N61165.AR.003821
CNC CHARLESTON
5090.3a

OIL WATER SEPARATOR DATA BINDER 3 CNC CHARLESTON SC

9/1/2000

NAVFAC SOUTHERN

Oil Water Separator Data
Charleston Naval Complex
Charleston, South Carolina

Binder 3

Prepared by
M.A. Hunt, P.E.
Southern Division,
Naval Facilities Engineering Command
North Charleston, South Carolina

September 2000

Scan
Oil/Water Separator Data
Binders 1 - 2 - 3

Compliance

OIL WATER SEPARATOR DATA

BINDER 3

CHARLESTON NAVAL COMPLEX
CHARLESTON, SOUTH CAROLINA

Revision No. 0

Prepared for and by:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina

September 2000

OIL WATER SEPARATOR DATA

BINDER 3

CHARLESTON NAVAL COMPLEX
CHARLESTON, SOUTH CAROLINA

Revision No. 0

Prepared for and by:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina

Table of Contents

List of Figures

Facility 236 OWS

Operation
Building 236 is a two story facility built as the pipe shop within the shipyard adjacent to Dry Dock 5. The building contains a freon recovery system in the northern end. The oil water separator received liquids from floor drains near this system and other shop operations and separated waste oil to a 560 gallon tank. Water was directed to the sanitary sewer system. No other piping was routed to this tank.

Sample and Analysis
A rapid assessment has been done at this site targeting the waste oil tanks. Soil and groundwater samples were taken within 4' to 8' of the tank. The soil analysis was typical of UST program, BTEX, PAHs, Metals (Hg, Ag, As, Ba, Cd, Cr, Pb, and Se) and Total Recoverable Petroleum Hydrocarbons (pgs 4-21). Monitoring wells have been installed at the site to assess contamination extent

The IR program sampled the waste oil tank area as part of the AOC 583 investigation. Soil samples were taken in and around the waste oil tanks. Representative samples were analyzed for VOC, SVOC, cyanide, pesticides, and PCBs and reported at DQO Level III. No exceedances were noted in surface soil samples . Two monitoring wells are installed approximately 45' from the OWS on the downgradient side

Recommendations
Because of the function of the tank was to receive wastes from operations within the pipe shop, most notable being overflow from freon recovery system tanks or overpressurization, it is probable that both petroleum constituents and solvents were discharged to the OWS. This site is contained within an area that defined as AOC 583 of the Zone E RFI . Any further assessment and remediation should be undertaken concurrent with that planned for this site.

RE01

236-TK-1

TICIAL USE ONLY

LABORATORY DIVISION
CHARLESTON NAVAL SHIPYARD

GENERAL LABORATORY REPORT

28 JULY, 1994

File No: 10320

To: Code 106 & 106C Attn: Ross

Subj: Analysis of Oil from UST

Ref: (a) Job Order: 9163521000
(b) Report No: 94CH01100 Trace No.: REM 0001 - 0004
(c) EPA METHOD 600/04-81-045

1. Four (4) samples were analyzed by gas chromatographic methods per references (a) and (b) for Polychlorinated Biphenyl (PCB) content. The analysis was performed in accordance with reference (c). Detailed results of the analyses follow:

