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CONTAMINATION ASSESSMENT REPORT ADDENDUM SOUTH FUEL FARM SITE FACILITY 43 NAS CECIL FIELD FL

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ABB ENVIRONMENTAL

CONTAMINATION ASSESSMENT REPORT ADDENDUM
SOUTH FUEL FARM SITE, FACILITY 43

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Unit Identification Code: N60200

Contract No.: N62467-89-D-0317/090

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January 1996

CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

The Contractor, ABB Environmental Services, Inc., hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/090 are complete and accurate and comply with all requirements of this contract.

DATE: January 3, 1996

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Project Technical Lead

(DFAR 252.227-7036)

FOREWORD

To meet its mission objectives, the U.S. Navy performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks and conventional methods of past disposal, hazardous materials may have entered the environment in ways unacceptable by today's standards. With growing knowledge of the long-term effects of hazardous materials on the environment, the Department of Defense (DOD) initiated various programs to investigate and remediate conditions related to suspected past releases of hazardous materials at their facilities.

One of these programs is the Comprehensive Long-Term Environmental Action, Navy Underground Storage Tank (UST) program. This program complies with Subtitle I of the Resource Conservation and Recovery Act and the Hazardous and Solid Waste Amendment of 1984. In addition, the UST program complies with all appropriate State and local storage tank regulations as they pertain to each naval facility.

The UST program includes the following activities:

- registration and management of Navy and Marine Corps storage tank systems,
- contamination assessment planning,
- site field investigations,
- preparation of contamination assessment reports,
- remedial (corrective) action planning,
- implementation of the remedial action plans, and
- tank and pipeline closures.

The Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) manages the Navy UST program and the Florida Department of Environmental Protection oversees the Navy UST program at Naval Air Station (NAS) Cecil Field.

Questions regarding the UST program at NAS Cecil Field should be addressed to Mr. Bryan Kizer, Code 1842, at (803) 820-5896.

EXECUTIVE SUMMARY

The South Fuel Farm (SFF), Facility 43, is located at Naval Air Station (NAS) Cecil Field in Jacksonville, Florida. Prior to the tank removals in 1985 and 1994, the site contained three aboveground storage tanks, four underground storage tanks (USTs), and four earth-mounded tanks (EMTs). Fuels stored at the SFF included leaded and unleaded gasoline, aviation gasoline, diesel fuel, and JP-5.

In July 1994, four USTs and three of the four EMTs were excavated at the SFF. Excessively contaminated soil excavated during the tank removals was returned to the site. Southern Division, Naval Facilities Engineering Command requested that the Florida Department of Environmental Protection (FDEP) comments on the 1992 SFF Contamination Assessment Report be addressed and a contamination assessment (CA) was scoped to address the current site conditions.

A supplemental investigation was conducted at the SFF from March 1995 to November 1995 to assess the horizontal and vertical extent of soil and groundwater contamination associated with operation of the facility fuel storage tank system. Soil samples from 272 soil borings and groundwater samples from 50 shallow and deep monitoring wells were collected for analysis in accordance with Chapter 62-770, Florida Administrative Code (FAC) requirements and applicable FDEP guidelines.

The findings, conclusions, and recommendations for the SFF site are based on data collected during this CA.

SUMMARY. Based on the findings of the CA field investigations and laboratory analytical results, the following is a summary of existing conditions at the SFF Site:

Aquifer Characteristics and Hydrogeologic Parameters.

- Site soil consists predominantly of silty sand from the surface to approximately 70 feet below land surface (bls). The top of a hardpan layer was encountered in most borings at depths ranging from approximately 2 feet to 9 feet bls. Where encountered, the hardpan layer ranged from less that 1 foot to 11 feet in thickness to a maximum depth of 20 feet bls.

- Depth to water ranges from approximately 6 to 8 feet bls at the site. There is a net downward vertical gradient in the northern part of the site and a net upward vertical gradient in the southern part of the site. The upward gradient is associated with the stormwater drainage line.

- The groundwater flow direction is toward the southeast in both the shallow and deep zones; however, the shallow zone groundwater flow direction is significantly affected by the stormwater drainage line.

- The average hydraulic gradient across the site is 0.007 feet per foot (ft/ft) in the shallow waterbearing zone and 0.003 ft/ft in the deep zone. The average hydraulic conductivity for the shallow and deep waterbearing zones are 1.17 feet per day (ft/day) and 4.03 ft/day,

respectively. The average pore water velocity is 0.023 ft/day in the shallow zone and 0.034 ft/day in the deep zone.

Soil and Groundwater Contamination Assessment.

- Excessively contaminated soil (organic vapor analyzer [OVA] headspace reading exceeding 50 parts per million) was present throughout most of the site; however, the highest OVA headspace readings were concentrated in seven areas.

- Benzene, total volatile organic aromatics, total recoverable petroleum hydrocarbons, total polynuclear aromatic hydrocarbons, total naphthalenes, and lead concentrations in groundwater samples from site monitoring wells exceeded Chapter 62-770, FAC, "no further action" or "monitoring only" target levels for Class G-II groundwater.

- Chlorinated compounds were detected in a few site monitoring well samples and the stormwater drainage line discharge in concentrations that slightly exceed State target levels.

- The vertical extent of petroleum-contaminated groundwater exceeding the Chapter 62-770, FAC "no further action" or "monitoring only" target levels for Class G-II groundwater is less than 65 feet bls.

- Free-phase petroleum product was not detected in any of the site monitoring wells or piezometers.

- All remaining active fuel storage and transmission systems at the site (Day Tank 342-DT and associated pipes and the North Fuel Farm supply pipeline) are undergoing inspection or tightness testing, as applicable.

CONCLUSIONS.

- The horizontal and vertical extent of excessively contaminated soil and petroleum-contaminated groundwater have been adequately assessed at the SFF Site in accordance with Chapter 62-770, FAC.

- Spills and leaks from the tanks and pipelines at the site are the sources of soil and groundwater contamination.

- Petroleum-contaminated groundwater exceeding the Chapter 62-770, FAC, "no further action" or "monitoring only" target levels for Class G-II groundwater has migrated vertically and downgradient from the source areas and is discharging to (but not going beyond) the stormwater drainage line on the south side of the site.

- The hardpan layer is acting as a semi-confining unit (aquitard) between the shallow and deep waterbearing zones.

- The source of chlorinated compounds in groundwater at the site is unknown and is likely upgradient of the SFF Site.

RECOMMENDATIONS. Based on the findings, conclusions and interpretations of the CA at the SFF Site, the Navy recommends the development of a remedial action plan to address the requirements of Chapter 62-770, FAC.

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
ASTs	aboveground storage tanks
bls	below land surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
°C	degrees Celsius
CA	contamination assessment
CAR	contamination assessment report
CARA	contamination assessment report addendum
cm/sec	centimeters per second
CompQAP	Conprehensive Quality Assurance Plan
D	indicates deep well
EMTs	earth-mounded tanks
°F	degrees Fahrenheit
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
ft/day	feet per day
ft/ft	feet per foot
gpd/ft	gallons per day per foot
gpd/ft^2	gallons per day per foot squared
i	hydraulic gradient
ID	inside diameter
K	hydraulic conductivity
MCL	maximum contaminant level
n	porosity
N	new well
NA	not applicable
NAS	Naval Air Station
NFA	no further action
OVA	organic vapor analyzer
PAHs	polynuclear aromatic hydrocarbons
Pb	lead
PCE	perchloroethylene
ppb	parts per billion
ppm	parts per million
PVC	polyvinyl chloride
R	replacement well

GLOSSARY (Continued)

SM	Service Mark
SFF	South Fuel Farm
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SVOCs	semivolatile organic compounds
TCE	trichloroethene
TM	Trademark
TRPH	total recoverable petroleum hydrocarbon
USTs	underground storage tanks
VOA	volatile organic aromatics
υ	average linear velocity of groundwater flow

1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES), was contracted by Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) to perform a supplemental contamination assessment (CA) and prepare a contamination assessment report addendum (CARA) for the South Fuel Farm (SFF), Facility 43, located at Naval Air Station (NAS) Cecil Field in Jacksonville, Florida (Figure 1-1). The CA was performed from December 1990 to December 1991 and a Contamination Assessment Report (CAR) was submitted to the Florida Department of Environmental Protection (FDEP) July 1992. The FDEP recommended a supplemental investigation to complete the CA of the site.

The supplemental investigation was delayed until after July 1994, when four underground storage tanks (USTs) and three of the four earth-mounded tanks (EMTs) were excavated at the SFF Site. During the excavation, nine monitoring wells installed during the 1990-1991 CA were destroyed, and excessively contaminated soil was excavated and returned to the site. After the completion of the tank removal, SOUTHNAVFACENGCOM requested that a CA be conducted to assess the current site conditions. This CARA has been prepared for SOUTHNAVFACENGCOM for submittal to the FDEP for review and approval.

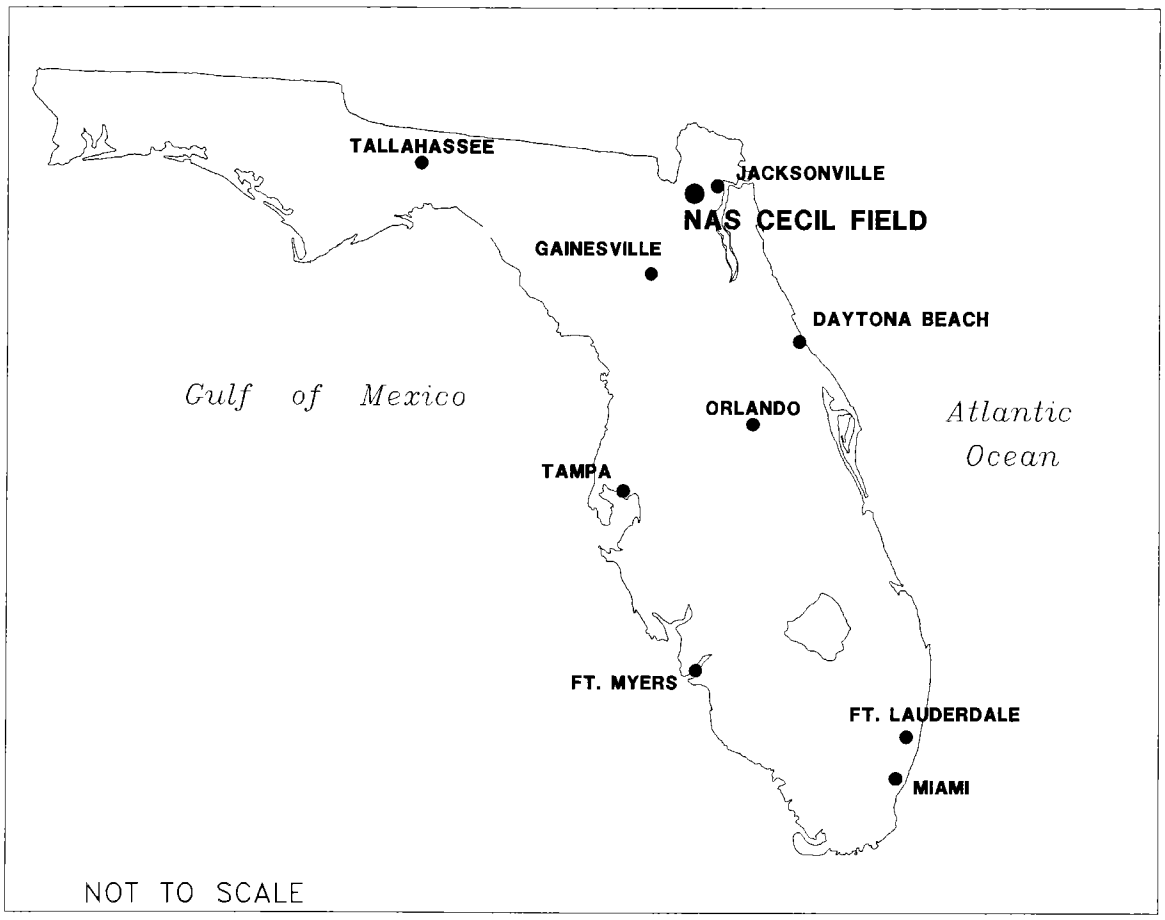
1.1 PURPOSE. A supplemental investigation was conducted at the SFF from March 1995 through November 1995 to assess the horizontal and vertical extent of soil and groundwater contamination associated with operation of the facility fuel storage tank system. The purpose of this CARA is to present the findings of the 1995 CA and update information regarding the site.

1.2 SITE DESCRIPTION. The SFF site is located at NAS Cecil Field which is situated in southwestern Duval County, approximately 14 miles southwest of the City of Jacksonville, Florida. The air station is located at the junction of State Road 228 (Normandy Boulevard) and 103rd Street (Figure 1-2). The Yellow Water Weapons Department area lies to the north and is separated from the air station by State Road 228.

The SFF, Facility 43, is located at the intersection of 2nd Street and Weed Street, approximately 500 feet northwest of the Flight Operations control tower at NAS Cecil Field. With exception to the earth cover on Day Tank 342-DT, the site is essentially flat with a slight slope to the south-southwest. Figure 1-3 shows the current site layout.

1.3 SITE HISTORY. According to NAS Cecil Field Fuel Department personnel, numerous releases have occurred in the past at the SFF. Most are believed to have resulted from tank overfills and small spills associated with the former truck and railroad loading stands.

