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CNC CHARLESTON
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CORRECTIVE MEASURES STUDY TECHNICAL MEMORANDUM AREAS OF CONCERN 655, 656, 666 ZONE H CNC CHARLESTON SC

3/31/1999

ENSAFE

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY
CHARLESTON NAVAL COMPLEX,
NORTH CHARLESTON, SOUTH CAROLINA
CTO-029

ZONE H CORRECTIVE MEASURES STUDY TECHNICAL MEMORANDUM AOC 655,656,666

CONTRACT N62467-89-D-0318

Prepared for:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA

Prepared by:

ENSAFE, INC.
5724 SUMMER TREES DRIVE
MEMPHIS, TENNESSEE 38134
(901)372-7962

MARCH 31, 1999

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4

61 Forsyth Street SW
Atlanta, Georgia 30303-3104

April 7, 1999

E-Mail
4WD-FFB

Mr. David P. Dodds
Remedial Project Manager
Code 18710
Department of the Navy
Southern Division, NAVFAC
2155 Eagle Drive
North Charleston, South Carolina 29419-9010

SUBJ: Naval Base Charleston (CNAV)
Proposed NFA Status for AOC 655, 656, 666

Dear Mr. Dodds:

The Environmental Protection Agency, Region 4 (EPA) has reviewed the Technical Memorandum Proposing NFA Status for AOCs 655, 656, and 666 and concurs with the proposal of NFA status for these Areas of Concern. CNAV is a RCRA permitted site in the HSWA authorixzed State of South Carolina. Therefore, concurrence of the South Carolina Department of Health and Environmental Control is also required.

Sincerely,

Dann J. Spariosu, Ph.D.
Senior Remedial Project Manager

cc: J. Tapia
P. Bergstrand
T. Haverkost

ENSAFE

ENSAFE INC. ENVIRONMENTAL AND MANAGEMENT CONSULTANTS

311 Plus Park Blvd., Suite 130 • Nashville, Tennessee 37217 • Telephone 615-399-8800 • Facsimile 615-399-7467 • www.ensafe.com

March 31, 1999

Commanding Officer
ATTN: David Dodds, Code 18710
SOUTHNAVFACENGCOM
2155 Eagle Drive
P.O. Box 190010
North Charleston, South Carolina 29419-9010

Subject: **CTO-029, Charleston, South Carolina**
Document Transmittal - Technical Memorandum AOC 655, March 31, 1999
Technical Memorandum AOC 656, March 31, 1999
Technical Memorandum AOC 666, March 31, 1999

Reference: **Contract N62467-89-D-0318 (CLEAN II)**

Dear Mr. Dodds:

Please find enclosed two copies of the subject Technical Memorandums. These documents are submitted for your formal review prior to distribution to the Project Team. If you are in agreement with the findings of these documents, please prepare a Navy cover letter for the official distribution of these documents to the Project Team. The cover letter should be sent to Ms. Diane Maddux in our Charleston office.

Please contact the undersigned if you have any questions concerning this submittal.

Sincerely,
EnSafe Inc.

Don Schroeder

Donald M. Schroeder, P.E.
Environmental Engineer

Enclosures: As Stated

cc:
Contracts File: CTO No. 29
Project File: 2908-001-14-400-00
SOUTHDIV: Ms. Kim Reavis/Code 0233KR

TECHNICAL MEMORANDUM

To: Environmental Cleanup Project Team
Charleston Naval Complex
Charleston, South Carolina

From: Don Schroeder, P.E.
EnSafe, Nashville

Date: 31 March 1999

Re: AOC 655 Removal from the Zone H CMS

Objective

The purpose of this technical memorandum (tech memo) is to present the justification for removal of AOC 655 from the Zone H CMS. SCDHEC has agreed that Zone H Minor Site AOC 655, along with AOCs 656 and 666 and SWMU 136/AOC 663 are eligible for removal from the CMS process.

Site Description

AOC 655, which is behind Building 656 the former Base Exchange, is the site of a fuel line rupture in 1985 that released approximately 300 gallons of No. 2 fuel oil. The Site Map for AOC 655 is presented on Figure 1. The fuel line, which originated at a 5,800-gallon UST, supplied fuel to a boiler in Building 656. The majority of the site is covered with asphalt and concrete. There is a small area between Building 656 and the former UST which is covered with grass and gravel. There were no Navy DET ISMs completed at the site, but the UST and fuel lines have been removed.

Site Background

AOC 655 was included in the RFI at the request of the USEPA and SCDHEC. This AOC is not considered a hazardous material or waste treatment, storage or disposal area. The virgin petroleum products that were stored at this AOC are not classified as a hazardous material or waste and are typically regulated as a petroleum or special waste/material.

The CMS Work Plan summarized that the surface soil risk above background at the site is near the lower threshold of 1E-6 under the residential scenario, and is below this threshold under the industrial scenario. The primary contributor to risk in groundwater at the site is arsenic.

However, the groundwater arsenic concentration did not exceed the MCL of 50 μg/L through four quarters of sampling at the three site monitoring wells. The groundwater data for arsenic concentrations at AOC 655 is summarized in Table 1.

The Project Team requested that AOC 655 be placed in the CMS process due to concerns over possible arsenic in the groundwater. Two more quarters of groundwater monitoring at the three site wells was required. This additional sampling would confirm or refute the presence of arsenic and would determine if any remedial action is required. In addition, the results of the Navy DET UST removal activities were also to be considered during the CMS process.

Navy DET Activities

The Navy DET removed the 5,800 gallon fuel oil UST and product piping from the site in October of 1996. The activities that were performed during tank removal are summarized in the Underground Storage Tank (UST) Assessment Report for UST 656 that is dated March 6, 1997. The 5,800 gallon fuel oil UST and all associated piping were excavated and removed. The tank and piping were removed from the site and disposed of properly.

Soil that was excavated from the tank pit and from over the piping lines was temporarily stockpiled adjacent to the tank pit. Samples were taken from the soil piles and from the remaining soil in the tank pit and trench lines. The samples were analyzed for 4 Volatile Organics (BTEX) and 16 Extractable Organics (PAHs). All soil samples were less than the residential RBC parameters for all of the BTEX and PAH constituents that were analyzed. All excavated soil was then returned to the tank pit and piping line trench area.

CMS Groundwater Sampling

Two additional rounds of groundwater sampling, as called for in the CMS Work Plan, were performed on the three site monitoring wells 655-01, 655-02 and 655-03. The arsenic results for the two additional rounds are summarized on Table 1. All additional sampling results were below the arsenic MCL of 50 μg/L. Five out of the six additional samples were also below the shallow groundwater background arsenic concentration of 21.5 μg/L. Only one sample, 655-G-W003-U6, was slightly above the background concentration at 23.5 μg/L. This sample represents an unfiltered sample of water from the monitoring well.

This same sample was also filtered and then analyzed for arsenic. After filtering, the arsenic concentration was reduced to 14.2 μg/L, which is well below the background reference concentration. This suggests that some of the arsenic concentration that is being reported in the sampling results is due to the presence of suspended solids in the sample, and is not an accurate reflection of the actual groundwater concentration. Both of these data points were qualified by noting that arsenic was also present in the method blank as well as the sample.

Recommendation

The UST Assessment Report does not indicate any residual soil risk from the confirmation sampling that was performed at the three site monitoring wells. The two additional rounds of groundwater monitoring, per CMS Work Plan requirements, do not show arsenic contamination above the MCL value. Given these facts, we believe that this site should be designated as a NFA site and be removed from the CMS altogether. If there are remaining regulatory issues associated with the Navy DET tank removal performed at the site, these should be handled by the appropriate UST/PST program.

