
E579SB002	579SB00201	09/12/1995	bis(2-Ethylhexyl) Phthalate	2.2	=	mg/kg
E579SB002	579SB00201	09/12/1995	Cadmium	2.9	=	mg/kg
E579SB006	579SB00601	09/14/1996	Cadmium	0.11	J	mg/kg
E579SB001	579SB00101	09/12/1995	Calcium	1390	=	mg/kg
E579SB002	579SB00201	09/12/1995	Calcium	11700	=	mg/kg
E579SB003	579SB00301	09/12/1995	Calcium	2330	=	mg/kg
E579SB004	579SB00401	09/12/1995	Calcium	918	=	mg/kg
E579SB005	579SB00501b	09/14/1996	Calcium	490	J	mg/kg
E579SB006	579SB00601	09/14/1996	Calcium	16700	=	mg/kg
E579SB001	579SB00101	09/12/1995	Chromium, Total	9.0	J	mg/kg

Appendix A-1

Constituents detected in Surface Soils

Charleston Naval Complex, AOC 579, Zone E

STATION	SAMPLE	DATE_COL	CHEM_NAME	RESULT	QUALIFIER	UNIT
E579SB002	579SB00201	09/12/1995	Chromium, Total	50.6	=	mg/kg
E579SB003	579SB00301	09/12/1995	Chromium, Total	6.1	=	mg/kg
E579SB004	579SB00401	09/12/1995	Chromium, Total	5.2	=	mg/kg
E579SB005	579SB00501b	09/14/1996	Chromium, Total	2.9	J	mg/kg
E579SB006	579SB00601	09/14/1996	Chromium, Total	15.8	J	mg/kg
E579SB001	579SB00101	09/12/1995	Chrysene	0.081	J	mg/kg
E579SB002	579SB00201	09/12/1995	Chrysene	2.6	=	mg/kg
E579SB003	579SB00301	09/12/1995	Chrysene	0.25	J	mg/kg
E579SB005	579SB00501b	09/14/1996	Chrysene	0.07	J	mg/kg
E579SB006	579SB00601	09/14/1996	Chrysene	0.25	J	mg/kg
E579SB001	579SB00101	09/12/1995	Cobalt	27.4	=	mg/kg
E579SB002	579SB00201	09/12/1995	Cobalt	2.5	J	mg/kg
E579SB003	579SB00301	09/12/1995	Cobalt	2.3	J	mg/kg
E579SB004	579SB00401	09/12/1995	Cobalt	10.2	=	mg/kg
E579SB006	579SB00601	09/14/1996	Cobalt	1.6	J	mg/kg
E579SB001	579SB00101	09/12/1995	Copper	14.6	J	mg/kg
E579SB002	579SB00201	09/12/1995	Copper	686	=	mg/kg
E579SB003	579SB00301	09/12/1995	Copper	17.8	=	mg/kg
E579SB004	579SB00401	09/12/1995	Copper	2.3	J	mg/kg
E579SB005	579SB00501b	09/14/1996	Copper	8.5	=	mg/kg
E579SB006	579SB00601	09/14/1996	Copper	34.6	=	mg/kg
E579SB006	579SB00601	09/14/1996	Dibenz(a,h)anthracene	0.096	J	mg/kg
E579SB002	579SB00201	09/12/1995	Dibenzofuran	0.14	J	mg/kg
E579SB002	579SB00201	09/12/1995	Di-n-octylphthalate	0.56	J	mg/kg
E579SB001	579SB00101	09/12/1995	Flouranthene	0.094	J	mg/kg
E579SB002	579SB00201	09/12/1995	Flouranthene	7.5	=	mg/kg
E579SB003	579SB00301	09/12/1995	Flouranthene	0.3	J	mg/kg
E579SB005	579SB00501b	09/14/1996	Flouranthene	0.069	J	mg/kg
E579SB006	579SB00601	09/14/1996	Flouranthene	0.45	=	mg/kg
E579SB002	579SB00201	09/12/1995	Fluorene	0.14	J	mg/kg
E579SB001	579SB00101	09/12/1995	Indeno(1,2,3-c,d)pyrene	0.04	J	mg/kg
E579SB002	579SB00201	09/12/1995	Indeno(1,2,3-c,d)pyrene	0.44	J	mg/kg
E579SB003	579SB00301	09/12/1995	Indeno(1,2,3-c,d)pyrene	0.11	J	mg/kg
E579SB005	579SB00501b	09/14/1996	Indeno(1,2,3-c,d)pyrene	0.046	J	mg/kg
E579SB006	579SB00601	09/14/1996	Indeno(1,2,3-c,d)pyrene	0.18	J	mg/kg
E579SB001	579SB00101	09/12/1995	Iron	3760	=	mg/kg
E579SB002	579SB00201	09/12/1995	Iron	12200	=	mg/kg
E579SB003	579SB00301	09/12/1995	Iron	6290	=	mg/kg
E579SB004	579SB00401	09/12/1995	Iron	2060	=	mg/kg
E579SB005	579SB00501b	09/14/1996	Iron	1830	=	mg/kg
E579SB006	579SB00601	09/14/1996	Iron	6500	=	mg/kg
E579SB001	579SB00101	09/12/1995	Lead	21.3	=	mg/kg
E579SB002	579SB00201	09/12/1995	Lead	362	=	mg/kg
E579SB003	579SB00301	09/12/1995	Lead	91.5	=	mg/kg
E579SB004	579SB00401	09/12/1995	Lead	3.8	=	mg/kg
E579SB005	579SB00501b	09/14/1996	Lead	4.8	=	mg/kg
E579SB006	579SB00601	09/14/1996	Lead	44.8	=	mg/kg
E579SB001	579SB00101	09/12/1995	Magnesium	277	J	mg/kg
E579SB002	579SB00201	09/12/1995	Magnesium	566	J	mg/kg
E579SB003	579SB00301	09/12/1995	Magnesium	405	J	mg/kg
E579SB004	579SB00401	09/12/1995	Magnesium	101	J	mg/kg
E579SB005	579SB00501b	09/14/1996	Magnesium	104	J	mg/kg
E579SB006	579SB00601	09/14/1996	Magnesium	916	=	mg/kg
E579SB001	579SB00101	09/12/1995	Manganese	27	=	mg/kg
E579SB002	579SB00201	09/12/1995	Manganese	99.3	=	mg/kg
E579SB003	579SB00301	09/12/1995	Manganese	247	=	mg/kg