In 1989, a release detection program was initiated at the SFF, at which time four release detection or compliance monitoring wells were installed. Afterward in 1990, Navy personnel detected several inches of free product in compliance wells CEF-43-01, CEF-43-02, and CEF-43-03 in the vicinity of Tanks 43-G and 43-H (ABB-ES, 1992).



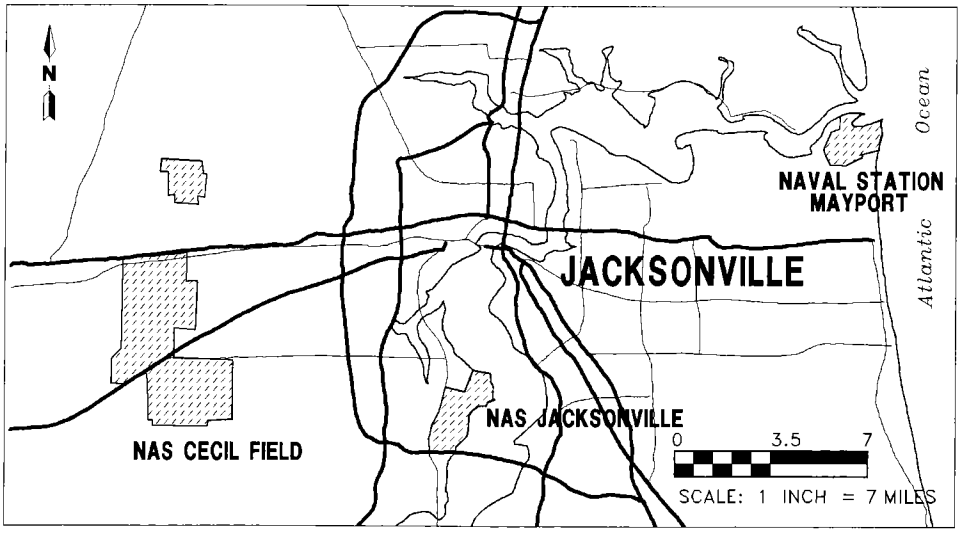


FIGURE 1-1
FACILITY LOCATION MAP

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SOUTH FUEL FARM SITE
FACILITY 43
NAS CECIL FIELD
JACKSONVILLE, FLORIDA

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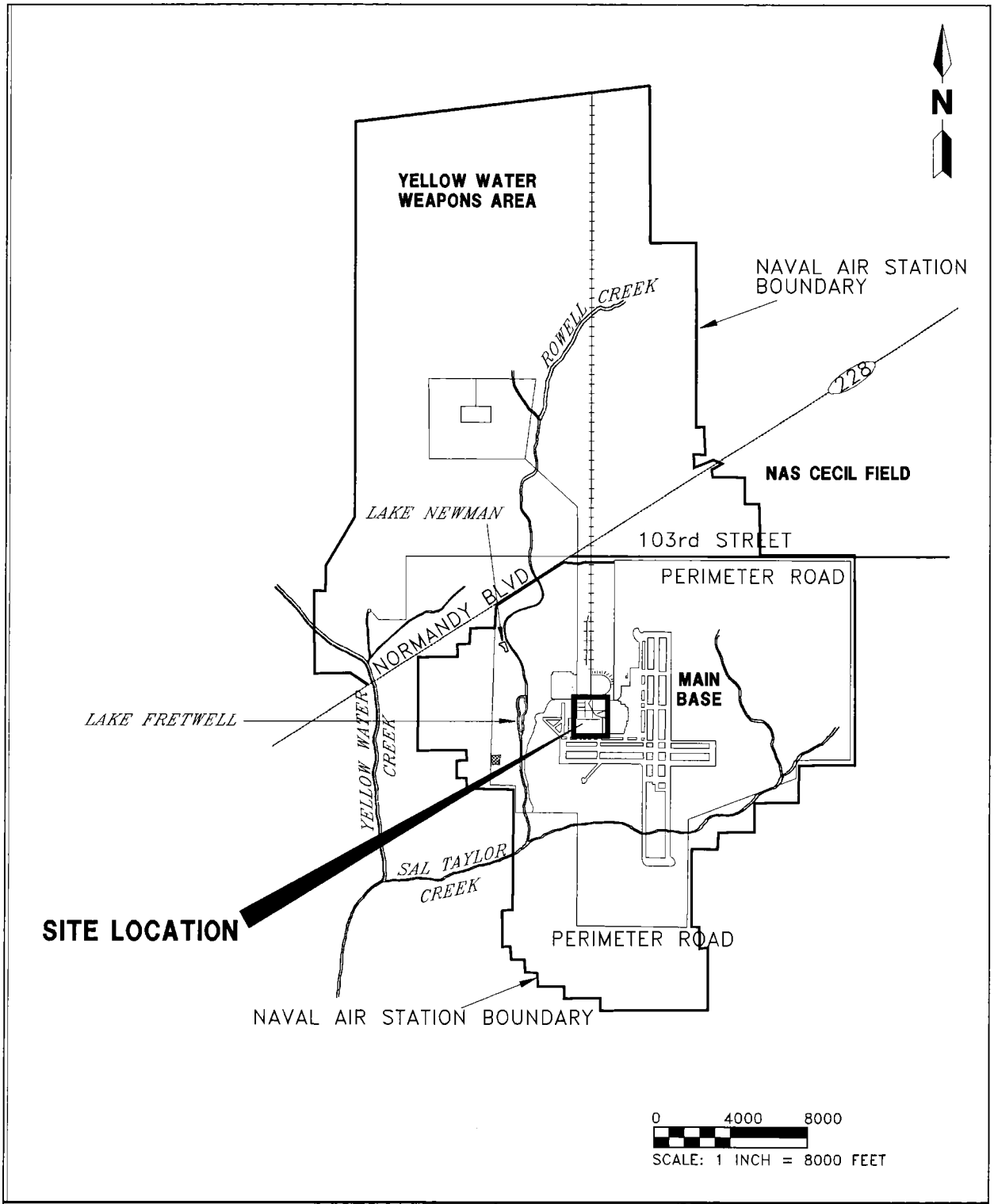

FIGURE 1-2
SITE VICINITY MAP

CECIL/FFSFACIL/JMK-JC/12-13-95

CONTAMINATION ASSESSMENT
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SOUTH FUEL FARM SITE
FACILITY 43
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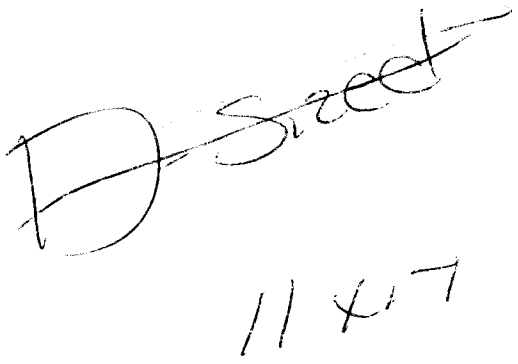
JACKSONVILLE, FLORIDA

Figure 1-3 Current Site Layout



Following the detection of free product at the SFF site, a CA was initiated in December 1990 and completed in December 1991. The CA included augering and sampling 56 soil borings and installing and sampling 24 shallow and 3 deep monitoring wells.

In July 1992, the Navy submitted a CAR for the SFF site to SOUTHNAVFACENGCOM and the FDEP. FDEP reviewed the CAR and requested a supplemental investigation to complete the site CA. The FDEP correspondence dated September 25, 1992, is attached in this CAR Addendum as Appendix A, Correspondence.

Innovative Services, Inc., removed all of the tanks and associated pipes from the SFF in July 1994, except for day tank 342-DT and its associated pipes. Three ASTs had been previously removed from the site in 1985. Innovative Services, Inc., personnel indicated that all of the tanks and lines removed during the 1994 removal action were in good condition but, based on soil sample data leaks may have occurred at some of the pipe or line connections. Nine monitoring wells, wells CEF-43-01 through CEF-43-09, were destroyed as a result of the tank removal activities. In addition to these wells but unrelated to the tank removal activities, well CEF-043-13 was apparently destroyed as a result of routine maintenance and grass cutting operations performed around the SFF site.

Prior to the tank removals in 1985 and 1994, the site contained three aboveground storage tanks (ASTs), four USTs, and four EMTs. Information regarding these tanks is provided in Table 1-1.

Currently, Day Tank 342-DT is the only fuel storage tank present and in service at the facility. The day tank was installed in 1957 and is a 200,000-gallon capacity EMT constructed of interior-lined, asphalt-coated steel. The tank is used to store JP-5 aviation fuel and is outfitted with overfill protection and impressed current-type corrosion protection. The associated pipes are corrosion-resistant, coated steel with cathodic protection.

Table 1-1
Storage Tank Information

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Tank Number	Date Installed	Tank Type	Capacity (gallons)	Fluids Stored	Construction	Status
43-B	1943	EMT	100,000	MOGAS and unleaded gasoline	Concrete with epoxy-lined interior	Removed 1994
43-C	1943	EMT	50,000	Aviation gasoline	Concrete with epoxy-lined interior	Removed 1994
43-D	1943	EMT	250,000	Diesel fuel	Concrete with epoxy-lined interior	Removed 1994
43-E	1943	UST	26,000	Aviation fuel and water	Asphalt-coated steel	Removed 1994
43-F	1943	UST	26,000	Aviation fuel and water	Asphalt-coated steel	Removed 1994
43-G	1943	UST	26,000	Aviation fuel, water, and non-spec fuel	Asphalt-coated steel	Removed 1994
43-H	1943	UST	26,000	Aviation fuel, water, and non-spec fuel	Asphalt-coated steel	Removed 1994
43-J	1944	AST	15,000	Diesel fuel	Asphalt-coated steel	Removed 1985
43-K	1944	AST	15,000	Diesel fuel	Asphalt-coated steel	Removed 1985
43-L	1944	AST	15,000	Diesel fuel	Asphalt-coated steel	Removed 1985
342-DT	1957	EMT	200,000	JP-5	Interior-lined, asphalt-coated steel	In service

Notes: EMT = earth-mounded tank.
MOGAS = motor gasoline.
UST = underground storage tank.
AST = above-ground storage tank.

2.0 SUMMARY OF PREVIOUS CONTAMINATION ASSESSMENT INVESTIGATION FINDINGS

A CA of the SFF Site was initiated in December 1990 and completed in December 1991. The investigation included augering and sampling 56 soil borings and installing and sampling 24 shallow and 3 deep monitoring wells. The findings of the 1992 SFF Site CAR (ABB-ES, 1992) are summarized below.

Findings:

- Excessively contaminated soil, as defined in Chapter 62-770.200, Florida Administrative Code (FAC), was assessed using organic vapor headspace analyses at six areas of the site. These areas include: (1) the area around the truck loading stand, (2) the vicinity of former ASTs located approximately 160 feet northwest of the truck loading stand, (3) an area approximately 120 feet northwest of Tank 43-B, (4) the area around Tanks 43-G and 43-H, (5) an area approximately 100 feet south of Tank 43-D north of the fuel containment pond, and (6) an area located approximately 100 feet south of Tank 342-DT.

- Free petroleum product accumulations of 0.17 foot, 0.69 foot, and 0.06 foot were measured in monitoring wells CEF-043-01, CEF-043-02, and CEF-043-03, respectively.

- Total benzene, toluene, ethylbenzene, and xylenes (BTEX) concentrations in excess of the FDEP guidance concentration of 50 parts per billion (ppb) were detected in groundwater samples from monitoring wells CEF-043-04, CEF-043-05, CEF-043-07, CEF-043-08, CEF-043-011, CEF-043-014, and CEF-043-023.

- Total naphthalenes concentrations in excess of the FDEP guidance concentration of 100 ppb were detected in groundwater samples from monitoring wells CEF-043-05 and CEF-043-07.

- Total recoverable petroleum hydrocarbon (TRPH) concentrations in excess of the FDEP guidance concentration of 5 parts per million (ppm) were detected in groundwater samples from wells CEF-043-04, CEF-043-09, and CEF-043-11.

- Total dissolved lead in excess of the FDEP guidance concentration of 50 ppb was detected in the groundwater sample from monitoring well CEF-043-09.

- Trichloroethene and 1,2-dichloroethene concentrations of 2 ppb and 15 ppb, respectively, were detected in groundwater samples from monitoring well CEF-043-30. The respective guidance concentrations for these compounds are 3 ppb and 4.2 ppb.

- The vertical extent of groundwater contamination at the site does not extend beyond 57 feet below land surface (bls) because dissolved-phase hydrocarbons were not detected in any of the vertical extent wells.

- The estimated hydraulic conductivity (K) of the shallow aquifer at the SFF ranged from 0.35 to 2.62 feet per day (ft/day).

- The site hydraulic gradient (i) was approximately 0.01 foot per foot (ft/ft). Assuming an estimated porosity (n) of 25 percent, the calculated range for average linear velocity of groundwater flow (v) is 0.01 to 0.10 ft/day.

3.0 FIELD METHODOLOGY

All methodologies and equipment used during this CA are in accordance with the ABB-ES FDEP-approved Comprehensive Quality Assurance Plan (CompQAP) and are described in Appendix C of the SFF Site CAR (ABB-ES, 1992).