SAMPLED LOCATION		RESULTS, ppm
REM-0001	00018	< 2
REM-0002	00017	< 2
REM-0003	00016	< 2
REM-0004	00013	< 2

236TK-1 UST 00013
-4 UST 00016
-5 UST 00017
-6 UST 00018

* TEST PERFORMED AGAIN TO < 2 ppm K. Rogers 42970 C/106C 7/29/94

Analyst

Head, Analytical and Applied Chemistry Branch

COPY TO: Code 134.1

Page 1

3-3

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Charleston/CH

cc: BECH00594 Report Date: October 06, 1995

Sample ID : CH08098 SBS

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	M	C
Metals Analysis												
Silver	U	0.46	0.46	7.8	mg/kg	1.0	JSS	08/22/95	1230	71339	5	2
Arsenic	U	2.5	2.5	17.5	mg/kg	1.0						
Barium		13.5	0.20	2	mg/kg	1.0						
Cadmium	U	0.19	0.20	2	mg/kg	1.0						
Chromium		8.6	0.30	2	mg/kg	1.0						
Lead		5.9	2.2	5.8	mg/kg	1.0						
Selenium	U	4.9	5.0	17.5	mg/kg	1.0						
Mercury		0.09	0.02	0.03	mg/kg	1.0	BBJ	08/24/95	1824	71296	6	2
C ·al Chemistry												
·al Rec. Petro. Hydrocarbons		342	12	12	mg/kg	1.0	CAM	08/22/95	1130	71459	7	2

The following prep procedures were performed:

GC/MS Base/Neutral Compounds	CPU	08/24/95	1430	71625	4
ICP	DVW	08/19/95	1010	71339	8
Mercury	BBJ	08/22/95	1600	71296	6

Surrogate Recovery	Test	Percent%	Acceptable Limits
2-Fluorobiphenyl	M610	98.8	(36.0 - 114.)
Nitrobenzene-d5	M610	75.4	(23.0 - 120.)
p-Terphenyl-d14	M610	131.	(51.8 - 135.)
1,2-Dichloroethane-d4	TCTFE-MSV	105.	(70.0 - 121.)
1,2-Dichloroethane-d4	TCTFE-MSV	105.	(70.0 - 121.)
Bromofluorobenzene	TCTFE-MSV	94.4	(74.7 - 118.)
Bromofluorobenzene	TCTFE-MSV	94.4	(74.7 - 118.)
Toluene-d8	TCTFE-MSV	95.6	(81.0 - 117.)
Toluene-d8	TCTFE-MSV	95.6	(81.0 - 117.)
Bromofluorobenzene	BTEX/NAP-8260	110.	(80.0 - 120.)
Dibromofluoromethane	BTEX/NAP-8260	116.	(80.0 - 120.)
Toluene-d8	BTEX/NAP-8260	106.	(80.0 - 120.)

25

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NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Charleston/CH

cc: BECH00594 Report Date: October 06, 1995

Sample ID : CH08098 SBS

M = Method	Method-Description
M 1	EPA 8240 extended
M 2	EPA 8260
M 3	EPA 3550
M 4	EPA 8270
M 5	EPA 6010A
M 6	EPA 7471
M 7	EPA 9071
M 8	EPA 3050

C = Container	Lab. Container ID	Reference ID
C 1	9508388-03.02	CH0809801
C 2	9508388-03.01	CH0809802

Notes:
The qualifiers in this report are defined as follows:
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U indicates presence of analyte < DL (Detect Limit)

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Analytical Report Specialist

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NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Charleston/CH

cc: BECH00594 Report Date: October 06, 1995

Sample ID	: 9508388-03 RA0 CH08098 SBS
Lab ID	: 9508388-12
Matrix	: Soil
Date Collected	: 08/14/95
Date Received	: 08/15/95
Priority	: Routine
Collector	: Client

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	M	C
Volatile Organics												
BTEX and Naphthalene - 6 items												
Benzene	U	12	1	12	ug/kg	1.0	TLD	08/29/95	1856	71823	1	1
Ethylbenzene	U	12	1	12	ug/kg	1.0						
Naphthalene	U	12	1	12	ug/kg	1.0						
Toluene	U	12	1	12	ug/kg	1.0						
meta- and para-Xylenes	U	12	1	12	ug/kg	1.0						
ortho-Xylene	U	12	1	12	ug/kg	1.0						
Organic Prep												
Evaporative Loss @ 105 C		17	1	1	wt%	1.0	DDT	08/19/95	1000	71919	2	N

Surrogate Recovery	Test	Percent%	Acceptable Limits
Bromofluorobenzene	BTEX/NAP-8260	106.	(80.0 - 120.)
Dibromofluoromethane	BTEX/NAP-8260	102.	(80.0 - 120.)
Toluene-d8	BTEX/NAP-8260	99.5	(80.0 - 120.)