Appendix A-1
 Constituents detected in Surface Soils
 Charleston Naval Complex, AOC 579, Zone E

STATION	SAMPLE	DATE_COL	CHEM_NAME	RESULT	QUALIFIER	UNIT
E579SB004	579SB00401	09/12/1995	Manganese	22.8	=	mg/kg
E579SB005	579SB00501b	09/14/1996	Manganese	103	=	mg/kg
E579SB006	579SB00601	09/14/1996	Manganese	42.4	=	mg/kg
E579SB001	579SB00101	09/12/1995	Mercury	0.08	=	mg/kg
E579SB002	579SB00201	09/12/1995	Mercury	8.0	=	mg/kg
E579SB003	579SB00301	09/12/1995	Mercury	0.06	=	mg/kg
E579SB004	579SB00401	09/12/1995	Mercury	0.16	=	mg/kg
E579SB006	579SB00601	09/14/1996	Mercury	0.47	=	mg/kg
E579SB001	579SB00101	09/12/1995	Nickel	16.5	=	mg/kg
E579SB002	579SB00201	09/12/1995	Nickel	31.9	=	mg/kg
E579SB003	579SB00301	09/12/1995	Nickel	4.3	J	mg/kg
E579SB004	579SB00401	09/12/1995	Nickel	7.3	=	mg/kg
E579SB005	579SB00501b	09/14/1996	Nickel	1.2	J	mg/kg
E579SB006	579SB00601	09/14/1996	Nickel	5.3	=	mg/kg
E579SB001	579SB00101	09/12/1995	Phenanthrene	0.046	J	mg/kg
E579SB002	579SB00201	09/12/1995	Phenanthrene	5.0	=	mg/kg
E579SB003	579SB00301	09/12/1995	Phenanthrene	0.200	J	mg/kg
E579SB006	579SB00601	09/14/1996	Phenanthrene	0.170	J	mg/kg
E579SB006	579SB00601	09/14/1996	Potassium	465	J	mg/kg
E579SB001	579SB00101	09/12/1995	Pyrene	0.092	J	mg/kg
E579SB002	579SB00201	09/12/1995	Pyrene	6.4	=	mg/kg
E579SB003	579SB00301	09/12/1995	Pyrene	0.41	J	mg/kg
E579SB005	579SB00501b	09/14/1996	Pyrene	0.066	J	mg/kg
E579SB006	579SB00601	09/14/1996	Pyrene	0.35	J	mg/kg
E579SB006	579SB00601	09/14/1996	Selenium	0.43	J	mg/kg
E579SB001	579SB00101	09/12/1995	Silver	5.1	=	mg/kg
E579SB006	579SB00601	09/14/1996	Silver	0.32	J	mg/kg
E579SB001	579SB00101	09/12/1995	Sodium	125	J	mg/kg
E579SB002	579SB00201	09/12/1995	Sodium	139	J	mg/kg
E579SB003	579SB00301	09/12/1995	Sodium	133	J	mg/kg
E579SB004	579SB00401	09/12/1995	Sodium	132	J	mg/kg
E579SB005	579SB00501b	09/14/1996	Sodium	133	J	mg/kg
E579SB006	579SB00601	09/14/1996	Sodium	225	J	mg/kg
E579SB002	579SB00201	09/12/1995	Tin (Sn)	41	=	mg/kg
E579SB005	579SB00501b	09/14/1996	Tin (Sn)	1.3	J	mg/kg
E579SB006	579SB00601	09/14/1996	Tin (Sn)	2.7	J	mg/kg
E579SB001	579SB00101	09/12/1995	Vanadium	7.1	=	mg/kg
E579SB002	579SB00201	09/12/1995	Vanadium	13.5	=	mg/kg
E579SB003	579SB00301	09/12/1995	Vanadium	8.9	=	mg/kg
E579SB004	579SB00401	09/12/1995	Vanadium	3.0	J	mg/kg
E579SB005	579SB00501b	09/14/1996	Vanadium	2.6	J	mg/kg
E579SB006	579SB00601	09/14/1996	Vanadium	16.6	=	mg/kg
E579SB001	579SB00101	09/12/1995	Zinc	33.2	=	mg/kg
E579SB002	579SB00201	09/12/1995	Zinc	901	=	mg/kg
E579SB003	579SB00301	09/12/1995	Zinc	67.3	=	mg/kg
E579SB004	579SB00401	09/12/1995	Zinc	6.8	=	mg/kg
E579SB005	579SB00501b	09/14/1996	Zinc	9.8	=	mg/kg
E579SB006	579SB00601	09/14/1996	Zinc	66	=	mg/kg

Appendix A-2

Constituents detected in Subsurface Soils
Charleston Naval Complex, AOC 579, Zone E