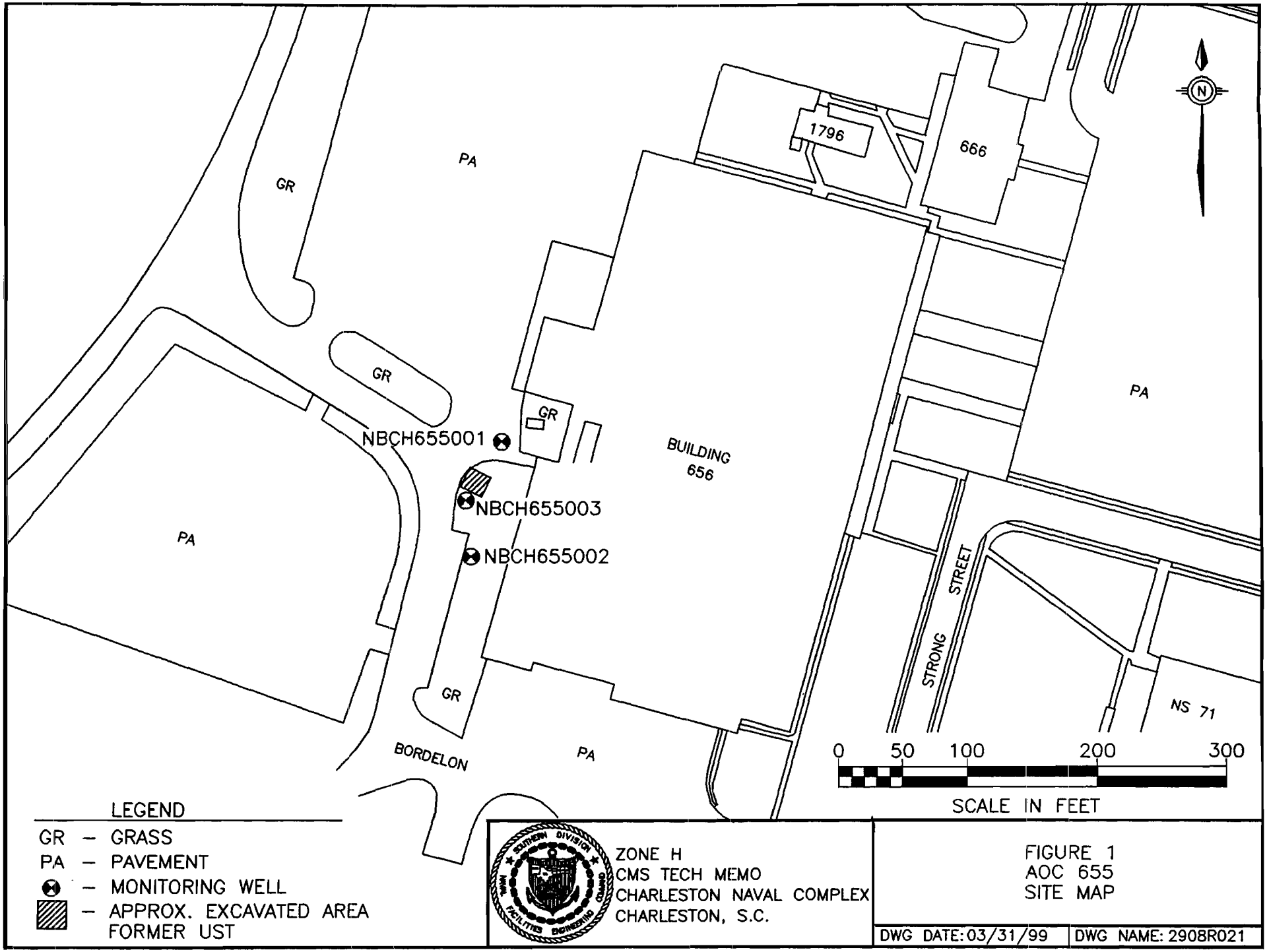

GR
PA
1796
666
GR
GR
NBCH655001
GR
BUILDING
656
PA
NBCH655003
NBCH655002
PA
STRONG STREET
NS 71
GR
BORDELON
PA
0 50 100 200 300
SCALE IN FEET
LEGEND
GR – GRASS
PA – PAVEMENT
– MONITORING WELL
– APPROX. EXCAVATED AREA FORMER UST
ZONE H
CMS TECH MEMO
CHARLESTON NAVAL COMPLEX
CHARLESTON, S.C.
FIGURE 1
AOC 655
SITE MAP
DWG DATE: 03/31/99
DWG NAME: 2908R021

Table 1
Groundwater Data for Arsenic at AOC 655

Sample Number	Date	Arsenic (μg/l)
MCL		**50**
Background		**21.5**
655-G-W001-01	10/28/94	9.4 U
655-G-W001-02	04/03/95	6.8 U
655-G-W001-03	09/21/95	6.8 J
655-G-W001-04	03/26/96	3.3 J
655-G-W001-05	06/01/98	2.9 UJ
655-G-W001-06	11/11/98	6.1 J
655-G-W002-01	10/27/94	22.9
655-G-W002-02	04/03/95	9.6 U
655-G-W002-03	09/20/95	15.9
655-G-W002-04	03/25/96	12.6
655-G-W002-05	06/01/98	9.2 J
655-G-W002-06	11/11/98	10.6
655-G-W003-01	10/27/94	42.3
655-G-W003-02	04/03/95	27.9
655-G-W003-03	09/20/95	38.3
655-G-W003-04	03/26/96	32.7
655-G-W003-05	06/01/98	10 J
655-G-W003-U6	01/12/99	23.5 J
655-G-W003-F6	01/12/99	14.2 J

Notes:
U – The material was analyzed but not detected at the listed numerical quantitation limit.
J – The associated numerical value is an estimated quantity.
UJ – The material was analyzed for but not detected at the estimated numerical quantitation limit.

5.8 AOC 655

AOC 655, which is behind Building 656, the former Base Exchange, is the site of a fuel line rupture in 1985 that released approximately 300 gallons of No. 2 fuel oil. The fuel line, which originated from a 5,800-gallon UST, supplied fuel to a boiler in Building 656. A large portion of the site is covered with asphalt or concrete. However, a small area between Building 656 and the UST is covered with grass and gravel.

It is important to note that AOC 655 was included in the RFI at the request of the USEPA and SCDHEC. This AOC is not considered a hazardous material or waste treatment, storage, or disposal area. Virgin petroleum products are not classified as hazardous material or waste; they are typically regulated as a petroleum or special material/waste. Therefore, soil and groundwater were sampled at AOC 655 during the RFI to assess the presence or absence of residual contamination resulting from the previous oil spill and other possible releases that may have occurred nearby.

5.8.1 Current Use

The AOC 655 site is not currently used by either federal or nonfederal tenants, nor is the former Base Exchange presently in use.

5.8.2 Future Use

According to the Charleston Naval Complex Redevelopment Authority, this area will likely be used for industrial purposes in the future.

5.8.3 ISM Status

The Navy DET has recently removed a UST and associated soil at the subject site. The results of the Navy DET ISM at the site will be reviewed by EnSafe and considered during the CMS process.

5.8.4 Fate and Transport Summary

The possibility of AOC 655 soil to groundwater, groundwater to surface water, and soil to air cross-media transport was evaluated during the RFI. None of these contaminant transport routes was considered a concern for this site.

5.8.5 Human Health Risk Assessment Summary

Table 5.8.1 summarizes AOC 655 total groundwater risk and hazard and soil risk and hazard in excess of Zone H background.

Table 5.8.1
AOC 655
Site Human Health Risk and Hazard above Background[1]

		Surface Soil		Shallow GW		Deep GW	
		HI[2]	ILCR[3]	HI	ILCR	HI	ILCR
AOC 655	Res.[4]	NA	1.3E-6	6	1E-4	ND	ND
	Ind.[4]	NA	3.7E-7	1	4E-5	ND	ND

Notes:

1 — Maximum background risk in shallow surface soil =arsenic (4.1E-5 Res.; 5.8E-6 Ind.); beryllium (1.1E-5 Res.;1.5E-6 Ind.); BEQ (6.7E-6 Res.; 1.4E-6 Ind.).
Maximum background hazard shallow surface soil =arsenic (0.71 Res.; 0.04 Ind.); beryllium (0.004 Res.;0.0 Ind.); BEQ (0.0 Res.;0.0 Ind.).
Background risk and hazard has not been established for groundwater

2 — Cumulative hazard is presented as HI (hazard index). For sites with no inorganic COCs, hazard is generally not applicable.