3.1 SOIL BORING PROGRAM. Prior to initiating the soil boring program, a field grid with 20-foot grid spacing was set up at the SFF Site to facilitate mapping of existing site features and proposed soil boring locations. From March 26 to May 3, 1995, a total of 272 soil borings were advanced to assess the horizontal and vertical extent of soil contamination in the vadose zone.

Soil borings were advanced using stainless steel hand augers. Soil samples were collected from each boring at land surface, 1 foot bls, and every other foot thereafter to the groundwater table. Each sample was screened for organic vapors using an organic vapor analyzer (OVA) equipped with a flame ionization detector as described in Chapter 62-770.200(2), FAC. Samples were also screened for methane using the OVA and a charcoal filter. The maximum soil headspace reading observed was recorded for each sample. Characterization borings were advanced in the source areas previously assessed during the 1991 CA. From the source area, borings were progressively installed at grid nodes to assess the lateral limits of contamination. Boring spacings ranged from approximately 20 to 40 feet. Borings were installed around the edge of excessively contaminated soil (OVA headspace greater than 50 ppm) and within the area of excessively contaminated soil.

In addition to the assessment of vadose zone contamination, OVA readings measured from soil samples collected at or near the groundwater table were used to indicate potential areas of groundwater contamination. These data were used to facilitate monitoring well placement during the well installation phase of the field investigation.

3.2 MONITORING WELL INSTALLATION PROGRAM. Twenty-five shallow monitoring wells (designated CEF-043-1N through CEF-043-9N, CEF-043-13R, CEF-043-32 through CEF-043-45, and CEF-043-48) and four deep monitoring wells (designated CEF-043-46D and CEF-043-47D) were installed at the SFF Site in May 1995. Ten shallow piezometers (PZ-1 through PZ-10) were also installed where soil borings indicated free-phase hydrocarbons may be present. Following sampling and receipt of analytical data from all of the SFF Site wells installed through May 1995, two additional deep wells (CEF-043-49D and CEF-043-50D) were installed in November 1995 to complete the vertical assessment of groundwater contamination.

Prior to installation of deep monitoring wells CEF-043-49D and -50D, groundwater samples were collected with a TerraProbe℠ at the proposed deep well location screen intervals and analyzed in the field for BTEX. Groundwater samples were also collected with the TerraProbe℠ around the perimeter of shallow monitoring well CEF-043-44 to assess the horizontal extent of petroleum contamination in groundwater and the effect of the stormwater drainage line on contaminant migration.

As discussed in Section 1.3, previously existing monitoring wells CEF-043-1 through CEF-043-9 were destroyed during the July 1994 tank removal operations. Nine new monitoring wells (CEF-043-1N through CEF-043-9N) were subsequently installed in the general vicinity of the former well locations. The new wells were not intended to replace the former wells and were, therefore, designated with the letter "N" to prevent confusion between current and historical analytical data. Monitoring well CEF-043-13R, however, was installed as a replacement well for former monitoring well CEF-043-13. The locations of all of the currently existing monitoring wells, piezometers, and TerraProbe℠ samples at the SFF are shown in Figure 3-1.

Deep monitoring wells CEF-043-46D, CEF-043-47D, CEF-043-49D, and CEF-043-50D were installed and nested with shallow wells CEF-043-2N, CEF-043-41, CEF-043-15, and CEF-043-6N, respectively, to assess the vertical extent of groundwater contamination and evaluate the vertical gradient in the shallow aquifer.

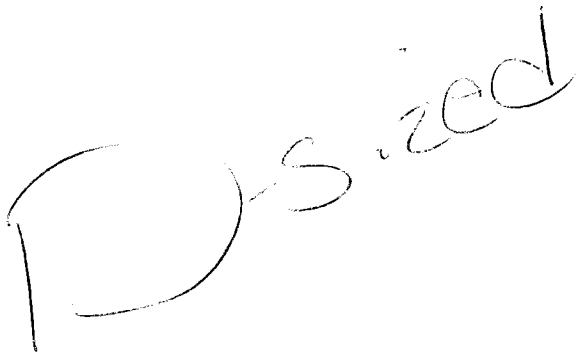
The shallow water-table monitoring wells were drilled with 4.25-inch inside diameter (ID) hollow-stem augers to total depths ranging from 13 to 15 feet bls. Depth to water ranged from approximately 4 to 7 feet bls. A 10-foot-long, 0.010-slot, 2-inch ID, polyvinyl chloride (PVC) well screen was installed in each of the boreholes with the top of the well screen positioned approximately 2 to 3 feet above the groundwater table. Sections of 2-inch ID PVC well riser were installed above the well screens and extended to land surface. The wells were completed flush to the ground surface with bolt-down covers and steel well vaults. A 20/30 grade silica sand filter pack was installed around each well screen to a height approximately 2 feet above the top of the screen. Approximately 1 foot of 30/65 silica sand was installed on top of the filter pack as a seal. The remainder of the well annulus was grouted to land surface with Portland Type I cement and 5 percent bentonite grout mixture.

The vertical extent monitoring wells were constructed by initially drilling with 8.25-inch ID, hollow-stem augers to depths ranging from 36 to 60 feet bls and grouting in place 6-inch ID PVC casings below the upper contaminated portion of the shallow aquifer. Before resuming drilling operations, the grout around the 6-inch ID casings was allowed to set for 24 hours. The wells were then completed via mud-rotary drilling by drilling out the bottom of the grouted surface casings with a 5.25-inch outer diameter drill bit. The well borings were advanced to total depths ranging from 43.5 to 70 feet bls. For each well, a 5-foot section of 2-inch ID, 0.010-slot, PVC well screen was set to the total depth of the well boring with a section of 2-inch ID PVC riser extending to land surface. A 20/30 silica sand filter pack was installed around the well screens to a height of approximately 2 feet above the top of the screens. Approximately 2 feet of 30/65 silica sand was installed as a seal on top of the filter pack. The annular space between the 6-inch casings and 2-inch risers was grouted to land surface with Portland Type I cement and 5 percent bentonite grout mixture.

All shallow and deep wells were completed flush to the ground surface. Well boring and construction logs for the newly installed monitoring wells are presented in this CAR Addendum as Appendix B, Monitoring Well Boring and Construction Logs, May to November 1995.

Piezometers PZ-1 through PZ-10 were installed where soil borings indicated free-phase hydrocarbons may be present in the subsurface. The piezometers were installed to a depth of approximately 14 feet bls with 2 to 3 feet of screen

Figure 3-1 Monitoring Well, Piezometer, and Terraprobe℠ Sample Location Map



positioned above the groundwater table. The piezometers were constructed similar to the shallow monitoring wells.

Following installation, the wells and piezometers were developed with a centrifugal pump and surged with a hand-operated surge block to facilitate good hydraulic connection with the aquifer. Groundwater quality parameters (pH, conductivity, turbidity and temperature) were monitored during well development. The wells were considered developed when groundwater quality parameters stabilized and the well discharge became relatively clear. Investigation-derived wastes produced during the drilling program were properly containerized for disposal.

3.3 GROUNDWATER SAMPLING PROGRAM. Groundwater samples were collected from existing site monitoring wells CEF-043-10 through -15 and -17 through -31 from April 27 to May 10, 1995, before installing monitoring wells CEF-043-32 through-48. Monitoring well CEF-043-16 was not sampled because it is downgradient of monitoring well CEF-043-17 which had no detectable concentrations of petroleum contaminants in 1991. The groundwater samples were analyzed for the Kerosene analytical group parameters described in Chapter 62-770.600(8)(b). The laboratory analytical results from these samples were used to plan the monitoring well installation program to assess the horizontal and vertical extent of groundwater contamination at the site.

Groundwater samples were collected from monitoring wells CEF-043-32 through -48 from May 30 through June 8, 1995, and analyzed for the Kerosene analytical group parameters. Laboratory analytical results from these samples indicated that the vertical extent of groundwater contamination needed further assessment downgradient of monitoring wells CEF-043-27D and -46D. The horizontal extent of contamination also needed further assessment downgradient of monitoring well CEF-043-44.

Unusually high total VOA concentrations were detected in the groundwater sample collected on June 1, 1995 from MW-44. The high concentrations were suspected to be related to the contaminant migration into the well resulting from excessive development to remove highly turbid groundwater. Monitoring well CEF-043-44 was resampled on August 1, 1995, to confirm groundwater sample results which may not have been representative of actual conditions.

Groundwater samples were collected and analyzed in the field at eight locations at the SFF Site by Vironex Environmental Field Services on September 25, 1995. The samples were collected with a TerraProbe℠ sampling device and analyzed for BTEX using a photoionization detector gas chromatograph. The samples were used to assess BTEX concentrations in groundwater at the proposed locations of deep monitoring wells CE-043-49D and -50D and around the perimeter of shallow monitoring well CEF-043-44. Groundwater sample depths and analytical results are summarized in Table 3-1. Sampling locations are shown in Figure 3-1. A copy of the report submitted by Vironex is attached to this CAR Addendum as Appendix C, Groundwater Sample Screening Data.

Monitoring wells CEF-043-49D and -50D were installed and sampled in November 1995, to assess the vertical extent of groundwater contamination downgradient of monitoring wells CEF-043-27D and -46D, respectively. Groundwater samples collected from monitoring wells CEF-043-49D and -50D were analyzed for the Kerosene analytical group. Monitoring well CEF-043-44 was resampled only for

Table 3-1
Groundwater Sampling Summary,
April 27, 1995, to November 20, 1995

Contamination Assessment Report Addendum
South Fuel Farm Site, Facility 43
Naval Air Station Cecil Field
Jacksonville, Florida

Well Number CEF-043-	Installation Date	Well TD (feet bls)	Date Sampled	Purpose of Well
[1,2]10	1991	14.5	05/09/95	Shallow characterization well - upgradient
[2,]11	1991	14.5	05/09/95	Shallow characterization well - upgradient
12	1991	13.5	04/27/95	Shallow characterization well - downgradient
14	1991	13.4	05/10/95	Shallow characterization well - upgradient
15	1991	15	04/27/95	Shallow lateral extent well - crossgradient
16	1991	15	NS	Shallow lateral extent well - crossgradient
17	1991	15.1	05/05/95	Shallow lateral extent well - upgradient
18	1991	15.1	05/05/95	Shallow lateral extent well - upgradient
19	1991	15.3	05/05/95	Shallow lateral extent well - upgradient
20	1991	15.3	05/05/95	Shallow lateral extent well - upgradient
21	1991	15.2	05/05/95	Shallow lateral extent well - upgradient
22	1991	14.9	05/09/95	Shallow characterization well - crossgradient and downgradient
[2,]23	1991	15	05/09/95	Shallow characterization well - downgradient
24	1991	15.2	04/27/95	Shallow lateral extent well - downgradient
[3]25	1991	15.5	04/27/95	Shallow lateral extent well - downgradient
29	1991	13	04/27/95	Shallow lateral extent well - downgradient
30	1991	13	04/27/95	Shallow lateral extent well - downgradient and crossgradient
[2]31	1991	13	05/04/95	Shallow lateral extent well - crossgradient
[3]14	1991	13.4	06/12/95	Shallow characterization well - upgradient
26D	1991	42.7	06/02/95	Deep vertical extent well - crossgradient and downgradient
27D	1991	36.3	05/31/95	Deep vertical extent well - downgradient
28D	1991	57.5	06/02/95	Deep vertical extent well - downgradient and crossgradient
1N	05/08/95	14	06/06/95	Shallow characterization well - source area
2N	05/08/95	14	06/06/95	Shallow characterization well - source Area
3N	05/08/95	14	06/09/95	Shallow characterization well - downgradient
4N	05/08/95	14.5	06/07/95	Shallow characterization well - source area
5N	05/09/95	15.5	06/07/95	Shallow characterization well - source areas
6N	05/09/95	15.5	06/01/95	Shallow characterization well - source area
7N	05/09/95	15.5	05/30/95[2]	Shallow characterization well - source area
8N	05/09/95	15.5	05/30/95[2]	Shallow characterization well - source area
9N	05/10/95	14	05/31/95	Shallow characterization well - source area
13R	05/16/95	15	06/01/95	Shallow lateral extent well - crossgradient
32	05/07/95	13.5	06/12/95	Shallow lateral extent well - crossgradient
33	05/07/95	15	06/13/95	Shallow lateral extent well - crossgradient
34	05/03/95	14.5	06/07/95	Shallow lateral extent well - crossgradient

See notes at end of table.