M = Method	Method-Description
M 1	EPA 8260
M 2	EPA 3550

C = Container	Lab. Container ID	Reference ID
C 1	9508388-12.01	CH0809801

44

3 - 7

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SC	10120	10582
TN	02934	
VA	00151	
WI	99988729	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Charleston/CH

cc: BECH00594 Report Date: October 06, 1995

Sample ID : 9508388-03 RA0 CH08098 SBS

C = Container	Lab. Container ID	Reference ID

Notes:
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Analytical Report Specialist

P O Box 30712 • Charleston, SC 29417 • (803) 556-8171 • Fax (803) 766-1178 *9508388-12*

TANK 1

WASTE OIL
GROUP #2

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FL	E87156/87294	E87472/87458
NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

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Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Charleston/CH

cc: BECH00594 Report Date: October 06, 1995

Sample ID	: CH08098 SBS
Lab ID	: 9508388-03
Matrix	: Soil
Date Collected	: 08/14/95
Date Received	: 08/15/95
Priority	: Routine
Collector	: Client

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	M	C
Volatile Organics												
Trichlorotrifluoroethane	J	2	12	12	ug/kg	1.0	SME	08/24/95	1944	71666	1	1
BTEX and Naphthalene - 6 items												
Benzene	U	12	1	12	ug/kg	1.0	TLD	08/28/95	1105	71823	2	N
Ethylbenzene	U	12	1	12	ug/kg	1.0						
Naphthalene	J	0.7	1	12	ug/kg	1.0						
Toluene	J	2	1	12	ug/kg	1.0						
meta- and para-Xylenes	J	0.8	1	12	ug/kg	1.0						
ortho-Xylene	J	0.7	1	12	ug/kg	1.0						
Organic Prep												
Evaporative Loss @ 105 C		17	1	1	wt%	1.0	DDT	08/19/95	1000	71274	3	2
Extractable Organics												
Polynuclear Aromatic Hydrocarbons - 16 items												
Acenaphthene	U	390	200	390	ug/kg	1.0	JCB	08/26/95	0239	71625	4	2
Acenaphthylene	U	390	200	390	ug/kg	1.0						
Anthracene	U	390	200	390	ug/kg	1.0						
Benzo(a)anthracene	U	390	200	390	ug/kg	1.0						
Benzo(a)pyrene	U	390	200	390	ug/kg	1.0						
Benzo(b)fluoranthene	U	390	200	390	ug/kg	1.0						
Benzo(ghi)perylene	U	390	200	390	ug/kg	1.0						
Benzo(k)fluoranthene	U	390	200	390	ug/kg	1.0						
Chrysene	U	390	200	390	ug/kg	1.0						
Dibenzo(a,h)anthracene	U	390	200	390	ug/kg	1.0						
Fluoranthene	J	43	200	390	ug/kg	1.0						
Fluorene	U	390	200	390	ug/kg	1.0						
Indeno(1,2,3-c,d)pyrene	U	390	200	390	ug/kg	1.0						
Naphthalene	U	390	200	390	ug/kg	1.0						
Phenanthrene	J	110	200	390	ug/kg	1.0						
Pyrene	J	110	200	390	ug/kg	1.0						