STATION	SAMPLE	DATE_COL	CHEM_NAME	RESULT	QUALIFIER	UNIT
E579SB006	579SB00602	09/14/1996	2-Methylnaphthalene	0.084	J	mg/kg
E579SB001	579SB00102	09/12/1995	Aluminum	5380	=	mg/kg
E579SB002	579SB00202	09/12/1995	Aluminum	8130	=	mg/kg
E579SB003	579SB00302	09/12/1995	Aluminum	1510	=	mg/kg
E579SB004	579SB00402	09/12/1995	Aluminum	4690	=	mg/kg
E579SB005	579SB00502b	09/14/1996	Aluminum	9640	=	mg/kg
E579SB006	579SB00602	09/14/1996	Aluminum	14900	=	mg/kg
E579SB001	579SB00102	09/12/1995	Antimony	1.1	J	mg/kg
E579SB002	579SB00202	09/12/1995	Antimony	0.65	J	mg/kg
E579SB001	579SB00102	09/12/1995	Arsenic	3.2	=	mg/kg
E579SB002	579SB00202	09/12/1995	Arsenic	10.7	=	mg/kg
E579SB003	579SB00302	09/12/1995	Arsenic	0.62	J	mg/kg
E579SB004	579SB00402	09/12/1995	Arsenic	0.680	J	mg/kg
E579SB005	579SB00502b	09/14/1996	Arsenic	7.200	=	mg/kg
E579SB006	579SB00602	09/14/1996	Arsenic	42.7	=	mg/kg
E579SB001	579SB00102	09/12/1995	Barium	24.6	=	mg/kg
E579SB002	579SB00202	09/12/1995	Barium	82.6	=	mg/kg
E579SB003	579SB00302	09/12/1995	Barium	17.1	J	mg/kg
E579SB004	579SB00402	09/12/1995	Barium	25.8	=	mg/kg
E579SB005	579SB00502b	09/14/1996	Barium	47.8	=	mg/kg
E579SB006	579SB00602	09/14/1996	Barium	38.1	=	mg/kg
E579SB002	579SB00202	09/12/1995	Benzo(a)Anthracene	0.071	J	mg/kg
E579SB002	579SB00202	09/12/1995	Benzo(a)Pyrene	0.067	J	mg/kg
E579SB006	579SB00602	09/14/1996	Benzo(a)Pyrene	0.051	J	mg/kg
E579SB002	579SB00202	09/12/1995	Benzo(b)Fluoranthene	0.16	J	mg/kg
E579SB006	579SB00602	09/14/1996	Benzo(b)Fluoranthene	0.052	J	mg/kg
E579SB002	579SB00202	09/12/1995	Benzo(g,h,i)Perylene	0.052	J	mg/kg
E579SB002	579SB00202	09/12/1995	Benzo(k)Fluoranthene	0.1	J	mg/kg
E579SB001	579SB00102	09/12/1995	Benzoic acid	0.062	J	mg/kg
E579SB001	579SB00102	09/12/1995	Beryllium	0.6	J	mg/kg
E579SB002	579SB00202	09/12/1995	Beryllium	0.84	J	mg/kg
E579SB003	579SB00302	09/12/1995	Beryllium	0.18	J	mg/kg
E579SB004	579SB00402	09/12/1995	Beryllium	0.42	J	mg/kg
E579SB005	579SB00502b	09/14/1996	Beryllium	0.96	=	mg/kg
E579SB006	579SB00602	09/14/1996	Beryllium	1.0	=	mg/kg
E579SB002	579SB00202	09/12/1995	Cadmium	0.14	J	mg/kg
E579SB001	579SB00102	09/12/1995	Calcium	971	=	mg/kg
E579SB002	579SB00202	09/12/1995	Calcium	1920	=	mg/kg
E579SB003	579SB00302	09/12/1995	Calcium	242	J	mg/kg
E579SB004	579SB00402	09/12/1995	Calcium	339	J	mg/kg
E579SB005	579SB00502b	09/14/1996	Calcium	6350	=	mg/kg
E579SB006	579SB00602	09/14/1996	Calcium	3510	=	mg/kg
E579SB001	579SB00102	09/12/1995	Chromium, Total	4.6	=	mg/kg
E579SB002	579SB00202	09/12/1995	Chromium, Total	10.7	=	mg/kg
E579SB003	579SB00302	09/12/1995	Chromium, Total	1.8	=	mg/kg
E579SB004	579SB00402	09/12/1995	Chromium, Total	2.6	=	mg/kg
E579SB005	579SB00502b	09/14/1996	Chromium, Total	11.5	J	mg/kg
E579SB006	579SB00602	09/14/1996	Chromium, Total	23.9	J	mg/kg
E579SB002	579SB00202	09/12/1995	Chrysene	0.26	J	mg/kg
E579SB006	579SB00602	09/14/1996	Chrysene	0.059	J	mg/kg

Appendix A-2

Constituents detected in Subsurface Soils
Charleston Naval Complex, AOC 579, Zone E