Table 3-1 (Continued)
Groundwater Sampling Summary
April 27, 1995, to November 20, 1995

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Well Number CEF-043-	Installation Date	Well TD (feet bls)	Date Sampled	Purpose of Well
35	05/07/95	13.5	06/07/95	Shallow characterization well - source area
36	05/08/95	13.5	06/12/95	Shallow characterization well - source area
37	05/08/95	13.5	05/31/95	Shallow characterization well - source area
38	05/08/95	14	06/09/95	Shallow lateral extent well - upgradient
39	05/10/95	14	05/31/95	Shallow lateral extent well - upgradient
40	05/10/95	15.5	06/08/95	Shallow characterization well - downgradient
41	05/10/95	15	06/08/95	Shallow characterization well - source area
42	05/16/95	15	05/31/95	Shallow lateral extent well - downgradient (near pipeline)
43	05/16/95	15	06/08/95	Shallow lateral extent well - downgradient (near pipeline)
44	05/16/95	15	06/01/95	Shallow lateral extent well - downgradient (near pipeline)
45	05/17/95	14	05/31/95	Shallow characterization well - downgradient (near pipeline)
46D	05/20/95	45.5	06/02/95	Deep vertical extent well - source area
47D	05/21/95	43.5	06/02/95	Deep vertical extent well - source area
48	05/22/95	14	05/31/95	Shallow lateral extent well - crossgradient
49D	11/16/95	35	11/20/95	Deep vertical and lateral extent well - downgradient (of well 27D)
50D	11/16/95	70	11/20/95	Deep vertical extent well - source area

[1] Monitoring wells CEF-043-01 through CEF-043-09 (i.e., former source area wells) were destroyed during July 1994 tank removal operations. Monitoring well 13 was destroyed due to unknown cause.
[2] Lead samples were collected on 05/10/95 within 24 hours of well purge.
[3] Lead sample not collected from well CEF-043-14 due to access problem on 05/10/95.

Notes: bls = below land surface.
TD = total depth.

analysis of purgeable aromatics (U.S. Environmental Protection Agency Method 602) and methyl-tert-butyl-ether because no other Kerosene analytical group compounds were detected in the sample collected June 1, 1995. Groundwater sampling dates and other related information are summarized in Table 3-1.

Quality assurance and quality control samples were collected in accordance with the ABB-ES CompQAP. All samples were packed on ice and shipped via overnight carrier to Quanterra Environmental Services. Copies of the chain-of-custody records and laboratory receipt forms are attached in this CAR Addendum as Appendix C, Groundwater Sample Screening Data.

3.4 GROUNDWATER ELEVATION SURVEY. To accurately measure groundwater elevations in the monitoring wells and assess the water table elevation, groundwater flow direction, and groundwater gradient at the SFF site, a top of well casing elevation survey was performed by a Florida-licensed professional surveyor. The top of casing elevation on the north side of each well and piezometer was surveyed to within ± 0.01 foot of vertical accuracy. The relative horizontal locations of the wells and other site control points were surveyed to within ±0.1 foot of horizontal accuracy and referenced to the Florida State plane grid coordinate system. Ground surface elevations at the wells and elevations of other control points at the site were also surveyed. Depth to groundwater was measured in existing site monitoring wells CEF-043-10, -11, -12, and -14 through -31 on May 4, 1995, prior to installation of monitoring wells CEF-043-32 through -48. Depth to groundwater was measured in existing and newly installed SFF site monitoring wells CEF-043-1N through -48 and piezometers PZ-1 through PZ-10 on June 6, 1995. SFF site water table elevation data, including data from the 1991 CA, are summarized in Table 3-2.

Table 3-2
Groundwater Elevation Data

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Monitoring Well CEF-043-	Well Depth (ft bls)	Screen Interval (ft bls)	TOC Elevation	December 10, 1991		May 4, 1995		June 6, 1995	
				DTW BTOC	Water Level Elevation	DTW BTOC	Water Level Elevation	DTW BTOC	Water Level Elevation
01N	14.0	3.5 to 13.5	78.15	NA	---	NA	---	6.53	71.62
02N	14.0	3.5 to 13.5	78.00	NA	---	NA	---	6.74	71.26
03N	14.0	3.5 to 13.5	78.26	NA	---	NA	---	7.20	71.06
04N	14.5	4 to 14	78.07	NA	---	NA	---	6.82	71.25
05N	15.5	5 to 15	78.46	NA	---	NA	---	7.55	70.91
06N	15.5	5 to 15	77.79	NA	---	NA	---	6.65	71.14
07N	15.5	5 to 15	77.61	NA	---	NA	---	6.33	71.28
08N	15.5	3.5 to 13.5	78.41	NA	---	NA	---	6.94	71.47
09N	14.0	4.0 to 14.0	77.50	NA	---	NA	---	5.19	72.31
10	14.5	4.0 to 14.0	78.55	8.24	70.31	7.71	70.84	7.21	71.34
11	14.5	3.0 to 13.0	77.64	7.30	70.34	6.76	70.88	5.86	71.78
12	13.5	3.0 to 13.0	75.11	5.56	69.55	5.24	69.87	4.55	70.56
13R	13.5	4.0 to 14.0	74.19	NA	---	NA	---	5.89	68.30
14	13.4	5.0 to 15.0	76.22	6.96	69.26	6.70	69.52	5.52	70.70
15	15.0	5.0 to 15.0	76.86	8.25	68.61	7.97	68.89	7.27	69.59
16	15.0	5.0 to 15.0	77.06	7.80	69.26	7.47	69.59	6.74	70.32
17	15.1	5.0 to 15.0	77.34	7.70	69.64	7.41	69.93	6.44	70.90
18	15.1	5.0 to 15.0	77.50	6.48	71.02	6.31	71.19	5.37	72.13
19	15.3	5.0 to 15.0	78.47	6.80	71.67	6.53	71.94	5.55	72.92
20	15.3	5.0 to 15.0	78.59	7.35	71.24	6.87	71.72	5.86	72.73
21	15.2	5.0 to 15.0	76.71	7.93	68.78	5.38	71.33	4.27	72.44
22	14.9	4.9 to 14.9	77.24	7.14	70.10	6.70	70.54	5.72	71.52
23	15.0	5.0 to 15.0	75.97	6.60	69.37	6.14	69.83	4.97	71.00
24	15.2	5.2 to 15.2	73.64	5.93	67.71	5.44	68.20	4.58	69.06
25	15.5	5.5 to 15.5	72.81	5.46	67.35	5.71	67.10	5.08	67.73
26D	42.7	37.7 to 42.7	77.55	8.38	69.17	7.93	69.62	7.04	70.51
27D	36.3	30.0 to 35.0	76.31	8.79	67.52	8.32	67.99	7.45	68.86
28D	57.5	52.0 to 57.0	73.72	5.54	68.18	5.25	68.47	4.30	69.42
29	13.0	3.0 to 13.0	75.37	6.70	68.67	6.21	69.16	4.73	70.64
30	13.0	3.0 to 13.0	76.22	6.32	69.90	5.83	70.39	4.58	71.64
31	13.0	3.0 to 13.0	76.99	NM	---	5.91	71.08	5.02	71.97
32	13.5	3 to 13	76.53	NA	---	NA	---	4.45	72.08
33	15.0	4.5 to 14.5	76.97	NA	---	NA	---	5.21	71.76

See notes at end of table.

Table 3-2 (Continued)
Groundwater Elevation Data

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Monitoring Well CEF-043-	Well Depth (ft bls)	Screen Interval (ft bls)	TOC Elevation	December 10, 1991		May 4, 1995		June 6, 1995	
				DTW BTOC	Water Level Elevation	DTW BTOC	Water Level Elevation	DTW BTOC	Water Level Elevation
34	14.5	4 to 14	76.84	NA	---	NA	---	5.21	71.63
35	13.5	3 to 13	75.69	NA	---	NA	---	3.93	71.76
36	13.5	3 to 13	76.58	NA	---	NA	---	4.77	71.81
37	13.5	3 to 13	77.90	NA	---	NA	---	6.00	71.90
38	14.0	3.5 to 13.5	77.62	NA	---	NA	---	5.76	71.86
39	14.0	3.5 to 13.5	79.12	NA	---	NA	---	5.88	73.24
40	15.5	5 to 15	75.65	NA	---	NA	---	4.48	71.17
41	15.0	4.5 to 14.5	74.98	NA	---	NA	---	5.30	69.68
42	15.0	4.5 to 14.5	NS	NA	---	NA	---	4.28	--
43	15.0	4.5 to 14.5	73.16	NA	---	NA	---	5.68	67.48
44	15.0	4.5 to 14.5	71.68	NA	---	NA	---	5.08	66.60
45	14.0	3.5 to 13.5	74.66	NA	---	NA	---	4.91	69.75
46D	45.5	40 to 35	78.29	NA	---	NA	---	8.12	70.17
47D	43.5	38 to 43	74.99	NA	---	NA	---	6.05	68.94
48	14.0	3.5 to 13.5	77.10	NA	---	NA	---	5.66	71.44
49D	35.0	30 to 35	NS	NA	--	NA	--	--	--
50D	70.0	65 to 70	NS	NA	--	NA	--	--	--
PZ-1	14.0	4 to 14	78.08	NA	---	NA	---	6.67	71.41
PZ-2	14.0	4 to 14	75.25	NA	---	NA	---	6.89	68.36
PZ-3	13.0	3 to 13	77.07	NA	---	NA	---	6.96	70.11
PZ-4	14.0	4 to 14	77.26	NA	---	NA	---	7.64	69.62
PZ-5	14.0	4 to 14	80.50	NA	---	NA	---	9.22	71.28
PZ-6	14.0	4 to 14	80.35	NA	---	NA	---	9.30	71.05
PZ-7	14.0	4 to 14	80.71	NA	---	NA	---	9.62	71.09
PZ-8	14.0	4 to 14	77.36	NA	---	NA	---	6.13	71.23
PZ-9	14.0	4 to 14	78.75	NA	---	NA	---	7.53	71.22
PZ-10	14.0	4 to 14	78.66	NA	---	NA	---	6.91	71.75

Notes: bls = below land surface.
ft = feet.
TOC = top of casing.
DTW = depth to water.
BTOC = below top of casing.
NA = not applicable.
NM = not measured.
NS = not surveyed.
--- = no value calculated.

4.0 CONTAMINATION ASSESSMENT RESULTS

4.1 SITE-SPECIFIC AQUIFER CHARACTERIZATION AND HYDROGEOLOGIC PARAMETERS. Hydraulic characteristics of the shallow aquifer at the SFF Site were assessed using the following data:

- soil boring and monitoring well logs
- groundwater elevations in site monitoring wells
- analysis of rising-head aquifer slug tests

The geological characteristics of the shallow aquifer were assessed using hand auger samples from the soil boring program and split-spoon samples from monitoring well installation. In general, the sediments at the SFF Site are composed of silty fine-grained sand and silty sand with trace amounts of clay. A "hardpan" layer composed of cemented silty sand was encountered throughout most of the site from 7 to 20 feet bls. Where not encountered, the hardpan layer was presumed to have been previously removed during the UST installation and excavation activities. Similar lithologies were encountered in the deep well borings. Below 20 feet bls, sediments were typically gray to olive, fine-grained silty sand.

Groundwater elevations across the site were assessed by measuring groundwater levels in site monitoring wells and surveying the well top-of-casing elevations. Water level elevation differences between most of the shallow and deep well pairs were greater than 1 foot. Water level elevation data were plotted on separate maps to illustrate groundwater flow in both the shallow and deeper zones of the aquifer. Figure 4-1 depicts the water table elevation in the shallow zone and Figure 4-2 depicts the potentiometric surface in the deep zone of the aquifer on May 4, 1995. Groundwater gradients and flow direction in both zones are shown on these maps. The shallow water table and potentiometric surface maps were then superimposed to show net vertical flow potentials and plotted. Figure 4-3 depicts vertical flow potentials on May 4, 1995, calculated by subtracting deep and shallow water level elevations in site monitoring wells. Figures 4-4 and 4-5, respectively, depict water table and potentiometric surfaces in the shallow and deep zones of the aquifer on June 6, 1995.

Rising-head aquifer slug tests were performed in monitoring wells CEF-043-21, CEF-043-2N, CEF-043-41 and CEF-043-46D using a data logger and a 20 pounds-per-square inch pressure transducer. The tests were performed to estimate the hydraulic conductivity in the shallow aquifer and confirm earlier slug test results reported in the 1992 SFF site CAR. The field data were plotted using AQTESOLV™ (Geraghty and Miller, 1989), an analytical computer program based on the Bouwer-Rice method for unconfined aquifers (Bouwer and Rice, 1976). Slug test results for the shallow monitoring wells showed hydraulic conductivity values ranged from 3.3×10^{-4} to 3.5×10^{-3} centimeters per second (cm/sec) with an arithmetic mean value of 1.4×10^{-3} cm/sec. The slug tests of deep monitoring well CEF-043-46D showed similar results for the arithmetic mean in the shallow monitoring wells. Table 4-1 presents the slug test results. Copies of the slug test data and computer-generated graphical curves are attached in this CAR Addendum as Appendix D, Slug Test Data and Graphical Curves.