3 — Cumulative risk is presented as ILCR (incremental lifetime cancer risk).

4 — Residential risk and hazard are for a child; Industrial risk and hazard are for an adult site worker.

NA — Site hazard is inapplicable to the organic COCs at this site.

ND — Not determined. Deep GW was not sampled during the RFI at this site.

Surface soil risk above background is near the lower threshold risk of 1E-6 under the residential scenario and is below the threshold under the industrial scenario. The Navy DET has also excavated and removed some soil near sample point 655-SB-001, which was one of the three highest point-risk locations.

The primary contributor to risk in groundwater at this site is arsenic. However, arsenic exceeded the UTL in only one of three groundwater monitoring wells (NBCH655003), and did not exceed the arsenic MCL of 50 mg/L through four quarters.

Table 5.8.2
AOC 655
(mg/L arsenic)

Well	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
NBCH655003	42.3	27.9	41.3	32.8

Note:
ND = non-detect

5.8.6 Ecological Risk Assessment Summary

No ecological risk is anticipated for AOC 655 due to lack of suitable habitat and ecological receptors.

5.8.7 Remedial Objectives

The project team has requested that AOC 655 be placed in the CMS process due to arsenic in groundwater.

5.8.8 Potential Remedial Alternatives

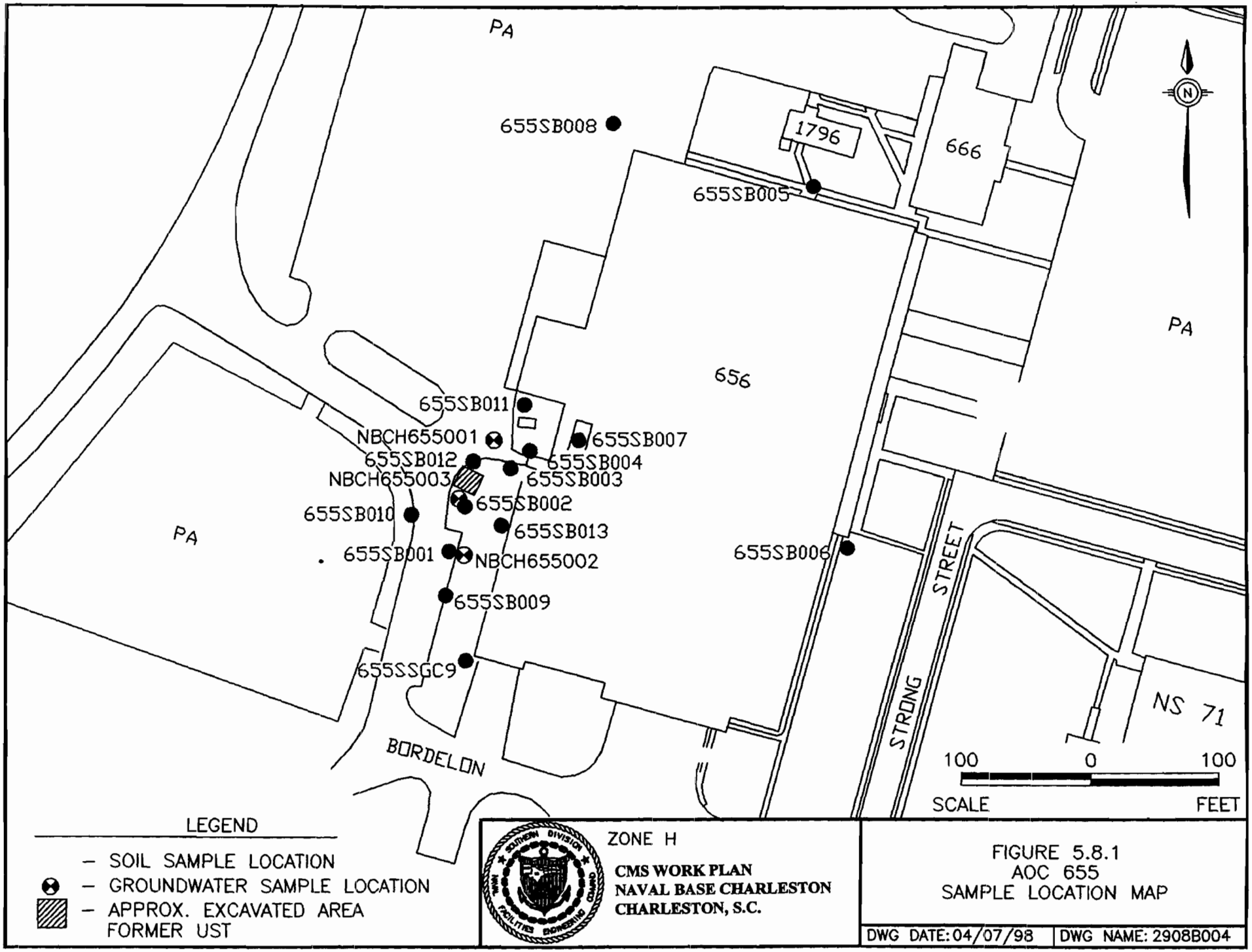
Based on the project team's concern about groundwater, proposed remedial alternative(s) for this site include:

- Additional short-term groundwater monitoring (e.g., two more quarters) of wells NBCH-655-001, -002, and - 003 to confirm or refute the presence of arsenic and to determine if remedial action is required.

5.8.9 CMS Data Needs

Based on the project team's concern about groundwater, the following activities are proposed Figure 5.8.1):

- Two additional rounds of groundwater sampling with analysis of groundwater for arsenic and a background and zone-wide comparative analysis of arsenic levels


PA
655SB008
1796
666
655SB005
PA
656
655SB011
NBCH655001
655SB007
655SB012
655SB004
NBCH655003
655SB003
655SB002
655SB010
655SB013
PA
655SB001
NBCH655002
655SB006
655SB009
655SSGC9
STRONG STREET
NS 71
BORDELON
100 0 100
SCALE FEET
LEGEND
– SOIL SAMPLE LOCATION
– GROUNDWATER SAMPLE LOCATION
– APPROX. EXCAVATED AREA FORMER UST
ZONE H
CMS WORK PLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.
FIGURE 5.8.1
AOC 655
SAMPLE LOCATION MAP
DWG DATE: 04/07/98
DWG NAME: 2908B004

4.13 AOC 655

AOC 655 is the site where approximately 300 gallons of No. 2 fuel oil spilled in 1985 when a fuel line in the Building 656 boiler room ruptured. The line supplied fuel oil to the boiler from a nearby 5,800-gallon UST, which is also within the subject AOC. Approximately 150 gallons of the spilled fuel was reported to have escaped through a seam in the building's concrete floor to underlying soil.

A previous soil-gas investigation (Appendix L) near Building 656 identified responses for acetone, benzene, toluene, ethylbenzene, and oil compounds. Air sampling within Building 656 detected anthropogenic compounds, but did not identify the source.

Soil and groundwater were sampled at AOC 655 to assess any residual contamination from the previous oil spill and other releases which may have occurred in the vicinity. Sample locations are shown on Figure 4.13.1. Tables 4.13.1 and 4.13.2 summarize the organic and inorganic results, respectively, for soil. A complete analytical report for the soil samples collected at AOC 655 is in Appendix I.