STATION	SAMPLE	DATE_COL	CHEM_NAME	RESULT	QUALIFIER	UNIT
E579SB001	579SB00102	09/12/1995	Cobalt	1.2	J	mg/kg
E579SB002	579SB00202	09/12/1995	Cobalt	1.600	J	mg/kg
E579SB004	579SB00402	09/12/1995	Cobalt	4.0	J	mg/kg
E579SB005	579SB00502b	09/14/1996	Cobalt	2.6	J	mg/kg
E579SB006	579SB00602	09/14/1996	Cobalt	4.5	J	mg/kg
E579SB001	579SB00102	09/12/1995	Copper	3.1	=	mg/kg
E579SB002	579SB00202	09/12/1995	Copper	20.5	=	mg/kg
E579SB003	579SB00302	09/12/1995	Copper	0.7	=	mg/kg
E579SB004	579SB00402	09/12/1995	Copper	0.79	J	mg/kg
E579SB005	579SB00502b	09/14/1996	Copper	4.9	=	mg/kg
E579SB006	579SB00602	09/14/1996	Copper	37.1	=	mg/kg
E579SB002	579SB00202	09/12/1995	Flouranthene	0.72	=	mg/kg
E579SB005	579SB00502b	09/14/1996	Flouranthene	0.063	J	mg/kg
E579SB006	579SB00602	09/14/1996	Flouranthene	0.072	J	mg/kg
E579SB002	579SB00202	09/12/1995	Indeno(1,2,3-c,d)pyrene	0.045	J	mg/kg
E579SB001	579SB00102	09/12/1995	Iron	3740	=	mg/kg
E579SB002	579SB00202	09/12/1995	Iron	4320	=	mg/kg
E579SB003	579SB00302	09/12/1995	Iron	1530	=	mg/kg
E579SB004	579SB00402	09/12/1995	Iron	2210	=	mg/kg
E579SB005	579SB00502b	09/14/1996	Iron	8860	=	mg/kg
E579SB006	579SB00602	09/14/1996	Iron	19800	=	mg/kg
E579SB001	579SB00102	09/12/1995	Lead	15.1	=	mg/kg
E579SB002	579SB00202	09/12/1995	Lead	44.8	=	mg/kg
E579SB003	579SB00302	09/12/1995	Lead	1.8	=	mg/kg
E579SB004	579SB00402	09/12/1995	Lead	1.5	=	mg/kg
E579SB005	579SB00502b	09/14/1996	Lead	16.3	=	mg/kg
E579SB006	579SB00602	09/14/1996	Lead	40.5	=	mg/kg
E579SB001	579SB00102	09/12/1995	Magnesium	213	J	mg/kg
E579SB002	579SB00202	09/12/1995	Magnesium	339	J	mg/kg
E579SB003	579SB00302	09/12/1995	Magnesium	69.1	J	mg/kg
E579SB004	579SB00402	09/12/1995	Magnesium	164	J	mg/kg
E579SB005	579SB00502b	09/14/1996	Magnesium	852	=	mg/kg
E579SB006	579SB00602	09/14/1996	Magnesium	1970	=	mg/kg
E579SB001	579SB00102	09/12/1995	Manganese	36.7	=	mg/kg
E579SB002	579SB00202	09/12/1995	Manganese	113	=	mg/kg
E579SB003	579SB00302	09/12/1995	Manganese	19.9	=	mg/kg
E579SB004	579SB00402	09/12/1995	Manganese	15.6	=	mg/kg
E579SB005	579SB00502b	09/14/1996	Manganese	143	=	mg/kg
E579SB006	579SB00602	09/14/1996	Manganese	426	=	mg/kg
E579SB002	579SB00202	09/12/1995	Mercury	0.13	=	mg/kg
E579SB004	579SB00402	09/12/1995	Mercury	0.14	=	mg/kg
E579SB005	579SB00502b	09/14/1996	Mercury	0.07	=	mg/kg
E579SB006	579SB00602	09/14/1996	Mercury	0.31	=	mg/kg
E579SB006	579SB00602	09/14/1996	Naphthalene	0.063	J	mg/kg
E579SB001	579SB00102	09/12/1995	Nickel	2.3	J	mg/kg
E579SB002	579SB00202	09/12/1995	Nickel	4.0	J	mg/kg
E579SB003	579SB00302	09/12/1995	Nickel	0.86	J	mg/kg
E579SB004	579SB00402	09/12/1995	Nickel	4.2	J	mg/kg
E579SB005	579SB00502b	09/14/1996	Nickel	4.8	J	mg/kg
E579SB006	579SB00602	09/14/1996	Nickel	8.0	=	mg/kg

Appendix A-2
Constituents detected in Subsurface Soils
Charleston Naval Complex, AOC 579, Zone E

STATION	SAMPLE	DATE_COL	CHEM_NAME	RESULT	QUALIFIER	UNIT
E579SB002	579SB00202	09/12/1995	Phenanthrene	0.3	J	mg/kg
E579SB006	579SB00602	09/14/1996	Phenanthrene	0.058	J	mg/kg
E579SB005	579SB00502b	09/14/1996	Potassium	559	J	mg/kg
E579SB006	579SB00602	09/14/1996	Potassium	1150	=	mg/kg
E579SB002	579SB00202	09/12/1995	Pyrene	0.6	=	mg/kg
E579SB005	579SB00502b	09/14/1996	Pyrene	0.067	J	mg/kg
E579SB006	579SB00602	09/14/1996	Pyrene	0.067	J	mg/kg
E579SB005	579SB00502b	09/14/1996	Selenium	0.87	=	mg/kg
E579SB006	579SB00602	09/14/1996	Selenium	0.65	J	mg/kg
E579SB001	579SB00102	09/12/1995	Sodium	73.7	J	mg/kg
E579SB002	579SB00202	09/12/1995	Sodium	72.6	J	mg/kg
E579SB003	579SB00302	09/12/1995	Sodium	63	J	mg/kg
E579SB004	579SB00402	09/12/1995	Sodium	86.4	J	mg/kg
E579SB005	579SB00502b	09/14/1996	Sodium	267	J	mg/kg
E579SB006	579SB00602	09/14/1996	Sodium	277	J	mg/kg
E579SB005	579SB00502b	09/14/1996	Tin (Sn)	0.84	J	mg/kg
E579SB006	579SB00602	09/14/1996	Tin (Sn)	2.200	J	mg/kg
E579SB001	579SB00102	09/12/1995	Vanadium	6.6	=	mg/kg
E579SB002	579SB00202	09/12/1995	Vanadium	6.0	=	mg/kg
E579SB003	579SB00302	09/12/1995	Vanadium	2.1	J	mg/kg
E579SB004	579SB00402	09/12/1995	Vanadium	3.2	J	mg/kg
E579SB005	579SB00502b	09/14/1996	Vanadium	15.2	=	mg/kg
E579SB006	579SB00602	09/14/1996	Vanadium	40.5	=	mg/kg
E579SB001	579SB00102	09/12/1995	Zinc	9.0	=	mg/kg
E579SB002	579SB00202	09/12/1995	Zinc	91.1	=	mg/kg
E579SB003	579SB00302	09/12/1995	Zinc	3.0	=	mg/kg
E579SB004	579SB00402	09/12/1995	Zinc	3.9	=	mg/kg
E579SB005	579SB00502b	09/14/1996	Zinc	14.3	=	mg/kg
E579SB006	579SB00602	09/14/1996	Zinc	86.9	=	mg/kg