Figure 4-1 Water Table Contour Map (Shallow Zone), May 4, 1995

Figure 4-2 Potentiometric Surface Map (Deep Zone), May 4, 1995

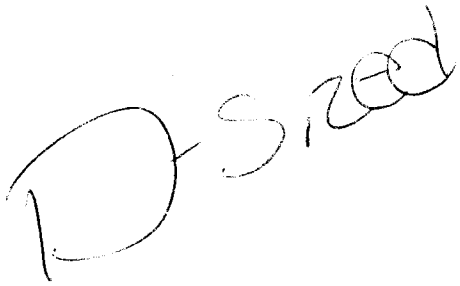

Figure 4-3 Vertical Groundwater Flow Potential Map, May 4, 1995

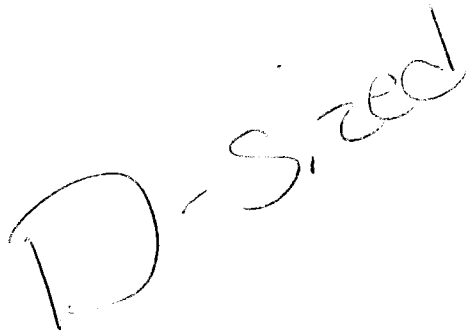

Figure 4-4 Water Table Contour Map (Shallow Zone), June 6, 1995

Figure 4-5 Potentiometric Surface Map (Deep Zone) June 6, 1995

D-5.200

Table 4-1
Slug Test Results

Contamination Assessment Report Addendum
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Well Description	Aquifer Saturated Thickness (feet)[1]	K (ft/day)	K (cm/sec)
CEF-043-2N	80.0	0.94	3.3×10^{-4}
CEF-043-21	80.0	9.94	3.5×10^{-3}
CEF-043-41	80.0	1.40	4.9×10^{-4}
CEF-043-46D	80.0	4.03	1.4×10^{-3}
Arithmetic mean[2]	80.0	4.09	1.4×10^{-3}

[1] The aquifer saturated thickness was estimated by subtracting the measured depth to water at the wells from the estimated depth to the top of the Hawthorn Group.
[2] Arithmetic mean of results for the shallow monitoring wells; excludes result from deep well CEF-043-46D.

Notes: K = hydraulic conductivity.
ft/day = feet per day.
cm/sec = centimeters per second.

4.1.1 Groundwater Flow Velocity. By evaluating the hydraulic conductivity, hydraulic gradient, and effective porosity of an aquifer, the average pore water velocity (ν) can be estimated from the relationship:

$$\nu = K \times i / n_e \qquad (1)$$

where

ν = average linear pore water velocity in ft/day,

K = hydraulic conductivity in ft/day,

i = hydraulic gradient in ft/ft, and

n_e = effective porosity in percent.

The hydraulic conductivity value for monitoring well CEF-043-21 was not used in the pore water velocity or transmissivity calculations because it was not consistent with values estimated for shallow wells CEF-043-2N and -41, nor was it typical for shallow zone sediments encountered throughout the site.

Because the predominant lithology underlying the site is fine-grained, silty sand, an effective porosity of 35 percent or 0.35 is estimated for the shallow aquifer (Driscoll, 1986). However, contrasts in hydraulic conductivity and horizontal gradient exist between the shallow and deep part of the aquifer; therefore, average linear velocities of groundwater flow are estimated for both parts. The parameters for each are summarized below.

Shallow Part: $K = 1.17$ ft/day
$\underline{i} = 0.007$ ft/ft
$n_e = 0.35$

Deep Part: $K = 4.03$ ft/day
$\underline{i} = 0.003$ ft/ft
$n_e = 0.35$

By substituting these parameters into Equation (1), average linear velocities of 0.023 ft/day and 0.034 ft/day are calculated for the shallow and deep part of the aquifer, respectively.

4.2 CONTAMINATION ASSESSMENT RESULTS.

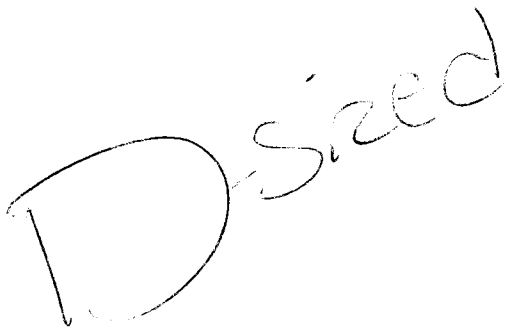
4.2.1 Soil Assessment Results OVA data indicates excessively contaminated soil at the SFF site associated with the USTs, EMTs, and underground pipes. Seven apparent source areas designated as Areas "A" through "G" were assessed at the SFF site. The seven source areas and the extent of excessively contaminated soil are shown in Figure 4-6. OVA headspace data from the 1995 CA soil boring program conducted at the SFF site are summarized in Table E-1 of Appendix E, Organic Vapor Analyzer Data.

Area "A" is located in the northwestern part of the site near the west end of the former truck and railroad loading stands. Excessively contaminated soil was not detected above the 3-foot depth level in this area, indicating that fuel was likely released from underground pipe connections at the fuel stands. OVA headspace measurements in this area typically exceeded 5,000 ppm. OVA readings abruptly decrease to zero directly north of this area and gradually decrease southward. Soil contamination in Area "A" extends from approximately 3 feet bls to 7 feet bls.

Area "B" is located in the northwest corner of the SFF Site approximately 100 feet northwest of area "A". Area "B" is associated with the former ASTs and an adjacent infiltration basin. The ASTs were formerly located on the north side of the basin and removed in 1985. Petroleum hydrocarbon vapors detected at the surface extended to approximately 5 feet bls. A maximum concentration of 1,200 ppm was detected in boring location B-16. Excessively contaminated soil was also detected within the adjacent basin. OVA readings exceeding 50 ppm were detected in soil samples from the basin bottom to the top of the groundwater table at approximately 3 feet below the bottom of the basin. Excessively contaminated soil appeared to be concentrated along the south side of the basin. A maximum OVA reading of 3,300 ppm was measured in a soil sample collected from boring B-7. Boring B-7 is located adjacent to a discharge pipe that enters the basin bottom from an oil/water separator located approximately 15 feet to the southeast. The oil/water separator was formerly connected to the fueling system at the SFF and is the suspected source of soil contamination in the basin. The separator tank was visually inspected during the field investigation and contained water with a strong petroleum hydrocarbon odor. The areal extent of excessively contaminated soil in Area "B" is approximately 3,000 square feet.

Area "C" is on the northeast side of the SFF Site near the former location of Tank 43-B. The highest OVA reading in this area (1,700 ppm) was measured in a soil sample collected from boring B-167 located adjacent to the 10-inch fuel supply

Figure 4-6 Excessively Contaminated Soil Distribution Map



line from the North Fuel Farm. The North Fuel Farm supply line is currently the only line connected to the SFF Day Tank 342-DT and is the suspected source of contamination in Area "C". Excessively contaminated soil was not detected above the 4- to 5-foot bls depth level indicating that the contamination source is the fuel supply line. The horizontal extent of excessively contaminated soil in Area "C" is approximately 50 feet in diameter or approximately 1,600 square feet.

Area "D" is in the west-central part of the site and mainly encompasses the former location of USTs 43-E through 43-H. Tanks 43-G and 43-H were formerly located east of tanks 43-E and 43-F. OVA readings in Area "D" generally range from 1,000 ppm to greater than 5,000 ppm in both of the former tank locations. Excessively contaminated soil was detected in most borings from land surface to the groundwater table and is likely associated with tank overfills and leaks at pipe connections. Excessively contaminated soil was not detected in the vicinity of Tanks 43-E and 43-F during the 1991 SFF Site CA (ABB-ES, 1992); therefore, soil contamination detected during the 1995 SFF site CA is probably the result of mixing and replacement of contaminated soil excavated during the tank removals in 1994.

Area "E" is the area north of Day Tank 342-DT which was formerly occupied by EMTs 43-B, 43-C, and 43-D. Fuel releases are suspected to have occurred from pipeline and tank connections where isolated areas of excessively contaminated soil was detected near the former tank locations. Excessively contaminated soil in Area "E" was generally detected below the 3-foot depth level. Excessively contaminated soil near the surface at some locations may be due to the mixing and replacement of contaminated soil in the excavations following tank removal. Except for a small circular area approximately 60 feet in diameter (2,800 square feet) located between the former truck loading area and the former location of Tanks 43-E and 43-F, excessively contaminated soil in Areas "A", "D", and "E" appears to be continuous from one source area to the next. The total estimated area of excessively contaminated soil in Areas "A", "D", and "E" (Tanks 43-B through 43-H) is approximately 60,000 square feet.

Area "F" extends from the southern part of Day Tank 342-DT to the stormwater drainage line that runs northwest to southeast along the southern boundary of the site. Excessively contaminated soil was detected from the surface to the groundwater table in this area and OVA readings generally exceeded 5,000 ppm. Soil contamination in this area is associated with a surface release of more than 20,000 gallons of fuel. The areal extent of excessively contaminated soil in Area "F" is approximately 30,000 square feet.

Area "G" is in the vicinity of a concrete drainage ditch located on the west side of the SFF Site. Excessively contaminated soil was detected at three small isolated areas along the west bank of the drainage ditch covering an area of approximately 2,200 square feet.

Assuming a total area of excessively contaminated soil to be approximately 100,000 square feet, the estimated volume of contaminated soil to a depth of 7 feet bls would be approximately 26,000 cubic yards.

4.2.2 Groundwater Assessment Results Laboratory analyses were performed on groundwater samples collected from all monitoring wells at the SFF Site except shallow monitoring well CEF-043-16. Monitoring well CEF-043-16 was not sampled because shallow monitoring well CEF-043-17 is located approximately 80 feet

upgradient. Groundwater samples were collected in three sampling episodes between April 27 and November 20, 1995.

A sample of the discharge water from the buried stormwater drainage line in the southernmost part of the SFF Site was also collected and analyzed for the kerosene analytical group parameters.

Analytical results of all groundwater samples and the discharge sample are presented in Tables 4-2 and 4-3. Copies of the laboratory analytical reports chain-of-custody forms, and field logbook entries during groundwater sample collection are included in Appendix F, Analytical Laboratory Report.

Volatile Organic Compounds. Volatile organic compounds were detected in groundwater samples collected from 33 of 49 monitoring wells.

Benzene was detected in the groundwater samples collected from 16 of 49 monitoring wells. Benzene concentrations ranged from 1.1 ppb detected in the groundwater samples collected from monitoring wells CEF-043-37 and CEF-043-46D to 460 ppb detected in the groundwater sample collected from CEF-043-5N. All benzene concentrations detected exceed the State No Further Action (NFA) target level of 1 ppb (FDEP, October 1990). Figure 4-7 presents the distribution of benzene concentrations detected in shallow monitoring wells. Figure 4-8 presents the distribution of benzene detected in deep monitoring wells.

Total VOA, the sum concentration of benzene, toluene, ethylbenzene, and xylenes ranged from 2.0 ppb in the groundwater sample collected from monitoring well CEF-043-43 to 10,980 ppb in the groundwater sample collected from CEF-043-6N. The State NFA target level for total VOAs is 50 ppb (FDEP, October 1990). Total VOA concentrations exceeding the State NFA target level were detected in 19 SFF monitoring wells: CEF-043-1N through CEF-043-9N, CEF-043-11, CEF-043-14, CEF-043-23, CEF-043-27D, CEF-043-36, CEF-043-41, CEF-043-44, CEF-043-45, CEF-043-46D, and CEF-043-49D. Figure 4-9 presents the distribution of total VOAs detected in shallow monitoring wells. Figure 4-10 presents the distribution of total VOAs detected in deep monitoring wells.

Total trihalomethanes is the sum concentration of bromodichloromethane, dibromochloromethane, and chloroform. Total trihalomethane concentrations ranging from 3.3 ppb to 12.1 were detected in SFF monitoring wells CEF-043-25, CEF-043-44, CEF-043-46D, and CEF-043-47D. The Florida maximum contaminant level (MCL) for total trihalomethanes is 100 ppb (FDEP, June 1994).

Ethylene dibromide was not detected in groundwater samples from any of the site monitoring wells or the stormwater drain discharge.

A 2-chloroethyl vinyl ether concentration of 1 ppb was detected in the groundwater sample collected from monitoring well CEF-043-3N. The State MCL for 2-chloroethyl vinyl ether is 1 ppb (FDEP, June 1994). 2-chloroethyl vinyl ether was not detected in any other SFF groundwater sample.

Methylene chloride was detected in 13 of 29 groundwater samples. It was also detected in associated rinsate samples, trip blank samples, and laboratory method blank samples. Methylene chloride concentrations detected in these samples ranged from 1.2 ppb to 77 ppb. The State MCL for methylene chloride is 5 ppb.

Table 4-2
Analytical Results for Groundwater Samples, Volatile Organic Aromatics, April through November 1995

Contamination Assessment Report Addendum
South Fuel Farm Site, Facility 43
Naval Air Station Cecil Field
Jacksonville, Florida

Contaminant	Groundwater Sample Designation								State Target Levels
	CEF-043-1N	CEF-043-2N	CEF-043-3N	CEF-043-88[1]	CEF-043-4N[2]	CEF-043-5N	CEF-043-6N	CEF-043-7N	
Volatile Organic Aromatics (VOAs). Reported in parts per billion (ppb).									
Benzene	ND	ND	ND	ND	ND	460	380	ND	1
Toluene	32	1,600	13	15	34	3,700	3,000	280	NA
Ethylbenzene	120	220	41	49	8.8	210	1,100	420	NA
Total xylenes	730	710	100	120	50	1,100	6,500	3,600	NA
Total VOAs	882	2,530	154	184	92.8	5,470	10,980	4,400	50
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	NA
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	NA
Total trihalomethanes	ND	ND	ND	ND	ND	ND	ND	ND	[3]100
Methyl tert-butyl ether	ND	ND	2.1	ND	ND	ND	ND	ND	50
Ethylene dibromide	ND	ND	ND	ND	ND	ND	ND	ND	0.02
2-Chloroethyl vinyl ether	ND	ND	1.0	ND	ND	ND	ND	ND	[4]1
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	[3]600
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	[4]700
Methylene chloride	B 14	B 25	B 2.1	ND	B 1.5	B 77	ND	ND	[3]5
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	[3]3
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	[3]3
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	[4]2,100
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	[3]200

See notes at end of table.