4.13.1 Soil Sampling and Analysis

Soil sampling was conducted in two phases at AOC 655. During the primary soil sampling event, 12 soil samples were collected from eight locations. Eight soil samples were collected from the 0- to 1-foot depth interval, and four samples were collected from the 3- to 5-foot depth interval. Primary soil sample locations were based on the reported fuel oil spill, the UST and its associated piping, and the results of the previous soil-gas investigation conducted at the site. The locations were sampled using hand augers as described in Section 2.2.2. Two proposed soil sample locations in the boiler room were not sampled due to concrete overlying soil and the unknown location of utilities that were built into the concrete. Soil samples were analyzed for VOCs, SVOCs, metals, cyanide, pesticides/PCBs, and TPH. Eight samples were collected from five additional locations during the secondary sampling event. Five from the upper interval and

three from the lower interval were analyzed for TPH and pesticides/PCBs. These additional sample locations were based on primary soil sample analytical results. Two samples selected for duplicate analysis as a QA measure were analyzed for hexavalent chromium, herbicides, organophosphate pesticides, and dioxins in addition to the standard suite of analyses.

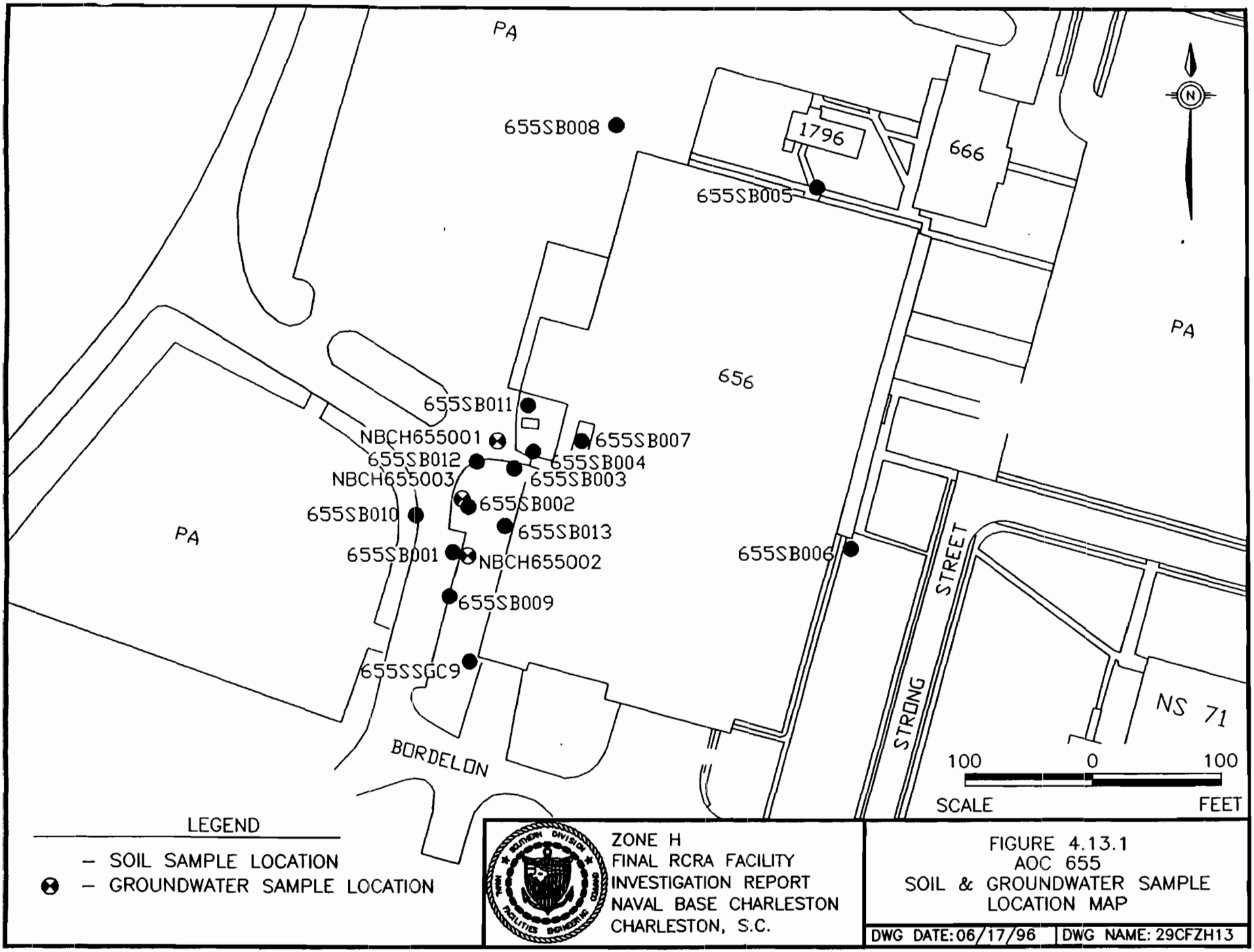
Results of a soil-gas confirmation sample (SGCSB009), next to Building 656, are included in the AOC 655 tables.

4.13.1.1 Volatile Organic Compounds in Soil

Five VOCs (acetone, 2-butanone, methylene chloride, tetrachloroethene, and toluene) were detected in one or more of the soil samples collected at AOC 655. Acetone and methylene chloride were detected in all samples analyzed for these compounds. Detected concentrations were two to four orders of magnitude less than each compound's RBSL. Toluene was detected in five upper interval and one lower interval samples at concentrations five orders of magnitude less than its RBSL. Tetrachloroethene and 2-butanone were each detected in one sample at a concentration of three and five orders of magnitude less than their respective RBSLs.

4.13.1.2 Semivolatile Organic Compounds in Soil

SVOCs were detected in three of the 13 samples analyzed for these compounds at AOC 655. Sixteen SVOCs were detected in the soil-gas confirmation sample (SGCSB009). Eight SVOCs were detected in a soil sample collected from the 0- to 1-foot interval at location 655SB005. One SVOC was detected in a soil sample from the 0- to 1-foot interval at location 655SB006. The following were present in soil samples collected at AOC 655 (including the soil-gas confirmation sample) at concentrations exceeding their respective RBSLs: benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. All above-RBSL detections were in the soil-gas confirmation sample.


PA
655SB008
1796
666
655SB005
656
655SB011
NBCH655001
655SB007
655SB012
655SB004
NBCH655003
655SB003
655SB002
655SB010
655SB013
655SB001
NBCH655002
655SB009
655SSGC9
655SB006
PA
PA
STRONG STREET
NS 71
BORDELON
100 0 100
SCALE FEET
LEGEND
– SOIL SAMPLE LOCATION
– GROUNDWATER SAMPLE LOCATION
ZONE H
FINAL RCRA FACILITY
INVESTIGATION REPORT
NAVAL BASE CHARLESTON
CHARLESTON, S.C.
FIGURE 4.13.1
AOC 655
SOIL & GROUNDWATER SAMPLE
LOCATION MAP
DWG DATE: 06/17/96
DWG NAME: 29CFZH13

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4.13.1.3 Pesticides and PCBs in Soil

Pesticide compounds were present in soil samples from seven of the eight primary locations and in all five secondary sampling locations. Pesticides were detected in 12 of the 13 samples collected from the 0- to 1-foot interval and in four of seven samples collected from the 3- to 5-foot depth interval. Ten pesticide compounds were detected in the soil samples collected at AOC 655. Two of the compounds (aldrin and dieldrin) were detected at concentrations exceeding their RBSLs. Dieldrin (RBSL-40 μg/kg) was detected in a soil sample collected from the 0- to 1-foot interval at location 655SB007 (360 μg/kg) and in a sample collected from the 3- to 5-foot interval at location 655SB005 (61.8 μg/kg [average of original and duplicate sample results]). Aldrin (RBSL-38 μg/kg) was detected in the soil sample collected from the 3- to 5-foot interval at the same location (105 μg/kg [average of original and duplicate sample results]).