Data Validation Summary - Charleston Naval Complex - Zone E

TO: Kris Garcia/CH2M HILL/ATL
FROM: Herb Kelly/CH2M HILL/GNA
DATE: March 6, 2002

The purpose of this memorandum is to present the results of the data validation process for the samples collected on January 11, 2002, at AOC 579 in Zone E.

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

The Quality Control areas that were review and the resulting findings are documented within each subsection that follows. This data was validated for compliance with the analytical method requirements. This process also included a review of the data to assess the accuracy, precision, and completeness based upon procedures described in the guidance documents such as the Environmental Protection Agency (EPA) *National Functional Guidelines for Inorganic Data Review (EPA 1994)*. 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 analysis of selected metals following SW-846 6010/7000 Series methodology.

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

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

The following primary flags were used to qualify the data:

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

Secondary Data Validation Qualifiers

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

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

54450	E579SB010	579SB01001	01/11/02	SO	54450008	N	0	1		X	
54450	E579SB009	579SB00902SD	01/11/02	SO	1200133851	SD	3	5			X
54450	E579SB009	579SB00902MS	01/11/02	SO	1200133850	MS	3	5			X
54450	E579SB009	579SB00902	01/11/02	SO	54450007	N	3	5	X	X	X
54450	E579SB009	579SB00901	01/11/02	SO	54450005	N	0	1	X	X	X
54450	E579SB009	579CB00901	01/11/02	SO	54450006	FD	0	1	X	X	X
54450	E579SB008	579SB00802	01/11/02	SO	54450004	N	3	5	X	X	X
54450	E579SB008	579SB00801	01/11/02	SO	54450003	N	0	1	X	X	X
54450	E579SB007	579SB00702	01/11/02	SO	54450002	N	3	5	X	X	X
54450	E579SB007	579SB00701SD	01/11/02	SO	1200133296	SD	0	1	X	X	
54450	E579SB007	579SB00701MS	01/11/02	SO	1200133295	MS	0	1	X	X	
54450	E579SB007	579SB00701	01/11/02	SO	54450001	N	0	1	X	X	X
54452	FIELDQC	579EB007M1SD	01/11/02	WQ	1200133262	SD			X	X	
54452	FIELDQC	579EB007M1SD	01/11/02	WQ	1200133846	SD					X
54452	FIELDQC	579EB007M1MS	01/11/02	WQ	1200133261	MS			X	X	
54452	FIELDQC	579EB007M1MS	01/11/02	WQ	1200133845	MS					X
54452	FIELDQC	579EB007M1	01/11/02	WQ	54452001	EB			X	X	X

MATRIX CODE

SO - Soil

WQ - Water QC Samples

SAMPLE TYPE CODE

EB - Equipment Blank

FD - Field Duplicate

MS - Matrix Spike

SD - Matrix Spike duplicate

N - Native Sample

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 blank/continuing calibration blank and equipment blank samples 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 2.

TABLE 2
Equipment Blank Contamination: Metals
Charleston Naval Complex, Zone E, AOC 579, Charleston, SC

SDG	Lab Sample ID	Sample ID	Sample Type	Parameter	Lab Result	Units	Flag Concentrations
54450	CCB	CCB	CCB	Antimony	5.41	µg/L	<1.35 mg/Kg
	CCB	CCB	CCB	Arsenic	4.36	µg/L	<1.09 mg/Kg

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

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

Recoveries/ Relative Percent Differences (RPDs) - MS/MSD

All Matrix Spike (MS) and Matrix Spike Duplicate (MSD) recoveries, and relative percent differences (RPDs) were within acceptable quality control limits, except as noted in Table 3 below.

TABLE 3
MS/MSD Recoveries and RPDs Out of QC Limits: Metals
Charleston Naval Complex, Zone E, AOC 579, Charleston, SC

SDG	Sample	Parameter	Recovery	Recovery Limits	RPD	RPD Limits	Associated Samples	Flag
54450	579SB00701 / #1	Antimony	42.2*/40.7*	80-120			all	Detects – J; Non-Detects – UJ
54450	579SB00902 / #5	Mercury	174*/426.8*	80-120	41*	35	all	Detects – J; Non-Detects – UJ

* - out of control limits

Field Duplicate Samples

The Relative Percent Differences (RPDs) for Arsenic and Mercury in the Native/Field Duplicate Sample set 54450-#5/54450-#6, were outside acceptable QC limits. Flags are not typically applied to results based upon Duplicate RPD values only, but in conjunction with other QC parameters. In addition, non-homogeneity in soil matrices is often the reason for poor precision between the native sample and its field duplicate. No flags were applied to the results based upon the Field Duplicate RPD results.