Table 4-2 (Continued)
Analytical Results for Groundwater Samples,
Volatile Organic Aromatics,
April through November 1995

Contamination Assessment Report Addendum
South Fuel Farm Site, Facility 43
Naval Air Station Cecil Field
Jacksonville, Florida

Contaminant	Groundwater Sample Designation								State Target Levels
	CEF-043-8N	CEF-043-9N	CEF-043-10	CEF-043-11	CEF-043-12	CEF-043-76[1]	CEF-043-13R	CEF-043-14	
Volatile Organic Aromatics (VOAs). Reported in parts per billion (ppb).									
Benzene	ND	1.4	ND	ND	ND	ND	ND	1.3	1
Toluene	ND	12	ND	ND	ND	ND	ND	8.5	NA
Ethylbenzene	10	83	ND	25	ND	ND	ND	5.9	NA
Total xylenes	40	300	3.6	32	ND	ND	ND	76	NA
Total VOAs	50	396.4	3.6	57	ND	ND	ND	91.7	50
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	NA
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	NA
Total trihalomethanes	ND	ND	ND	ND	ND	ND	ND	ND	[3]100
Methyl tert-butyl ether	8.1	ND	ND	ND	ND	ND	ND	ND	50
Ethylene dibromide	ND	ND	ND	ND	ND	ND	ND	ND	0.02
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND	ND	[4]1
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	[3]600
1,1-Dichloroethane	ND	ND	ND	1.1	ND	ND	ND	ND	[4]700
Methylene chloride	ND	ND	ND	ND	ND	ND	ND	ND	[3]5
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	[3]3
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	[3]3
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	[4]2,100
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	[3]200

See notes at end of table.

Table 4-2 (Continued)
Analytical Results for Groundwater Samples,
Volatile Organic Aromatics,
April through November 1995

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South Fuel Farm Site, Facility 43
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Contaminant	Groundwater Sample Designation								State Target Levels
	CEF-043-79[1]	CEF-043-15	CEF-043-17	CEF-043-18	CEF-043-19	CEF-043-20	CEF-043-21	CEF-043-22	
Volatile Organic Aromatics (VOAs). Reported in parts per billion (ppb).									
Benzene	1.5	ND	ND	ND	ND	ND	ND	ND	1
Toluene	9.2	ND	ND	ND	ND	ND	ND	ND	NA
Ethylbenzene	6.3	ND	ND	ND	ND	ND	ND	ND	NA
Total xylenes	83	ND	ND	ND	ND	ND	ND	ND	NA
Total VOAs	100	ND	ND	ND	ND	ND	ND	ND	50
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	NA
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	NA
Total trihalomethanes	ND	ND	ND	ND	ND	ND	ND	ND	[3]100
Methyl tert-butyl ether	ND	ND	ND	ND	ND	ND	ND	ND	50
Ethylene dibromide	ND	ND	ND	ND	ND	ND	ND	ND	0.02
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND	ND	[4]1
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	[3]600
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	[4]700
Methylene chloride	ND	ND	ND	ND	ND	ND	ND	ND	[3]5
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	[3]3
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	[3]3
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	[4]2,100
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	1.6	ND	[3]200

See notes at end of table.

Table 4-2 (Continued)
Analytical Results for Groundwater Samples,
Volatile Organic Aromatics,
April through November 1995

Contamination Assessment Report Addendum
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Contaminant	Groundwater Sample Designation								State Target Levels
	CEF-043-23[2]	CEF-043-24	CEF-043-25	CEF-043-26D	CEF-043-27D	CEF-043-28D	CEF-043-29	CEF-043-30	
Volatile Organic Aromatics (VOAs). Reported in parts per billion (ppb).									
Benzene	210	ND	ND	ND	30	ND	ND	ND	1
Toluene	29	ND	ND	ND	1.4	ND	ND	ND	NA
Ethylbenzene	64	ND	ND	3.9	16	ND	ND	ND	NA
Total xylenes	370	ND	ND	5.9	64	ND	ND	ND	NA
Total VOAs	673	ND	ND	9.8	111.4	ND	ND	ND	50
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	NA
Chloroform	ND	ND	6.7	ND	ND	ND	ND	ND	NA
Total trihalomethanes	ND	ND	6.7	ND	ND	ND	ND	ND	[3]100
Methyl tert-butyl ether	ND	ND	ND	ND	3.7	ND	ND	ND	50
Ethylene dibromide	ND	ND	ND	ND	ND	ND	ND	ND	0.02
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND	ND	[4]1
1,2-Dichlorobenzene	ND	ND	ND	ND	1.6	ND	ND	ND	[3]600
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	[4]700
Methylene chloride	ND	ND	ND	ND	ND	ND	ND	ND	[3]5
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	[3]3
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	[3]3
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	[4]2,100
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	[3]200

See notes at end of table.

Table 4-2 (Continued)
Analytical Results for Groundwater Samples,
Volatile Organic Aromatics,
April through November 1995

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South Fuel Farm Site, Facility 43
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Contaminant	Groundwater Sample Designation								State Target Levels
	CEF-043-31	CEF-043-32	CEF-043-33	CEF-043-34	CEF-043-35	CEF-043-36	CEF-043-37	CEF-043-38	
Volatile Organic Aromatics (VOAs). Reported in parts per billion (ppb).									
Benzene	ND	ND	ND	ND	ND	ND	1.1	ND	1
Toluene	ND	ND	ND	ND	ND	330	ND	ND	NA
Ethylbenzene	ND	ND	ND	1.9	3.9	320	1.4	ND	NA
Total xylenes	ND	ND	ND	2.4	18	1,000	9.5	ND	NA
Total VOAs	ND	ND	ND	4.3	21.9	1,650	12	ND	50
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	NA
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	NA
Total trihalomethanes	ND	ND	ND	ND	ND	ND	ND	ND	[3]100
Methyl tert-butyl ether	ND	ND	ND	ND	ND	ND	ND	ND	50
Ethylene dibromide	ND	ND	ND	ND	ND	ND	ND	ND	0.02
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND	ND	[4]1
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	[3]600
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	[4]700
Methylene chloride	ND	ND	ND	B 1.3	B 1.2	ND	ND	B 2.0	[3]5
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	[3]3
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	[3]3
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	[4]2,100
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	[3]200

See notes at end of table.

Table 4-2 (Continued)
Analytical Results for Groundwater Samples,
Volatile Organic Aromatics,
April through November 1995

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South Fuel Farm Site, Facility 43
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Contaminant	Groundwater Sample Designation								State Target Levels
	CEF-043-87[1]	CEF-043-39	CEF-043-40[2]	CEF-043-41[2]	CEF-043-90[1]	CEF-043-42	CEF-043-43	CEF-043-44[5]	
Volatile Organic Aromatics (VOAs). Reported in parts per billion (ppb).									
Benzene	ND	ND	3.1	52	70	ND	ND	28/32	1
Toluene	ND	ND	ND	ND	ND	ND	2.0	ND/ND	NA
Ethylbenzene	ND	ND	7.2	190	260	ND	ND	1.8/1.9	NA
Total xylenes	ND	ND	17	150	200	ND	ND	61/5.5	NA
Total VOAs	ND	ND	28.3	392	530	ND	2.0	90.8/39.4	50
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	12.1/NA	NA
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND/NA	NA
Total trihalomethanes	ND	ND	ND	ND	ND	ND	ND	12.1/NA	[3]100
Methyl tert-butyl ether	ND	ND	ND	4.5	ND	ND	ND	ND/ND	50
Ethylene dibromide	ND	ND	A ND	A ND	ND	ND	A ND	ND/ND	0.02
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND	ND/NA	[4]1
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND/ND	[3]600
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND/NA	[4]700
Methylene chloride	B 1.2	ND	B 1.9	B 1.9	ND	ND	B 1.5	ND/NA	[3]5
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	4.5/NA	[3]3
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND/NA	[3]3
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND/NA	[4]2,100
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND/NA	[3]200

See notes at end of table.

Table 4-2 (Continued)
Analytical Results for Groundwater Samples,
Volatile Organic Aromatics,
April through November 1995

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Contaminant	Groundwater Sample Designation								State Target Levels
	CEF-043-45	CEF-043-46D	CEF-043-46DD[1]	CEF-043-47D	CEF-043-48	CEF-043-49D	CEF-043-50D	Discharge	
Volatile Organic Aromatics (VOAs). Reported in parts per billion (ppb).									
Benzene	10	ND	1.1	2.4	ND	2.1	ND	2.6	1
Toluene	39	29	86	1.9	ND	ND	2.5	3.2	
Ethylbenzene	9.8	1.6	3.4	4.8	ND	5.2	ND	1.8	
Total xylenes	39	5.2	16	7.6	ND	43	6.9	14	
Total VOAs	97.8	35.8	106.5	16.7	ND	50.3	9.4	21.6	50
Bromodichloromethane	ND	1.2	ND	ND	ND	ND	ND	ND	
Chloroform	ND	8.4	5.6	3.3	ND	ND	ND	ND	
Total trihalomethanes	ND	9.6	5.6	3.3	ND	ND	ND	ND	[3]100
Methyl tert-butyl ether	ND	ND	ND	ND	ND	ND	ND	ND	50
Ethylene dibromide	ND	A ND	A ND	A ND	ND	ND	ND	ND	0.02
2-Chloroethyl vinyl ether	ND	ND	ND	ND	ND	ND	ND	ND	[4]1
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	[3]600
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	[4]700
Methylene chloride	ND	ND	ND	B 1.7	ND	ND	ND	ND	[3]5
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	4.9	[3]3
Trichloroethene	ND	ND	ND	2.8	ND	ND	3.3	1.3	[3]3
Trichlorofluoromethane	ND	ND	ND	2.5	ND	ND	ND	ND	[4]2,100
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	[3]200

[1] Duplicate groundwater sample collected at the same time and location as the preceding groundwater sample.
[2] Surrogate(s) outside acceptance criteria for volatile organic compound analyses due to demonstrated matrix effect.
[3] Maximum contaminant level from FDEP publication "Groundwater Guidance Concentrations", June 1994.
[4] Guidance concentration from Florida Department of Environmental Protection (FDEP) publication "Groundwater Guidance Concentrations", June 1994.
[5] Concentrations shown are for samples collected June 1/August 1, 1995.

Notes: Total VOA = the sum concentration of benzene, toluene, ethylbenzene, and xylenes.
Total trihalomethane = the sum concentration of bromodichloromethane, dibromochloromethane, and chloroform.
NA = not applicable.
ND = not detected.
B = compound detected in method blank associated with the sample. Methylene chloride was also detected several trip blanks and rinsate samples.
A = qualitative result, the associated internal standard did not meet the laboratory quality control criteria.

Table 4-3
Analytical Results for Groundwater Samples, Polynuclear Aromatic Hydrocarbons, Total Recoverable Petroleum Hydrocarbons, and Lead, April through November 1995

Contamination Assessment Report Addendum
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Contaminant	Groundwater Sample Designation								State Target Levels[2]
	CEF-043-1N	CEF-043-2N	CEF-043-3N	CEF-043-88[1]	CEF-043-4N	CEF-043-5N	CEF-043-6N	CEF-043-7N	
Polynuclear Aromatic Hydrocarbons (PAHs). Reported in parts per billion (ppb).									
Naphthalene	43	32	10	6.6	14	17	62	17	NA
1-methylnaphthalene	42	30	8.6	6.2	13	8	42	9.2	NA
2-methylnaphthalene	36	24	8.7	7.1	9.6	8.4	37	12	NA
Total naphthalenes	121	86	27.3	19.9	36.6	33.4	141	38.2	100
Acenaphthene	ND	ND	ND	ND	10	ND	ND	ND	NA
Fluorene	ND	ND	ND	ND	2.8	ND	ND	ND	NA
Total PAHs	ND	ND	ND	ND	12.8	ND	ND	ND	2
Total Recoverable Petroleum Hydrocarbons (TRPH). Reported in parts per million (ppm).									
TRPH	2.8	2.6	ND	ND	4.0	1.7	ND	2.8	5
Total Metals. Reported in ppb.									
Lead	11.4	17.2	7.1	7.9	8.1	ND	46.1	19	50

See notes at end of table.

Table 4-3 (Continued)
Analytical Results for Groundwater Samples,
Polynuclear Aromatic Hydrocarbons, Total Recoverable Petroleum Hydrocarbons, and Lead,
April through November 1995

Contamination Assessment Report Addendum
South Fuel Farm Site, Facility 43
Naval Air Station Cecil Field
Jacksonville, Florida

Contaminant	Groundwater Sample Designation								State Target Levels[2]
	CEF-043-8N	CEF-043-9N	CEF-043-10	CEF-043-11	CEF-043-12	CEF-043-76[1]	CEF-043-13R	CEF-043-14	
Polynuclear Aromatic Hydrocarbons (PAHs). Reported in parts per billion (ppb).									
Naphthalene			ND	110	ND	ND	ND	3.4	NA
1-methylnaphthalene			ND	140	3.2	ND	ND	3.6	NA
2-methylnaphthalene			ND	170	2.8	ND	ND	3.5	NA
Total naphthalenes	128	105	ND	420	6.0	ND	ND	10.5	100
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	NA
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	NA
Total PAHs	ND	ND	ND	ND	ND	ND	ND	ND	2
Total Recoverable Petroleum Hydrocarbons (TRPH). Reported in parts per million (ppm).									
TRPH	1.1	2.6	ND	1.0	ND	ND	ND	ND	5
Total Metals. Reported in ppb.									
Lead	5.8	20.8	ND	6.9	7.5	6.0	ND	ND	50

See notes at end of table.