PCBs were detected at six of the eight primary sampling locations and at all five secondary locations. PCBs were detected in 13 of the 20 soil samples collected (11 of 13 samples in the upper interval and two of seven in the lower interval). Two PCB compounds (Aroclors-1254 and 1260) were detected in the soil samples collected at AOC 655. Detected concentrations of Aroclor-1260 exceeded the RBSL at sample locations 01, 02, 09, 011, and 012. The highest concentrations (610 and 750 μg/kg) were in the samples from the upper and lower intervals at location 655SB001. Detected concentrations of Aroclor-1254 also exceed its RBSL of 83 μg/kg at sample locations 655SB004 and 655SB005. The highest concentrations of Aroclor-1254 were detected in soil samples collected from the 0- to 1-foot and 3- to 5-foot intervals at location 655SB004 110 μg/kg and 180 μg/kg, respectively.

4.13.1.4 Other Organic Compounds in Soil

Petroleum hydrocrabons were detected at 10 of the 12 sample locations and in 12 of the 19 samples analyzed. Concentrations ranged from 11,000 μg/kg to 120,000 μg/kg. Indeterminate lubricating oil was the primary petroleum hydrocarbon detected at AOC 655.

Herbicides and organophosphate pesticides were not detected in the two duplicate samples collected.

Dioxin analysis was conducted on two duplicate samples collected at AOC 655. Total TEQs for dioxin (screening level 1,000 pg/g) were 0.818 pg/g and 1.299 pg/g for these two samples.

4.13.1.5 Inorganic Elements in Soil

Table 4.13.2 summarizes inorganic results from the AOC 655 soil samples. No inorganic elements were detected at concentrations exceeding both their respective RBSLs and UTLs for background.

Cyanide (RBSL-160 μg/kg) was detected in one soil sample from AOC 655; it was from the 0- to 1-foot interval at location 655SB001 at a concentration of 1.5 μg/kg, which is two orders of magnitude below the RBSL.

4.13.2 Groundwater Sampling and Analysis

Three shallow monitoring wells were installed to sample groundwater near AOC 655 (see Figure 4.13.1). Groundwater sampling was conducted in accordance with procedures detailed in Section 2.4. First-round groundwater samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, cyanide, and TPH. Based on results from these samples, second-round samples were analyzed for SVOCs, metals, and pesticides. One second-round sample was duplicated and analyzed for the same parameters as the primary samples. Tables 4.13.3 and 4.13.4 summarize organics and inorganics results respectively for groundwater. A complete report of analytical data for groundwater samples collected at AOC 655 is included in Appendix I.

4.13.2.1 Volatile Organic Compounds in Groundwater

No VOCs were reported for groundwater samples collected during the first sampling round from AOC 655. VOCs were not analyzed in second-round samples because they were not detected in first-round samples.

4.13.2.2 Semivolatile Organic Compounds in Groundwater

No SVOCs were detected in the first-round or second-round groundwater samples from AOC 655.

4.13.2.3 Pesticides and PCBs in Groundwater

Two pesticide compounds were detected in the first and second round samples at AOC 655. Alpha-Chlordane and gamma-Chlordane were detected in well NBCH655002 at concentrations of 0.04 μg/L and 0.06 μg/L, respectively, during first-round sampling.. These concentrations, when combined, exceed the RBSL of 0.052 μg/L for Chlordane. During second-round sampling, the sample from well NBCH655002 reported alpha-Chlordane and gamma-Chlordane concentrations of 0.03 μg/L and 0.04 μg/L, respectively. These concentrations, when combined, are also above its RBSL.

No PCBs were detected in the groundwater samples collected at AOC 655.

4.13.2.4 Other Organic Compounds in Groundwater

No petroleum hydrocarbons were detected in the groundwater samples collected at AOC 655.

4.13.2.5 Inorganic Elements in Groundwater

Table 4.13.4 summarizes analytical results for inorganic chemicals from AOC 655 groundwater samples. Ten metals were detected at least once in samples from round one, while 12 metals were reported from second-round samples. Elements detected at concentrations above their corresponding RBSLs in first and second-round samples are arsenic (RBSL-0.038 μg/L) and

manganese (RBSL-18 μg/L). One arsenic value from a first-round sample exceeded its UTL of 27.99 μg/L as well as its RBSL. All other detections were below UTLs.

First-round samples from wells NBCH655002 and NBCH655003 had arsenic concentrations of 22.9 μg/L and 42.3 μg/L, respectively. Manganese was detected in groundwater samples from wells NBCH655001, NBCH655002, and NBCH655003 at concentrations of 578 μg/L, 298 μg/L, and 437 μg/L, respectively.

Second-round groundwater samples from wells NBCH655002 and NBCH655003 reported arsenic concentrations of 10.6 μg/L and 27.9 μg/L, respectively. Manganese was detected at concentrations of 689 μg/L, 346 μg/L, and 416 μg/L for NBCH655001 through NBCH655003, respectively.

No cyanide was detected in the groundwater samples collected at AOC 655.

4.13.3 Deviations from Final Zone H RFI Work Plan

Eighteen soil samples were proposed for collection in the Final Zone H RFI Work Plan. The actual number of soil samples collected at AOC 655 was 21 (14 upper interval, seven lower interval). All proposed upper interval samples were collected. Due to shallow depth to groundwater, only some second-interval samples were collected from the proposed locations. Based on analytical data for soil samples collected during the initial phase of sampling, additional sample locations were identified. Both sampling intervals were attempted at each of these additional sample locations. As with the initial phase of sampling, a portion of the second interval samples at the additional sample locations were not collected due to shallow depth to groundwater.

Groundwater samples were collected from each of the sample locations proposed in the Final Zone H RFI Work Plan.

Table 4.0.3 lists the quantities of proposed samples and quantities of actual samples collected.

Table 4.13.1
AOC 655
Organic Compounds in Soil (µg/kg)

Compound Name	No. of Detections (1st Interval/2nd Interval)	Range of Concentrations (upper interval/lower interval)	Risk-Based Screening Levels
Volatile Organic Compounds ***(12 Samples Collected — 8 Upper Interval Samples, 4 Lower Interval Samples, 2 Samples Duplicated)***			
Acetone	9/4	17-4,400/72-180	780,000
2-Butanone (MEK)	1/0	19/0	4,700,000
Methylene chloride	7/4	10-34/10-29	85,000
Tetrachloroethene	0/1	0/4.4	12,000
Toluene	6/1	2.9-8/5	1,600,000
Semivolatile Organic Compounds ***(12 Samples Collected — 8 Upper Interval Samples, 4 Lower Interval Samples, 2 Samples Duplicated)***			
Acenaphthene	1/0	140/0	470,000
Acenaphthylene	1/0	440/0	470,000
Anthracene	1/0	1,800/0	2,300,000
Benzo(a)anthracene	2/0	91-3,300/0	880
Benzo(b)fluoranthene	1/0	120-2,100/0	880
Benzo(k)fluoranthene	1/0	1,800/0	8,800
Benzo(g,h,i)perylene	1/0	960/0	310,000
Benzo(a)pyrene	1/0	2,400/0	88
BEHP	2/0	150-1,800/0	46,000
Butylbenzylphthalate	1/0	98/0	1,600,000
Chrysene	2/0	100-2,700/0	8,000
Dibenzo(a,h)anthracene	1/0	520/0	88
Dibenzofuran	1/0	210/0	31,000
Fluoranthene	2/0	170-4,200/0	310,000
Fluorene	1/0	660/0	310,000
Indeno(1,2,3-cd)pyrene	1/0	1,100	880
Phenanthrene	2/0	98.0-4,200/0	310,000
Pyrene	2/0	160-5,300/0	230,000

Table 4.13.1
AOC 655
Organic Compounds in Soil (µg/kg)