Rejected Data

No data was rejected for this sampling event.

Conclusion

A review of the analytical data submitted regarding the investigation of site AOC 579 in Zone E at the Charleston Naval Complex, Charleston, South Carolina by CH2M HILL has been completed. An overall evaluation of the data indicates that the sample handling, shipment, and analytical procedures have been adequately completed, and that the analytical results should be considered usable as qualified.

The analytical data had minor QC concerns as discussed above. However, the validation review demonstrated that the analytical systems were generally in control and the data results can be used in the decision making process.

Attachment 1 - Change Qualifiers and Results
 Zone E - AOC 579

SPID	SAMPLE ID	EXAMINER	WELL	DEPTH	WELL TYPE	PARAMETER	RESULT	UNIT	QUALIFIER	REMARKS
54450	579CB00901	54450006	SO	METAL	SW7471	MERCURY	1.7	=	1.7	J mg/kg MS, MD
54450	579SB00701	54450001	SO	METAL	SW7471	MERCURY	2.86	=	2.86	J mg/kg MS, MD
54450	579SB00702	54450002	SO	METAL	SW7471	MERCURY	0.631	=	0.631	J mg/kg MS, MD
54450	579SB00801	54450003	SO	METAL	SW7471	MERCURY	7.65	=	7.65	J mg/kg MS, MD
54450	579SB00802	54450004	SO	METAL	SW6010	ANTIMONY	0.547	U	0.547	UJ mg/kg MS
54450	579SB00802	54450004	SO	METAL	SW7471	MERCURY	0.043	=	0.043	J mg/kg MS, MD
54450	579SB00901	54450005	SO	METAL	SW6010	ANTIMONY	1.13	J	1.13	UJ mg/kg BL, MS
54450	579SB00901	54450005	SO	METAL	SW7471	MERCURY	19.1	=	19.1	J mg/kg MS, MD
54450	579SB00902	54450007	SO	METAL	SW6010	ANTIMONY	0.741	U	0.741	UJ mg/kg MS
54450	579SB00902	54450007	SO	METAL	SW7471	MERCURY	0.477	=	0.477	J mg/kg MS, MD

Meeting Today's Needs with a Vision for Tomorrow

Fax Transmission Cover Sheet

Date: 01/18/02
To: Herb Kelly From: Gina Anderson
(843) 769-7384

Fax Number: (352) 271-4811

Total Number of Pages (including this page): _____

Re: _____

COMMENTS

Herb,

Please find the results for 54450/52. The package will be shipped on Monday, 1/21

Original will Follow Via: _____ **US Mail** _____ **Express Mail** _____ **Other** _____ **None**

The information contained in this message is confidential and is intended only for the use of the individual or firm named above. If you are not the intended recipient and have received this message in error, you are asked not to copy or distribute any of the pages which follow. Please notify the sender immediately by telephone if you have received this communication in error and return the original to the sender by mail.

General Engineering Laboratories, Inc. • POB 30712 • Charleston SC 29417
Phone (843) 556-8171 • Fax (843) 766-1178

Certificate of Analysis

Company : CH2M Hill
 Address : 3011 S.W. Williston Road
 Gainesville, Florida 32614

Report Date: January 18, 2002

Contact: Mr. Herb Kelly
 Project: Charleston Naval Shipyard

Page 1 of 2

Client Sample ID:	579SB00701	Project:	CH2M00400
Sample ID:	54450001	Client ID:	CH2M006
Matrix:	Soil		
Collect Date:	11-JAN-02		
Receive Date:	11-JAN-02		
Collector:	Client		
Moisture:	15.9%		

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis Federal											
<i>7471 Cold Vapor Hg in Solid</i>											
Mercury		2.86	0.0465	0.102	mg/kg	10	JJ2	01/17/02	1111	130262	1
Metals Analysis-ICP Federal											
<i>3050/6010 Arsenic Federal</i>											
Antimony	J	3.63	0.547	12.0	mg/kg	2	HSC	01/16/02	0658	130031	2
Arsenic		149	0.316	2.00	mg/kg	2					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	FDG	01/15/02	1100	130030
SW846 7471A	EPA 7471A Mercury Prep Soil	ARD	01/16/02	1415	130261

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7471A	
2	SW846 3050B/6010B	

Notes:

The Qualifiers in this report are defined as follows :

- ** Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- B Analyte found in the sample as well as the associated blank.
- E Concentration exceeds instrument calibration range
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit
- U! Uncertain identification for gamma spectroscopy.
- X Lab-specific qualifier - must be fully described in case narrative and data summary package

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.

Certificate of Analysis

Company : CH2M Hill
 Address : 3011 S.W. Williston Road
 Gainesville, Florida 32614

Contact: Mr. Herb Kelly
 Project: Charleston Naval Shipyard

Report Date: January 18, 2002

Page 1 of 2

Client Sample ID: 579SB00702
 Sample ID: 54450002
 Matrix: Soil
 Collect Date: 11-JAN-02
 Receive Date: 11-JAN-02
 Collector: Client
 Moisture: 36.2%

Project: CH2M00400
 Client ID: CH2M006

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis- Federal											
<i>7471 Cold Vapor Hg in Solid</i>											
Mercury		0.631	0.0068	0.100	mg/kg	1	JJ2	01/17/02	1035	130262	1
Metals Analysis- ICP Federal											
<i>3050/6010 Arsenic: Federal</i>											
Antimony	J	1.52	0.721	12.0	mg/kg	2	HSC	01/16/02	0739	130031	2
Arsenic		27.4	0.417	2.00	mg/kg	2					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	FDG	01/15/02	1100	130030
SW846 7471A	EPA 7471A Mercury Prep Soil	ARD	01/16/02	1415	130261

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7471A	
2	SW846 3050B/6010B	

Notes:

The Qualifiers in this report are defined as follows :

- ** Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- B Analyte found in the sample as well as the associated blank.
- E Concentration exceeds instrument calibration range
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit
- UI Uncertain identification for gamma spectroscopy.
- X Lab-specific qualifier - must be fully described in case narrative and data summary package

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.