Table 4-3 (Continued)
Analytical Results for Groundwater Samples,
Polynuclear Aromatic Hydrocarbons, Total Recoverable Petroleum Hydrocarbons, and Lead,
April through November 1995

Contamination Assessment Report Addendum
South Fuel Farm Site, Facility 43
Naval Air Station Cecil Field
Jacksonville, Florida

Contaminant	Groundwater Sample Designation								State Target Levels[2]
	CEF-043-79[1]	CEF-043-15	CEF-043-17	CEF-043-18	CEF-043-19	CEF-043-20	CEF-043-21	CEF-043-22	
Polynuclear Aromatic Hydrocarbons (PAHs). Reported in parts per billion (ppb).									
Naphthalene	3.2	ND	ND	ND	ND	ND	ND	ND	NA
1-methylnaphthalene	3.1	ND	ND	ND	ND	ND	ND	ND	NA
2-methylnaphthalene	3.1	ND	ND	ND	ND	ND	ND	ND	NA
Total naphthalenes	9.4	ND	ND	ND	ND	ND	ND	ND	100
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	NA
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	NA
Total PAHs	ND	ND	ND	ND	ND	ND	ND	ND	2
Total Recoverable Petroleum Hydrocarbons (TRPH). Reported in parts per million (ppm).									
TRPH	ND	ND	ND	ND	ND	ND	ND	ND	5
Total Metals. Reported in ppb.									
Lead	NS	10.7	5.7	7.7	5.1	5.6	5.0	ND	50

See notes at end of table.

Table 4-3 (Continued)
Analytical Results for Groundwater Samples,
Polynuclear Aromatic Hydrocarbons, Total Recoverable Petroleum Hydrocarbons, and Lead,
April through November 1995

Contamination Assessment Report Addendum
South Fuel Farm Site, Facility 43
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Contaminant	Groundwater Sample Designation								State Target Levels[2]
	CEF-043-23	CEF-043-24	CEF-043-25	CEF-043-26D	CEF-043-27D	CEF-043-28D	CEF-043-29	CEF-043-30	
Polynuclear Aromatic Hydrocarbons (PAHs). Reported in parts per billion (ppb).									
Naphthalene	2.2	ND	ND	ND	ND	ND	ND	ND	NA
1-methylnaphthalene	ND	ND	ND	6	ND	ND	ND	ND	NA
2-methylnaphthalene	ND	ND	ND	3.1	ND	ND	ND	ND	NA
Total naphthalenes	2.2	ND	ND	9.1	ND	ND	ND	ND	100
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	NA
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	NA
Total PAHs	ND	ND	ND	ND	ND	ND	ND	ND	2
Total Recoverable Petroleum Hydrocarbons (TRPH). Reported in parts per million (ppm).									
TRPH	ND	ND	ND	ND	ND	ND	ND	ND	5
Total Metals. Reported in ppb.									
Lead	ND	9.5	ND	ND	ND	ND	11.4	12.5	50

See notes at end of table.

Table 4-3 (Continued)
Analytical Results for Groundwater Samples,
Polynuclear Aromatic Hydrocarbons, Total Recoverable Petroleum Hydrocarbons, and Lead,
April through November 1995

Contamination Assessment Report Addendum
South Fuel Farm Site, Facility 43
Naval Air Station Cecil Field
Jacksonville, Florida

Contaminant	Groundwater Sample Designation								State Target Levels[2]
	CEF-043-31	CEF-043-32	CEF-043-33	CEF-043-34	CEF-043-35	CEF-043-36	CEF-043-37	CEF-043-38	
Polynuclear Aromatic Hydrocarbons (PAHs). Reported in parts per billion (ppb).									
Naphthalene	ND	ND	ND	4.7	ND	80	ND	ND	NA
1-methylnaphthalene	ND	ND	ND	2.4	ND	38	ND	ND	NA
2-methylnaphthalene	ND	ND	ND	2.8	ND	53	ND	ND	NA
Total naphthalenes	ND	ND	ND	9.9	ND	171	ND	ND	100
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	NA
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	NA
Total PAHs	ND	ND	ND	ND	ND	ND	ND	ND	2
Total Recoverable Petroleum Hydrocarbons (TRPH). Reported in parts per million (ppm).									
TRPH	ND	ND	ND	ND	ND	4.4	3.5	ND	5
Total Metals. Reported in ppb.									
Lead	7.3	ND	ND	ND	ND	ND	72.3	ND	50

See notes at end of table.

Table 4-3 (Continued)
Analytical Results for Groundwater Samples,
Polynuclear Aromatic Hydrocarbons, Total Recoverable Petroleum Hydrocarbons, and Lead,
April through November 1995

Contamination Assessment Report Addendum
South Fuel Farm Site, Facility 43
Naval Air Station Cecil Field
Jacksonville, Florida

Contaminant	Groundwater Sample Designation								State Target Levels[2]
	CEF-043-87[1]	CEF-043-39	CEF-043-40	CEF-043-41	CEF-043-90[1]	CEF-043-42	CEF-043-43	CEF-043-44	
Polynuclear Aromatic Hydrocarbons (PAHs). Reported in parts per billion (ppb).									
Naphthalene	ND	ND	5.1	540	660	ND	ND	ND	NA
1-methylnaphthalene	ND	ND	19	490	690	ND	ND	ND	NA
2-methylnaphthalene	ND	ND	17	650	890	ND	ND	ND	NA
Total naphthalenes	ND	ND	41.1	1,680	2,240	ND	ND	ND	100
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	NA
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	NA
Total PAHs	ND	ND	ND	ND	ND	ND	ND	ND	2
Total Recoverable Petroleum Hydrocarbons (TRPH). Reported in parts per million (ppm).									
TRPH	ND	ND	1.1	150	160	ND	ND	ND	5
Total Metals. Reported in ppb.									
Lead	ND	ND	ND	ND	ND	11.2	ND	12.1	50

See notes at end of table.

Table 4-3 (Continued)
Analytical Results for Groundwater Samples,
Polynuclear Aromatic Hydrocarbons, Total Recoverable Petroleum Hydrocarbons, and Lead,
April through November 1995

Contamination Assessment Report Addendum
South Fuel Farm Site, Facility 43
Naval Air Station Cecil Field
Jacksonville, Florida

Contaminant	Groundwater Sample Designation								State Target Levels[2]
	CEF-043-45	CEF-043-46D	CEF-043-46DD[1]	CEF-043-47D	CEF-043-48	CEF-043-49D	CEF-043-50D	Discharge	
Polynuclear Aromatic Hydrocarbons (PAHs). Reported in parts per billion (ppb).									
Naphthalene	17	ND	ND	5.9	ND	ND	ND	ND	NA
1-methylnaphthalene	12	ND	ND	5.9	ND	ND	ND	ND	NA
2-methylnaphthalene	14	ND	ND	6.9	ND	ND	ND	2.1	NA
Total naphthalenes	43	ND	ND	18.7	ND	ND	ND	2.1	100
Acenaphthene	2.2	ND	ND	ND	ND	ND	ND	ND	NA
Fluorene	2.5	ND	ND	ND	ND	ND	ND	ND	NA
Total PAHs	4.7	ND	ND	ND	ND	ND	ND	ND	2
Total Recoverable Petroleum Hydrocarbons (TRPH). Reported in parts per million (ppm).									
TRPH	ND	ND	ND	ND	ND	ND	ND	ND	5
Total Metals. Reported in ppb.									
Lead	8.7	10.6	8.5	13.0	9.9	ND	ND	ND	50

[1] Duplicate groundwater sample collected at the same time and location as the preceding groundwater sample.
[2] State target levels are taken from Chapter 62-770.730, Florida Administrative Code.

Notes: Total naphthalenes = the sum concentration of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.
Total PAH = the sum concentration of detected PAHs excluding total naphthalenes.
NA = not applicable.
ND = not detected.
NS = not sampled.

Figure 4-7 Benzene Concentrations in Groundwater (Shallow Zone), April 27 to November 20, 1995

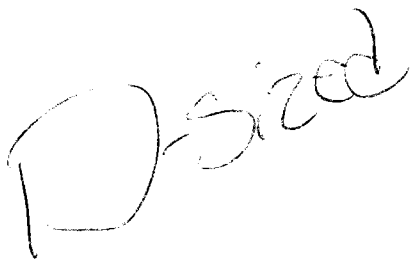
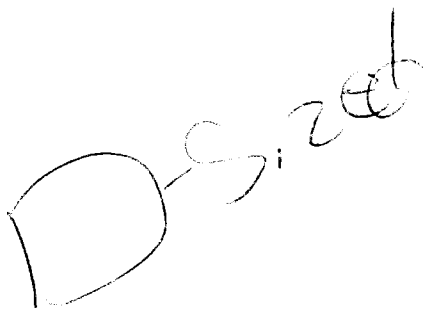


Figure 4-8 Benzene Concentrations in Groundwater (Deep Zone), April 27 to November 20, 1995

D-sized

Figure 4-9 Total VOA Concentrations in Groundwater (Shallow Zone), April 27 to November 20, 1995

Figure 4-10 Total VOA Concentrations in Groundwater (Deep Zone), April 27 to November 20, 1995



Tetrachloroethene (PCE) concentrations of 4.5 ppb and 4.9 ppb were detected in the groundwater samples collected from monitoring well CEF-043-44 and the stormwater drain discharge sample, respectively. The State MCL for PCE is 3 ppb. PCE was not detected in any other groundwater sample.

Trichloroethene (TCE) concentrations of 2.8 ppb, 3.3 ppb, and 1.3 ppb were detected in the groundwater samples collected from monitoring wells CEF-043-47D, CEF-043-50D, and the storm sewer discharge sample, respectively. The State MCL for TCE is 3 ppb. TCE was not detected in any other groundwater sample.

Methyl tert-butyl ether, 1,2-dichlorobenzene, 1,1-dichloroethane, trichlorofluoromethane, and 1,1,1-trichloroethane were detected in samples collected from various SFF monitoring wells. The concentrations of each of these compounds were below the respective State target level or MCL for each compound.

Polynuclear Aromatic Hydrocarbons (PAHs). Total PAHs is the sum concentration of all PAHs detected excluding naphthalenes. Total PAHs concentrations of 12.8 ppb and 4.7 ppb were detected in the groundwater samples collected from monitoring wells CEF-043-4N and CEF-043-45, respectively. According to Chapter 62-770.730 FAC, the State target level for total PAHs is the detection limit, 2 ppb. PAHs were not detected in any other groundwater sample collected from the SFF Site.

Total naphthalenes are the sum concentration of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene. Total naphthalenes concentrations were detected in 24 of 29 groundwater samples. Total naphthalenes concentrations ranged from 2.1 ppb detected in the water sample collected from storm sewer line discharge to 2,240 ppb detected in the duplicate groundwater sample collected from CEF-043-41. The State NFA target level for total naphthalenes is 100 ppb. Total naphthalenes concentrations exceeding the State NFA target level were detected in seven monitoring wells: CEF-043-1N, CEF-043-6N, CEF-043-8N, CEF-043-9N, CEF-043-11, CEF-043-36, and CEF-043-41. Figure 4-11 presents the distribution of total naphthalenes concentrations in shallow monitoring wells.

Total Recoverable Petroleum Hydrocarbons (TRPH). TRPH concentrations ranging from 1.0 ppm to 160 ppm were detected in 12 of 49 groundwater samples. The State NFA target level for TRPH is 5 ppm. A TRPH concentration exceeding the State NFA target level was detected in only one groundwater sample: 160 ppm detected in the groundwater sample collected from CEF-043-41.

Total Metals. Lead concentrations ranging from 5.0 ppb to 72.3 ppb were detected in 28 of 48 groundwater samples collected from SFF monitoring wells. The State NFA target level for lead is 50 ppb. A lead concentration exceeding the State NFA target level was detected in only one groundwater sample: 72.3 ppb detected in the groundwater sample collected from CEF-043-37.

A summary of all contaminant concentrations exceeding an applicable State target level or MCL is presented in Table 4-4.

Figure 4-11 Total Naphthalenes Concentrations in Groundwater (Shallow Zone) April 27, to November 20, 1995.