Compound Name	No. of Detections (1st Interval/2nd Interval)	Range of Concentrations (upper interval/lower interval)	Risk-Based Screening Levels
Pesticides ***(20 Samples Collected — 13 Upper Interval Samples, 7 Lower Interval Samples, 2 Samples Duplicated)***			
Aldrin	0/1	0/96	38
4,4'-DDE	6/1	2.6-13/6.4	1,900
4,4'-DDT	4/2	4-23/7-25	1,900
alpha-Chlordane	9/2	4-97/3-9	alpha+gamma 470
gamma-Chlordane	9/3	4-130/3.6-22	
Dieldrin	4/1	2.4-360/52.9	40
Endosulfan II	1/0	4.0/0	47,000
Endrin aldehyde	2/1	8-16/29	2,300
Heptachlor	2/0	1.3-11/0	140
Heptachlor epoxide	5/0	2-24/0	70
Polychlorinated Biphenyls ***(20 Samples Collected — 13 Upper Interval Samples, 7 Lower Interval Samples, 2 Samples Duplicated)***			
Aroclor-1254	3/1	81-110/180	83
Aroclor-1260	8/1	25.8-610/750	83
Total Petroleum Hydrocarbons ***(19 Samples Collected — 12 Upper Interval Samples, 7 Lower Interval Samples, 2 Samples Duplicated)***			
TPH	9/3	14,000-120,000/ 15,000-120,000	Not Listed
Herbicides ***(2 Duplicate Analyses — 1 Upper Interval Sample, 1 Lower Interval Sample)***			
No herbicides detected.			
Organophosphate Pesticides ***(2 Duplicate Analyses — 1 Upper Interval Sample, 1 Lower Interval Sample)***			
No organophosphates detected.			
Dioxins ***(2 Duplicate Analyses — 1 Upper Interval Sample, 1 Lower Interval Sample)***			
Total TEQ	1/1	1.299/0.818 pg/g	1000 pg/g

Table 4.13.2
AOC 655
Inorganic Elements in Soil (mg/kg)

Inorganic Elements	Number of Analyses (upper interval/lower interval)	Number of Detections (upper interval/lower interval)	Range of Concentrations for Detections (upper interval/lower interval)	Risk-Based Screening Level	Upper Tolerance Limit of Background[c]
Aluminum[a]	8/4	9/4	2,500-15,300/2,720-6,640	7,900	25,310/46,180
Iron[a]	8/4	9/4	2,060-21,200/1,540-5,650	Not Listed	30,910/66,170
Lead	9/4	5/0	3.2-215/0	400	118/68.69
Nickel	9/4	9/4	1.2-12.7/1.1-2.0	160	33.38/29.9
Potassium[a]	8/4	8/4	117-167/82.4-235	Not Listed	Nutrient[e]
Silver	9/4	0/0	0/0	39	Not Valid[d]
Sodium[a]	8/4	9/4	50.7-1,270/33.2-210	Not Listed	Nutrient[e]
Thallium	9/4	0/0	0/0	0.63	0.63/1.3
Antimony	9/4	0/0	0/0	3.1	Not Valid[d]
Arsenic	9/4	9/4	1.4-12.7/0.84-2.8	0.37	14.81/35.52
Barium	9/4	8/4	3.4-23.2/4.0-19.9	550	40.33/43.80
Beryllium	9/4	9/4	0.09-0.91/0.06-0.21	0.15	1.466/1.62
Cadmium	9/4	6/0	0.24-0.56/0	3.9	1.05/1.10
Cobalt	9/4	9/4	0.6-5.2/0.74-1.0	470	5.863/14.88
Copper	9/4	9/4	1.4-41.6/0.37-1.1	290	27.6/31.62
Vanadium	9/4	9/4	4.8-43.2/3.9-9.95	55	77.38/131.6
Zinc	9/4	9/4	13.6-115/4.4-7.7	2,300	214.3/129.6
Selenium	9/4	0/1	0/0.51	39	2.0/2.7
Mercury	9/4	8/1	0.02-0.11/2.0	2.3	0.485/0.74
Magnesium[a]	9/4	8/4	276-5,710/177-520	Not Listed	9,592/9,179
Manganese[a]	9/4	8/4	13.7-382/8.2-40.3	39	636.4/1,412
Calcium	9/4	8/4	1,560-152,000/2,550-5,930	Not Listed	Nutrient[e]
Chromium	10/4	8/4	5.3-35.8/3.9-9.2	39	85.65/83.86
Tin[a]	1/1	0/0	0/0	4,700	Not Valid[d]
Hexavalent Chromium[b]	1/1	0/0	0/0	39	Not Valid[d]
Cyanide	8/4	1/0	1.5/0	160	Not Valid[d]

Notes:
[a] = Elements that are not included in both SW-846 and Appendix IX methods.
[b] = Included in duplicate sample analyses only.
[c] = See Appendix J for UTL determination.
[d] = Number of nondetections prevented determination of UTL.
[e] = Elements considered to be nutrients; therefore, UTL was not determined.

Table 4.13.3
AOC 655
Organic Compounds in Groundwater (µg/L)

Round 1: 3 Samples Collected, 0 Samples Duplicated
Round 2: 3 Samples Collected, 1 Sample Duplicated

Compound Name	Sampling Round	Number of Detections	Range of Concentrations for Detections	Risk-Based Screening Level	Maximum Contaminant Level
Volatile Organic Compounds (Collected in Round 1 Only)					
No VOCs detected.					
Semivolatile Organic Compounds (Collected in Rounds 1 and 2)					
No SVOCs detected.					
Pesticides (Collected in Rounds 1 and 2)					
alpha-Chlordane	1	1	0.04	0.052	2
	2	1	0.03	(alpha+gamma)	(alpha+gamma)
gamma-Chlordane	1	1	0.06	0.052	2
	2	1	0.04	(alpha+gamma)	(alpha+gamma)
Polychlorinated Biphenyls (Collected in Round 1 Only)					
No PCBs detected.					
Total Petroleum Hydrocarbons (Collected in Round 1 Only)					
No TPH detected.					

Table 4.13.4
AOC 655
Inorganic Chemicals in Groundwater (μg/L)

Round 1: 3 Samples Collected, 0 Samples Duplicated
Round 2: 3 Samples Collected, 1 Sample Duplicated

Chemical Name	Sampling Round	Number of Detections	Range of Concentrations for Detections	Risk-Based Screening Level	Upper Tolerance Limit of Background[b]	Max. Contam. Level
Aluminum[c]	1	2	1,040-1,750	3,700	Not	Not
	2	3	26.60-2,210		Valid	Listed
Arsenic	1	2	22.9-42.3	0.038	27.99	50
	2	2	10.6-27.9			
Barium	1	3	54.7-255	260	323	2,000
	2	3	46.5-211			
Calcium[c]	1	3	153,000-196,000	Not Listed	Nutrient	Not
	2	3	161,500-271,000			Listed
Chromium[d]	1	0	--	18[e]	Not	100
	2	2	3.5-4.0		Valid	
Iron	1	3	17,600-45,400	Not Listed	45,760	Not
	2	3	16,750-39,300			Listed
Magnesium	1	3	175,000-541,000	Not Listed	3,866,000	Not
	2	3	122,000-649,000			Listed
Manganese	1	3	298-578	18	3,391	Not
	2	3	346-689			Listed
Potassium[c]	1	3	52,200-161,000	Not Listed	Nutrient	Not
	2	3	16,900-90,350			Listed
Sodium[c]	1	3	1,780,000-3,940,000	Not Listed	Nutrient	Not
	2	3	1,240,000-4,570,000			Listed
Vanadium[d]	1	1	10.1	26	Not	Not
	2	3	4.0-10.1		Valid	Listed
Zinc	1	0	--	1,100	Not	Not
	2	1	7.7		Valid	Listed
Cyanide[d]	1	--	Not Detected			
	2	--	No Analysis			

Notes:
[a] = Only elements with detections are listed. Cyanide was a separate analysis.
[b] = See Appendix J for UTL determinations.
[c] = Element considered to be a nutrient; therefore, UTL was not determined.
[d] = High percentage of nondetects in background samples prevented determination of UTL.
[e] = If trivalent chromium, RBSL-3700 μg/L.
[f] = Based on treatment technique AL.