Certificate of Analysis

Company : CH2M Hill
 Address : 3011 S.W. Williston Road
 Gainesville, Florida 32614

Report Date: January 18, 2002

Contact: Mr. Herb Kelly
 Project: Charleston Naval Shipyard

Page 1 of 2

Client Sample ID: 5795B00801
 Sample ID: 54450003
 Matrix: Soil
 Collect Date: 11-JAN-02
 Receive Date: 11-JAN-02
 Collector: Client
 Moisture: 10.5%

Project: CH2M00400
 Client ID: CH2M006

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis Federal											
<i>7471 Cold Vapor Hg in Solid</i>											
Mercury		7.65	0.466	1.03	mg/kg	100	JJ2	01/17/02	1113	130262	1
Metals Analysis-ICP Federal											
<i>3050/6010 Arsenic Federal</i>											
Antimony	J	6.11	0.504	12.0	mg/kg	2	HSC	01/16/02	0745	130031	2
Arsenic		71.6	0.291	2.00	mg/kg	2					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	FDG	01/15/02	1100	130030
SW846 7471A	EPA 7471A Mercury Prep Soil	ARD	01/16/02	1415	130261

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7471A	
2	SW846 3050B/6010B	

Notes:

The Qualifiers in this report are defined as follows :

- ** Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- B Analyte found in the sample as well as the associated blank.
- E Concentration exceeds instrument calibration range
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit
- UI Uncertain identification for gamma spectroscopy.
- X Lab-specific qualifier - must be fully described in case narrative and data summary package

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.

Certificate of Analysis

Company : CH2M Hill
 Address : 3011 S.W. Williston Road
 Gainesville, Florida 32614

Report Date: January 18, 2002

Contact: Mr. Herb Kelly
 Project: Charleston Naval Shipyard

Page 1 of 2

Client Sample ID:	579SB00802	Project:	CH2M00400
Sample ID:	54450004	Client ID:	CH2M006
Matrix:	Soil		
Collect Date:	11-JAN-02		
Reccive Date:	11-JAN-02		
Collector:	Client		
Moisture:	9.78%		

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis Federal											
<i>7471 Cold Vapor Hg in Solid</i>											
Mercury	J	0.0429	0.00454	0.100	mg/kg	1	JJ2	01/17/02	1039	130262	1
Metals Analysis-ICP Federal											
<i>3050/6010 Arsenic Federal</i>											
Antimony	U	0.0858	0.510	12.0	mg/kg	2	HSC	01/16/02	0751	130031	2
Arsenic		3.27	0.295	2.00	mg/kg	2					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	FDG	01/15/02	1100	130030
SW846 7471A	EPA 7471A Mercury Prep Soil	ARD	01/16/02	1415	130261

The following Analytical Methods were performed

Method	Description	Analyst	Comments
1	SW846 7471A		
2	SW846 3050B/6010B		

Notes:

The Qualifiers in this report are defined as follows :

- ** Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- B Analyte found in the sample as well as the associated blank.
- E Concentration exceeds instrument calibration range
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit
- UI Uncertain identification for gamma spectroscopy.
- X Lab-specific qualifier - must be fully described in case narrative and data summary package

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.

Certificate of Analysis

Company : CH2M Hill
 Address : 3011 S.W. Williston Road
 Gainesville, Florida 32614

Report Date: January 18, 2002

Contact: Mr. Herb Kelly
 Project: Charleston Naval Shipyard

Page 1 of 2

Client Sample ID: 579SB00901
 Sample ID: 54450005
 Matrix: Soil
 Collect Date: 11-JAN-02
 Receive Date: 11-JAN-02
 Collector: Client
 Moisture: 11.5%

Project: CH2M00400
 Client ID: CH2M006

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis Federal											
<i>7471 Cold Vapor Hg in Solid</i>											
Mercury		19.2	1.02	2.25	mg/kg	200	JJ2	01/17/02	1114	130262	1
Metals Analysis-ICP Federal											
<i>3050/6010 Arsenic Federal</i>											
Antimony	J	1.13	0.525	12.0	mg/kg	2	HSC	01/16/02	0757	130031	2
Arsenic		9.56	0.304	2.00	mg/kg	2					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	FDG	01/15/02	1100	130030
SW846 7471A	EPA 7471A Mercury Prep Soil	ARD	01/16/02	1415	130261

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7471A	
2	SW846 3050B/6010B	

Notes:

The Qualifiers in this report are defined as follows :

- ** Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- B Analyte found in the sample as well as the associated blank.
- E Concentration exceeds instrument calibration range
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit
- UI Uncertain identification for gamma spectroscopy.
- X Lab-specific qualifier - must be fully described in case narrative and data summary package

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.