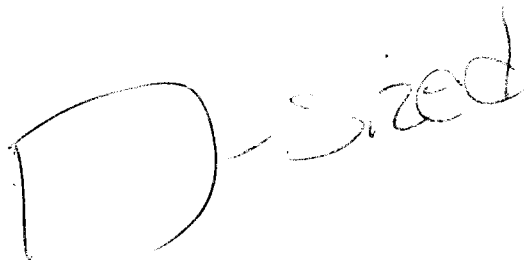


Table 4-4
Analyte Concentrations Exceeding State Regulatory Levels, April through November 1995

Contamination Assessment Report Addendum
South Fuel Farm Site, Facility 43
Naval Air Station Cecil Field
Jacksonville, Florida

Monitoring Well Designation	Contaminant	Contaminant Concentration[1]
CEF-043-1N	Total VOAs	882
	Total naphthalenes	121
	Methylene chloride	B 14
CEF-043-2N	Total VOAs	2,530
	Methylene chloride	B 25
CEF-043-3N[2]	Total VOAs	184
CEF-043-4N	Total VOAs	92.8
	Total PAHs	12.8
CEF-043-5N	Benzene	460
	Total VOAs	5,470
	Methylene chloride	B 77
CEF-043-6N	Benzene	380
	Total VOAs	10,980
	Total naphthalenes	141
CEF-043-7N	Total VOAs	4,300
CEF-043-8N	Total naphthalenes	128
CEF-043-9N	Benzene	1.4
	Total VOAs	396.4
	Total naphthalenes	105
CEF-043-11	Total VOAs	57
	Total naphthalenes	420
CEF-043-14[2]	Benzene	1.5
	Total VOAs	100
CEF-043-23	Benzene	210
	Total VOAs	673
CEF-043-27D	Benzene	30
	Total VOAs	111.4
CEF-043-36	Total VOAs	1,650
	Total naphthalenes	171
CEF-043-37	Benzene	1.1
	Lead	72.3
CEF-043-40	Benzene	3.1

See notes at end of table.

Table 4-4 (Continued)
Analyte Concentrations Exceeding State Regulatory Levels, April through November 1995

Contamination Assessment Report Addendum
South Fuel Farm Site, Facility 43
Naval Air Station Cecil Field
Jacksonville, Florida

Monitoring Well Designation	Contaminant	Contaminant Concentration[1]
CEF-043-41[2]	Benzene	70
	Total VOAs	530
	Total Naphthalenes	2,240
	TRPH	160
CEF-043-44[3]	Benzene	28/32
	Total VOAs	90.8
	Tetrachloroethene	4.5
CEF-043-45	Benzene	10
	Total VOAs	97.8
	Total PAHs	4.7
CEF-043-46D	Benzene	1.1
	Total VOAs	106.5
CEF-043-47D	Benzene	2.4
CEF-043-49D	Benzene	2.1
	Total VOAs	50.3
Discharge	Benzene	2.6
	Tetrachloroethene	4.9

[1] All concentrations are reported in parts per billion except for TRPH, which is reported in parts per million.
[2] The contaminant concentration shown in this table is the higher of the two concentrations detected in a groundwater sample or its duplicate.
[3] Concentrations shown are for samples collected June 1 and August 1, 1995.

Notes: Total VOAs = the sum concentration of benzene, toluene, ethylbenzene, and xylenes.
Total naphthalenes = the sum concentration of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.
Total PAHs = the sum concentration of polynuclear aromatic hydrocarbons excluding naphthalenes.
TRPH = total recoverable petroleum hydrocarbons.
B = Methylene chloride was detected in the method blank associated with the sample. Methylene chloride was also detected in trip blanks and rinsate samples.

5.0 SUMMARY CONCLUSIONS AND RECOMMENDATIONS

5.1 **SUMMARY**. Based on the site history, findings of the CA field investigations, and laboratory analytical results, the following is a summary of existing conditions the SFF Site:

Aquifer Characteristics and Hydrogeologic Parameters.

- Site soil consists predominantly of silty sand from he surface to approximately 70 feet bls. The top of a hardpan layer was encountered in most borings at depths ranging from approximately 2 feet to 9 feet bls. Where encountered, the hardpan layer ranged from less that 1 foot to 11 feet in thickness to a maximum depth of 20 feet bls.

- Depth to water ranges from approximately 6 to 8 feet bls at the site. There is a net downward vertical gradient in the northern part of the site and a net upward vertical gradient in the southern part of the site. The upward gradient is associated with the stormwater drainage line.

- The groundwater flow direction is toward the southeast in both the shallow and deep zones; however, the shallow zone groundwater flow direction is significantly affected by the stormwater drainage line.

- The average hydraulic gradient across the site is 0.007 ft/ft in the shallow waterbearing zone and 0.003 ft/ft in the deep zone. The average hydraulic conductivity for the shallow and deep waterbearing zones are 1.17 ft/day and 4.03 ft/day, respectively. The average pore water velocity is 0.023 ft/day in the shallow zone and 0.034 ft/day in the deep zone.

Soil and Groundwater Contamination Assessment.

- Excessively contaminated soil excavated during the tank removal operations was returned to the site.

- Excessively contaminated soil (OVA headspace reading exceeding 50 ppm) was present throughout most of the site; however, the highest OVA headspace readings were concentrated in seven areas.

- Benzene, total VOAs, BTEX, TRPH, total PAHs, total naphthalenes, and lead concentrations in groundwater samples from site monitoring wells exceeded Chapter 62-770, FAC, "no further action" or "monitoring only" target levels for Class G-II groundwater.

- Chlorinated compounds were detected in a few site monitoring well samples and the stormwater drainage line discharge in concentrations that slightly exceed State target levels.

- The vertical extent of petroleum-contaminated groundwater exceeding the Chapter 62-770, FAC "no further action" or "monitoring only" target levels for Class G-II groundwater is less than 65 feet bls.

- The source of much of the petroleum contamination at the site has been abated. The USTs and three of the four EMTs have been removed. The associated pipes have been drained and abandoned in place or removed.

- Free-phase petroleum product was not detected in any of the site monitoring wells or piezometers.

- All remaining active fuel storage and transmission systems at the site (Day Tank 342-DT and associated pipes and NFF supply pipeline) are undergoing inspection or tightness testing, as applicable.

5.2 CONCLUSIONS.

- The horizontal and vertical extent of excessively contaminated soil and petroleum-contaminated groundwater have been adequately assessed at the SFF Site in accordance with Chapter 62-770, FAC.

- Spills and leaks from the tanks and pipelines at the site are the sources of soil and groundwater contamination.

- Petroleum-contaminated groundwater exceeding the Chapter 62-770, FAC, "no further action" or "monitoring only" target levels for Class G-II groundwater has migrated vertically and downgradient from the source areas and is discharging to (but not migrating beyond) the stormwater drainage line on the south side of the site.

- The hardpan layer is acting as a semi-confining unit (aquitard) between the shallow and deep waterbearing zones.

- The source of chlorinated compounds in groundwater at the site is unknown and is likely upgradient of the SFF Site.

5.3 RECOMMENDATIONS. Based on the findings, conclusions and interpretations of the CA at the SFF Site, ABB-ES recommends the development of a remedial action plan to address the requirements of Chapter 62-770, FAC.

6.0 PROFESSIONAL REVIEW CERTIFICATION

This document, *Contamination Assessment Report Addendum, South Fuel Farm Site, Facility 43, Naval Air Station Cecil Field, Jacksonville, Florida,* has been prepared under the direction of a Professional Geologist registered in the state of Florida. The work and professional opinions rendered in this report were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice. This assessment is based on the geologic investigation and associated information detailed in the text and appended to this report or referenced in public literature. Recommendations are based upon interpretations of the applicable regulatory requirements, guidelines, and relevant issues discussed with regulatory personnel during the site investigation. If conditions that differ from those described are determined to exist, the undersigned geologist should be notified to evaluate the effects of any additional information on this assessment or the recommendations made in this report. This report meets the criteria set forth in Chapter 492 of the Florida Statutes with regard to good professional practices as applied to Chapter 62-770 of the Florida Administrative Code. This CAR Addendum was developed for the SFF Site at NAS Cecil Field, Jacksonville, Florida, and should not be construed to apply to any other site.

Michael J. Williams
Professional Geologist
P.G. No. 344

1/5/96
Date

REFERENCES

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Florida Department of Environmental Regulation
Twin Towers Office Bldg. ● 2600 Blair Stone Road ● Tallahassee, Florida 32399-2400
Lawton Chiles, Governor
Carol M. Browner, Secretary

September 25, 1991

Re 5 Oct 92 CAL

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Carl Loop
Code 18237
Department of the Navy
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
Post Office Box 10068
Charleston, South Carolina 26411-0068

Dear Mr. Loop:

Department personnel have completed the technical review of the Draft Contamination Assessment Report, South Fuel Farm, Facility 43, NAS Cecil Field. I have enclosed a memorandum addressed to me from Mr. Mark Canfield. It documents our comments on the referenced report.

If I can be of any further assistance, please contact me at 904/488-0190.

Sincerely,

Eric S. Nuzie

Eric S. Nuzie
Federal Facilities Coordinator

ESN/bb

Enclosure

cc: Mark Canfield
Brian Cheary
Lynn Griffin
John Mitchell
Jerry Young
Allison Drew
John Dingwall
Basit Ghori

State of Florida
DEPARTMENT OF ENVIRONMENTAL REGULATION

For Routing To Other Than The Addressee
To: Location:
To: Location:
To: Location:
From: Date:

Interoffice Memorandum

To: Eric S. Nuzie, Federal Facilities Coordinator
Bureau Of Waste Cleanup

THROUGH: James J. Crane, Environmental Administrator
Technical Review Section
Bureau Of Waste Cleanup

Tim J. Bahr, Technical Review Section
Bureau Of Waste Cleanup

FROM: Mark A. Canfield, Technical Review Section
Bureau of Waste Cleanup

DATE: September 23, 1992 Rec 5 Oct 92 CAL

SUBJECT: Draft CAR, dated July 1992
South Fuel Farm, Facility 43,
Naval Air Station Cecil Field

I have reviewed the Draft Contamination Assessment Report (CAR) dated July 1992 (received August 7, 1992), submitted for this site. As you will recall in our April 1, 1992 meeting with Carl Loop (Southern Division) it was decided that Draft CAR's would no longer be submitted for review. In my recent phone conversation with Carl Loop we agreed that this Draft CAR would be reviewed as a complete CAR. In order to meet the requirements of Chapter 17-770, Florida Administrative Code (F.A.C.), the following comments need to be addressed:

1. A new cover page should be submitted for this document and page 7-1 should be resubmitted signed, sealed, and dated.

2. The structural integrity of the existing product storage/ distribution system should be established via separate tank and line tightness tests in accordance with Chapter 17-761, F.A.C.

3. Free product recovery should be implemented in accordance with Rule 17-770.300(1), F.A.C., if measurable amounts are detected at any monitoring well.

4. The rationale for collecting soil samples at the groundwater interface should be discussed and soil boring logs should be provided.

5. Descriptive information should be provided on the Fuel Containment Area. Additionally, the underground fuel piping network should be included in the Figures indicating groundwater contamination and soil contamination.

6. The horizontal and vertical extent of soil contamination has not been adequately delineated in the unsaturated zone. Therefore, supplemental soil assessment in accordance with Rule 17-770.200(2), F.A.C., and the Department's May 1992 "Guidelines for Assessment and Remediation of Petroleum Contaminated Soils" should be performed. The extent of soil contamination should be further delineated in the following locations:

a. In the immediate vicinity of SB-26.
b. In the immediate vicinity of SB-24.
c. In the immediate vicinity of SB-22.
d. In the immediate vicinity of SB-45.
e. In the immediate vicinity of SB-44.
f. In the immediate vicinity of SB-47.
g. In the immediate vicinity of SB-39.
h. In the immediate vicinity of SB-38.
i. In the immediate vicinity of SB-04.
j. In the immediate vicinity of SB-42.
k. In the immediate vicinity of SB-12.
l. In the immediate vicinity of SB-32.
m. In the immediate vicinity of SB-31.
n. In the immediate vicinity of SB-30.
o. In the earthcover surrounding Tanks 43-B, 43-C, and 43-D.
p. In the immediate vicinity of tanks 43-E and 43-F.

Soil samples should be collected (at the surface, one-foot bls., and at every other foot thereafter to the water table) and values should be summarized in a table, and the approximate extent of soil contamination should be represented in graphic form. Please note, performing the supplemental soil assessment in conjunction with a soil Initial Remedial Action excavation/ treatment/disposal is acceptable, if planned.

7. Additional, permanent monitoring wells should be installed as follows to define the horizontal and vertical extent of the groundwater contamination.

a. One shallow well in the immediate vicinity of SB-26.

b. One shallow well in the immediate vicinity of SB-24.
c. One shallow well in the immediate vicinity of SB-22.
d. One shallow well in the immediate vicinity of SB-39.
e. One shallow well in the immediate vicinity of SB-34.
f. One shallow well in the immediate vicinity of SB-32.
g. One deep well in the immediate vicinity of CEF-043-07.

8. After installation of the supplemental monitoring wells, a complete round of sampling and analyses should be performed for EPA Methods 602 (including MTBE) and 610. In addition to the above sampling and analyses, MW-30 should also have EPA Method 601 performed and MW-9 should also have EPA Method 239.2 performed. These analyses are necessary so that this review can be completed and a Remedial Action Plan (RAP) prepared based on current data. Note, additional monitoring wells should be installed if significant contaminant concentrations are detected at a perimeter well or at a vertical extent well.

9. Following installation of the supplemental monitoring wells, and concurrent with the sampling event, a complete set of water level measurements must be obtained in order to verify the direction of groundwater flow and to estimate fluctuations in the water table. These data must be provided in tabular form (including top of casing elevations, depths to water, and corresponding water level elevations) and in graphic form showing the consultant's interpretation of the groundwater flow direction.

July '92
Call Mildred Luther
in Tallie