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5.10 AOC 655

AOC 655 is the site of a 1985 fuel line rupture that released approximately 300 gallons of No. 2 fuel oil. The fuel line supplied the Building 656 boiler from a nearby 5,800-gallon UST. A large portion of the site is covered with asphalt or concrete. The southern end of the building is a loading dock with a paved parking area. A small area between Building 656 and the UST is covered with grass and gravel. Remaining portions of the site are covered with grass and a sidewalk. Migration pathways for AOC 655 include soil to groundwater, surface soil to air and groundwater to surface water. Movement of contaminants with sediment and/or surface water is not likely due to the absence of any defined drainage feature at the AOC and the fact that most of the AOC is covered with either grass, asphalt, or concrete. Surface soil, subsurface soil and groundwater samples were collected at AOC 655.

5.10.1 AOC 655 — Soil to Groundwater Cross Media Transport

Table 5.10.1 compares constituent concentrations to groundwater protection SSLs, tap water RBCs, and background UTLs. Acetone, aldrin, copper, dieldrin, lead, and methylene chloride were detected in soil at concentrations exceeding groundwater protection SSLs or background UTLs. Acetone, aldrin, copper, dieldrin, lead and methylene chloride were not detected in AOC 655 shallow groundwater. Copper and lead were detected above the background UTLs in only one or two soil samples and are therefore not considered a significant migration threat. Acetone, dieldrin, and aldrin were detected above groundwater protection SSLs in only one or two soil samples. Although conservative screening has indicated the potential for isolated soil to groundwater migration, the limited extent of acetone, dieldrin, and aldrin in soil and their absence from groundwater suggest that this is not likely to a significant process. Total petroleum hydrocarbons were detected in soil, but in the absence of SSLs for these constituents, the soil-to-groundwater quantitative screening was not performed for these compounds. Methylene chloride was detected above a conservative groundwater protection SSL in 7 of 10 surface and 4 of 4 subsurface soil samples, however, methylene chloride was not detected in AOC 655 shallow groundwater. Although the potential exists for methylene chloride soil to

groundwater migration this does not appear to be a significant process. It should be noted that methylene chloride is a common laboratory contaminant and subsequent quarterly groundwater sampling should be reviewed to confirm fate and transport conclusions.

5.10.2 AOC 655 — Groundwater-to-Surface Water Cross-Media Transport

Arsenic and gamma-chlordane were detected in shallow groundwater at concentrations marginally above the tap water RBCs or background UTLs. Considering soil's neutral to high pH, arsenic is expected precipitate and sorb to the soil matrix rather than migrate in groundwater. Considering a K_{oc} value of 49,500, gamma-chlordane is expected to sorb to the soil matrix rather than migrate in groundwater. AOC 655 has no surface water feature, so qualitative screening was not performed for the groundwater-to-surface water migration pathway. The Cooper River, the closest surface water body to AOC 655, will be investigated as part of the Zone J RFI. Groundwater travel time from AOC 655 to the Cooper River is estimated to be 171 years. Based on the predicted travel times to surface water (not considering the attenuative capacity of the aquifer matrix) and the dilutional capacity of the receiving stream, no significant surface water impacts are expected.

5.10.3 AOC 655 — Soil-to-Air Cross-Media Transport

Table 5.10.2 lists the VOCs detected in surface soil samples collected at AOC 655, along with corresponding soil-to-air volatilization screening level. No VOC's maximum surface soil concentration exceeded its corresponding soil-to-air volatilization screening level. A conservative soil-to-air screening value of 10,000 mg/kg was used for 2-butanone. As a result, the soil-to-air migration pathway would not be expected to be significant at the site.

Table 5.10.1
Chemicals Detected in Soil and Groundwater
Comparison to Groundwater Protection SSLs, Tap Water RBCs and Grid-based Background UTLs
NAVBASE-Charleston, Zone H, AOC 655

Parameter	Surface Soil Maximum Conc.	Sub-surface Soil Maximum Conc.	Ground Water Protection SSL or UTL *	Units	Ground Water Maximum Conc.	Tap Water RBC or UTL *	Units	Exceeds Tap Water RBC	Exceeds Ground Water Protection SSL
Acenaphthene	140	ND	20000	UG/KG	ND	220	UG/L	NO	NO
Acenaphthylene	440	ND	20000	UG/KG	ND	220	UG/L	NO	NO
Acetone	4400	180	800	UG/KG	ND	370	UG/L	NO	YES
Aldrin	ND	87	5	UG/KG	ND	0.004	UG/L	NO	YES
Aluminum	15300	6640	46180	MG/KG	1750	3700	UG/L	NO	NO
Anthracene	1800	ND	430000	UG/KG	ND	1100	UG/L	NO	NO
Aroclor-1254	110	180	8200	UG/KG	ND	0.0087	UG/L	NO	NO
Aroclor-1260	610	750	8200	UG/KG	ND	0.0087	UG/L	NO	NO
Arsenic	12.7	2.8	35.52	MG/KG	42.3	27.99	UG/L	YES	NO
Barium	23.2	19.9	43.8	MG/KG	255	323	UG/L	NO	NO
Benzo(g,h,i)perylene	960	ND	98000	UG/KG	ND	150	UG/L	NO	NO
Benzo(a)pyrene Equivalents	3590.7	ND	4000	UG/KG	ND	0.0092	UG/L	NO	NO
Beryllium	0.91	0.21	180	MG/KG	ND	0.016	UG/L	NO	NO
2-Butanone (MEK)	19	ND	570	UG/KG	ND	190	UG/L	NO	NO
Butylbenzylphthalate	98	ND	6800	UG/KG	ND	730	UG/L	NO	NO
Cadmium	0.56	ND	6	MG/KG	ND	1.8	UG/L	NO	NO
alpha-Chlordane	97	9	2000	UG/KG	0.04	0.052	UG/L	NO	NO
gamma-Chlordane	130	22	2000	UG/KG	0.06	0.052	UG/L	YES	NO
Chromium	35.8	9.2	85.65	MG/KG	ND	18	UG/L	NO	NO
Cobalt	5.2	1	14.88	MG/KG	ND	220	UG/L	NO	NO
Copper	41.6	1.1	31.62	MG/KG	ND	140	UG/L	NO	YES
Cyanide	1.5	ND	NA	MG/KG	ND	75	UG/L	NO	NO
4,4'-DDE	13	6.4	500	UG/KG	ND	0.2	UG/L	NO	NO
4,4'-DDT	23	25	1000	UG/KG	ND	0.2	UG/L	NO	NO
Dibenzofuran	210	ND	12000	UG/KG	ND	15	UG/L	NO	NO
Dieldrin	360	44	1	UG/KG	ND	0.0042	UG/L	NO	YES
Dioxin (TCDD TEQ)	0.8184	1.2986	280	PG/G	ND	0.5	PG/L	NO	NO
Endosulfan II	4	ND	400	UG/KG	ND	22	UG/L	NO	NO
Endrin aldehyde	16	29	400	UG/KG	ND	1.1	UG/L	NO	NO
bis(2-Ethylhexyl)phthalate	1800	ND	11000	UG/KG	ND	4.8	UG/L	NO	NO
Fluoranthene	4200	ND	98000	UG/KG	ND	150	UG/L	NO	NO
Fluorene	660	ND	16000	UG/KG	ND	150	UG/L	NO	NO
Heptachlor	11	ND	60	UG/KG	ND	0.0023	UG/L	NO	NO
Heptachlor epoxide	24	ND	30	UG/KG	ND	0.0012	UG/L	NO	NO
Lead	215	ND	118	MG/KG	ND	15	UG/L	NO	YES
Manganese	382	40.3	1412	MG/KG	578	3391	UG/L	NO	NO
Mercury	0.11	2	3	MG/KG	ND	1.1	UG/L	NO	NO
Methylene chloride	34	29	10	UG/KG	ND	4.1	UG/L	NO	YES
Nickel	12.7	2	33.38	MG/KG	ND	73	UG/L	NO	NO
Phenanthrene	4200	ND	98000	UG/KG	ND	150	UG/L	NO	NO
Pyrene	5300	ND	140000	UG/KG	ND	110	UG/L	NO	NO
Selenium	ND	0.51	3	MG/KG	ND	18	UG/L	NO	NO
Total Petroleum Hydrocarbons	120	120	NA	UG/KG	ND	NA	UG/L	NO	NO
Tetrachloroethene	ND	4.4	40	UG/KG	ND	1.1	UG/L	NO	NO
Toluene	8	5	5000	UG/KG	ND	75	UG/L	NO	NO
Vanadium	43.2	10.2	131.6	MG/KG	10.1	26	UG/L	NO	NO
Zinc	115	7.7	4200	MG/KG	ND	1100	UG/L	NO	NO