Certificate of Analysis

Company : CH2M Hill
 Address : 3011 S.W. Williston Road
 Gainesville, Florida 32614

Report Date: January 18, 2002

Contact: Mr. Herb Kelly
 Project: Charleston Naval Shipyard

Page 1 of 2

Client Sample ID: 579CB00901
 Sample ID: 54450006
 Matrix: Soil
 Collect Date: 11-JAN-02
 Receive Date: 11-JAN-02
 Collector: Client
 Moisture: 10.2%

Project: CH2M00400
 Client ID: CH2M006

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis Federal											
<i>7471 Cold Vapor Hg in Solid</i>											
Mercury		1.70	0.0452	0.100	mg/kg	10 JJ2		01/17/02	1116	130262	1
Metals Analysis-ICP Federal											
<i>3050/6010 Arsenic Federal</i>											
Antimony	J	1.90	0.498	12.0	mg/kg	2 HSC		01/16/02	0803	130031	2
Arsenic		3.03	0.288	2.00	mg/kg	2					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	FDG	01/15/02	1100	130030
SW846 7471A	EPA 7471A Mercury Prep Soil	ARD	01/16/02	1415	130261

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7471A	
2	SW846 3050B/6010B	

Notes:

The Qualifiers in this report are defined as follows :

- ** Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- B Analyte found in the sample as well as the associated blank.
- E Concentration exceeds instrument calibration range
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit
- UI Uncertain identification for gamma spectroscopy.
- X Lab-specific qualifier - must be fully described in case narrative and data summary package

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.

Certificate of Analysis

Company : CH2M Hill
 Address : 3011 S.W. Williston Road
 Gainesville, Florida 32614

Report Date: January 18, 2002

Contact: Mr. Herb Kelly
 Project: Charleston Naval Shipyard

Page 1 of 2

Client Sample ID: 579SB00902
 Sample ID: 54450007
 Matrix: Soil
 Collect Date: 11-JAN-02
 Receive Date: 11-JAN-02
 Collector: Client
 Moisture: 37.7%

Project: CH2M00400
 Client ID: CH2M006

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis Federal											
<i>7471 Cold Vapor Hg in Solid</i>											
Mercury		0.477	0.00676	0.100	mg/kg	1	JJ2	01/17/02	1045	130262	1
Metals Analysis-ICP Federal											
<i>3050/6010 Arsenic Federal</i>											
Antimony	U	0.434	0.692	12.0	mg/kg	2	HSC	01/16/02	0809	130031	2
Arsenic		22.1	0.400	2.00	mg/kg	2					

Following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	FDG	01/15/02	1100	130030
SW846 7471A	EPA 7471A Mercury Prep Soil	ARD	01/16/02	1415	130261

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7471A	
2	SW846 3050B/6010B	

Notes:

The Qualifiers in this report are defined as follows :

- ** Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- B Analyte found in the sample as well as the associated blank.
- E Concentration exceeds instrument calibration range
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit
- UI Uncertain identification for gamma spectroscopy.
- X Lab-specific qualifier - must be fully described in case narrative and data summary package

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.

Certificate of Analysis

Company : CH2M Hill
Address : 3011 S.W. Williston Road
Gainesville, Florida 32614

Contact: Mr. Herb Kelly
Project: Charleston Naval Shipyard

Report Date: January 18, 2002

Page 1 of 1

Client Sample ID: 579SB01001
Sample ID: 54450008
Matrix: Soil
Collect Date: 11-JAN-02
Receive Date: 11-JAN-02
Collector: Client
Moisture: 11.2%

Project: CH2M00400
Client ID: CH2M006

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Metals Analysis-ICP Federal											
<i>30.50/6010 Arsenic Federal</i>											
Arsenic		178	0.294	2.00	mg/kg	2	HSC	01/16/02	0815	130031	1

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3050B	846 3050BS PREP	FDG	01/15/02	1100	130030

The following Analytical Methods were performed

Method	Description	Analyst Comments
I	SW846 3050B/6010B	

Notes:

The Qualifiers in this report are defined as follows :

- ** Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- B Analyte found in the sample as well as the associated blank.
- E Concentration exceeds instrument calibration range
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit
- U1 Uncertain identification for gamma spectroscopy.
- X Lab-specific qualifier - must be fully described in case narrative and data summary package

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Gina Anderson.

Reviewed by _____

Certificate of Analysis

Company : CH2M Hill
 Address : 3011 S.W. Williston Road
 Gainesville, Florida 32614

Report Date: January 18, 2002

Contact: Mr. Herb Kelly
 Project: Charleston Naval Shipyard

Page 1 of 2

Client Sample ID:	579EB007M1	Project:	CH2M00400
Sample ID:	54452001	Client ID:	CH2M006
Matrix:	Water		
Collect Date:	11-JAN-02		
Receive Date:	11-JAN-02		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis Federal											
<i>7470 Cold Vapor Hg Liquid</i>											
Mercury	U	0.00944	0.073	0.200	ug/L	1	JJ2	01/16/02	1145	130260	1
Metals Analysis-ICP Federal											
<i>3005/6010 Arsenic Federal</i>											
Antimony	U	0.868	3.80	60.0	ug/L	1	HSC	01/16/02	0416	130023	2
Arsenic	U	-1.12	4.57	10.0	ug/L	1					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 7470A	EPA 7470A Mercury Prep Liquid	ARD	01/15/02	1800	130259
SW846 3005A	ICP-TRACE SW846 3005A	BCD1	01/14/02	1407	130022

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SW846 7470A	
2	SW846 3005/6010B	

Notes:

The Qualifiers in this report are defined as follows :

- ** Indicates the analyte is a surrogate compound.
- < Actual result is less than amount reported
- > Actual result is greater than amount reported
- B Analyte found in the sample as well as the associated blank.
- E Concentration exceeds instrument calibration range
- J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
- U Indicates the compound was analyzed for but not detected above the detection limit
- UI Uncertain identification for gamma spectroscopy.
- X Lab-specific qualifier - must be fully described in case narrative and data summary package

The above sample is reported on an "as received" basis.