* - See Table 5.2-1
ug/kg - micrograms per kilogram
mg/kg - milligrams per kilogram
ng/kg - nanograms per kilogram
ug/L - micrograms per liter
pg/L - picograms per liter
NA - Not available
ND - Not detected

TABLE 5.10.2
Soil-to-Air Volatilization Screening Analysis for AOC 655
NAVBASE - Charleston Zone H
Charleston, South Carolina

VOCs	Maximum Concentratio in Surface Soil	Soil to Air SSL *	Units	Exceeds SSL
Acetone	4.4	62000	MG/KG	NO
2-Butanone	0.019	10000 +	MG/KG	NO
Methylene chloride	0.034	7	MG/KG	NO
Toluene	0.008	520	MG/KG	NO

* - Soil-to-air RBCs were obtained from USEPA Region III Risk-based Concentration Tables, March 1995.

+ - Screening value presented for 2-butanone was conservatively estimated at 10,000; actual may be higher.

9.13 AOC 655

AOC 655 is the site of a spill of approximately 300 gallons of No. 2 fuel oil. The spill occurred in 1985 when a fuel line within the boiler room of Building 656 ruptured. Approximately 150 gallons of the spilled fuel escaped through a seam in the concrete floor of the building to the underlying soil. Fuel oil was supplied to the boiler room from a nearby 5,800-gallon UST which is also within the subject AOC. Soil and groundwater sampling were conducted at AOC 655 to assess the presence or absence of residual contamination resulting from the previous oil spill and other possible releases which may have occurred in the vicinity.

As determined by soil sampling and subsequent risk assessment, four compounds or compound groups were responsible for risk present in surface soil at AOC 655. These compounds were Aroclor-1254, Aroclor-1260, dieldrin, and BEQs.

Aroclor-1260 was present at AOC 655 at RBSL-exceeding concentrations. The majority of the detections of Aroclor-1260 are centered in the area of the UST and the transformer vault adjacent to Building 656 where piping from the UST enters the building. The highest concentration of Aroclor-1260 was at the UST in both the upper and lower-interval samples collected from boring 656SB001. No other Aroclor-1260 was detected in the second-interval samples. Concentrations of Aroclor-1260 decrease at surface soil sample locations away from the UST.

Aroclor-1254 was detected at two soil borings at RBSL-exceeding concentrations (655SB005 and 655SB004). The 655SB005 detection of Aroclor-1254 is only slightly above the RBSL of 83 μg/kg. At soil boring 655SB004, immediately adjacent to the transformer vault, Aroclor-1254 was present in the upper and lower-interval at 110 μg/kg and 180 μg/kg, respectively. This soil boring is surrounded by sample locations where no Aroclor-1254 was detected. No other second-interval samples contained Aroclor-1254.

Dieldrin was present in two soil samples at RBSL-exceeding concentrations (655SB00502 and 655SB00701). The dieldrin concentration in the second-interval sample at 655SB005 was only slightly above dieldrin's RBSL (44 μg/kg). The concentration of dieldrin in the upper-interval sample at 655SB007 was considerably higher (360 μg/kg). However, this detection was in the open-air alcove of Building 656 where it was likely used as an insecticide. No other soil sample collected at AOC 655 contained RBSL-exceeding concentrations of dieldrin.

BEQs were present in one soil sample (655SSGC9) collected from AOC 655 at concentrations which resulted in their identification as site COCs. The concentration of these compounds, when equated to BAP, exceeded the RBSL for BAP. The 655SSGC9 sample contained a BEQ concentration of 3,590 μg/kg. The sample location is at the edge of the current sampling pattern. BEQs were not detected in any second-interval sample collected at AOC 655.

At AOC 655, the total soil pathway risk for site residents and site workers was calculated as 3E-5 and 6E-6, respectively. The soil pathway hazard indices for all receptor groups were below 0.1. The primary contributors to surface soil risk were BEQs, Aroclor-1254, Aroclor-1260, and dieldrin. Table 9.13 summarizes human health risk assessment results.

Figure 9.28 illustrates the distribution of risk considering a residential scenario for AOC 655. Three areas (based on three sample locations) were identified that presented risk in the range between 1E-5 and 1E-4. The majority of the sampled area presented a risk of between 1E-6 and 1E-5.

Considering an industrial scenario at AOC 655 (Figure 9.29), only one sample location presented risk in the 1E-5 to 1E-4 range and only a small portion of the sampled area presented risk in the 1E-6 to 1E-5 range.

Due to lack of significant hazard in both the residential and industrial scenarios, no hazard maps for AOC 655 were prepared.

TPH contamination in excess of the screening level is present in the vicinity of the fuel oil UST and the piping leading from the UST into Building 656. The highest concentration of TPH detected at AOC 655 was 120 mg/kg. TPH concentrations drop to below the screening level in all directions away from the fuel oil UST. TPH was detected in three second-interval soil samples collected at AOC 655. One second-interval sample (655SB00402) contained TPH at a concentration which exceeded the screening level.

No ecological risk is anticipated for AOC 655 due to the lack of suitable habitat and lack of ecological receptors.

AOC 655 surface soil is recommended for inclusion in the CMS process on the basis of site resident and site worker risk as well as TPH concentrations.

The total shallow groundwater pathway risk for site residents and site workers was calculated as 1E-3 and 2E-4, respectively. The child resident hazard index was computed as 9, and the adult resident and site worker hazard indices were 4 and 1. The contributors to shallow groundwater risk and hazard were arsenic (NBCH655002 and NBCH655003) and chlordane (NBCH655002). Each was detected in at least one well during both quarterly sampling events. No arsenic or chlordane (sum of alpha and gamma isomers) was reported above their corresponding MCLs (0.05 and 0.002 μg/l). AOC 655 shallow groundwater is recommended for inclusion in the CMS process on the basis of projected resident and worker risk and hazard. However, if MCLs are strictly followed with respect to establishing groundwater remedial goals, no corrective measures would be required.

No fate and transport concerns were identified for AOC 655.

Table 9.13
Zone H Conclusion Summary
AOC 655

	Unacceptable Risks for Human Health in Residential Scenario (Y/N)	Chemicals Driving Risk
Surface Soil	Yes, ILCR 3E-5	BEQ, Aroclor-1254 and 1260, Dieldrin
Shallow Groundwater	Yes, ILCR 1E-3	As, Chlordane
Deep Groundwater	NA	NA
	Above Levels of Concern (Y/N)	**Total TEQ (ppb)**
Dioxin in Surface Soil	No	0.81 pg/g 2,3,7,8-TCDD equivalents
Dioxin in Shallow Groundwater	No	ND
Dioxin in Deep Groundwater	NA	NA
	TPH Present at Concentrations >100 ppm (Y/N)	**Maximum Detected Concentration (ppm)**
Soil	Y	120

Note:
NA = Not Applicable