24

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Sample ID : CH08098 SBS

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Barium		13.5	0.20	2	mg/kg	1.0						
Cadmium	U	0.19	0.20	2	mg/kg	1.0						
Chromium		8.6	0.30	2	mg/kg	1.0						
Lead		5.9	2.2	5.8	mg/kg	1.0						
Selenium	U	4.9	5.0	17.5	mg/kg	1.0						
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p-Terphenyl-d14	M610	131.	(51.8 - 135.)
1,2-Dichloroethane-d4	TCTFE-MSV	105.	(70.0 - 121.)
1,2-Dichloroethane-d4	TCTFE-MSV	105.	(70.0 - 121.)
Bromofluorobenzene	TCTFE-MSV	94.4	(74.7 - 118.)
Bromofluorobenzene	TCTFE-MSV	94.4	(74.7 - 118.)
Toluene-d8	TCTFE-MSV	95.6	(81.0 - 117.)
Toluene-d8	TCTFE-MSV	95.6	(81.0 - 117.)
Bromofluorobenzene	BTEX/NAP-8260	110.	(80.0 - 120.)
Dibromofluoromethane	BTEX/NAP-8260	116.	(80.0 - 120.)
Toluene-d8	BTEX/NAP-8260	106.	(80.0 - 120.)

25

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M 8	EPA 3050

C ntainer	Lab. Container ID	Reference ID
C 1	9508388-03.02	CH0809801
C 2	9508388-03.01	CH0809802

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Analytical Report Specialist

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NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	999887791	

CERTIFICATE OF ANALYSIS

Client: Bechtel
PO Box 350
Oak Ridge, Tennessee 37831-0350
Contact: Ms. Lori Keller
Project Description: Charleston/CH

cc: BECH00594 Report Date: October 06, 1995

Sample ID	: 9508388-03 RA0 CH08098 SBS
Lab ID	: 9508388-12
Matrix	: Soil
Date Collected	: 08/14/95
Date Received	: 08/15/95
Priority	: Routine
Collector	: Client

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	M	C
Volatile Organics												
BTEX and Naphthalene - 6 items												
Benzene	U	12	1	12	ug/kg	1.0	TLD	08/29/95	1856	71823	1	1
F nzene	U	12	1	12	ug/kg	1.0						
N lene	U	12	1	12	ug/kg	1.0						
Toluene	U	12	1	12	ug/kg	1.0						
meta- and para-Xylenes	U	12	1	12	ug/kg	1.0						
ortho-Xylene	U	12	1	12	ug/kg	1.0						
Organic Prep												
Evaporative Loss @ 105 C		17	1	1	wt%	1.0	DDT	08/19/95	1000	71919	2	N

Surrogate Recovery	Test	Percent%	Acceptable Limits
Bromofluorobenzene	BTEX/NAP-8260	106.	(80.0 - 120.)
Dibromofluoromethane	BTEX/NAP-8260	102.	(80.0 - 120.)
Toluene-d8	BTEX/NAP-8260	99.5	(80.0 - 120.)

M = Method	Method-Description
M 1	EPA 8260
M 2	EPA 3550

C = Container	Lab. Container ID	Reference ID
C 1	9508388-12.01	CH0809801

44

3-13

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STATE	GEL	EPI
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NC	233	
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Analytical Report Specialist

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3-14

addition, the future site worker scenario assumed continuous exposure to surface soil conditions. Groundwater was formally assessed for the site worker and hypothetical site resident ingestion pathway. Table 6.2.2.7 justifies exposure pathways assessed in this HHRA.

Exposure Point Concentrations

More than 10 surface soil samples were analyzed; therefore, UCLs were calculated, and the lesser of the maximum reported concentrations or the calculated UCLs was used as the EPC for each COPC in Table 6.2.2.8. Because there are fewer than 10 groundwater monitoring wells at SWMU 13, the maximum concentration reported for groundwater COPCs was used as the EPC for the groundwater pathway.

Soil

Table 6.2.2.8 presents the EPCs used in this HHRA for SWMU 13. Tables 6.2.2.9 and 6.2.2.10 present the CDIs calculated for the incidental ingestion and dermal contact exposure pathways, respectively.

Groundwater

Table 6.2.2.11 presents exposure estimates for ingestion of shallow groundwater.

6.2.2.4 Toxicity Assessment

Toxicity assessment terms and methods are discussed in Section 6.1.4 of this report. Toxicological risk information is summarized in Table 6.2.2.12, and toxicological profiles are presented below for COPCs identified in Section 6.2.2.2.

Polyaromatic hydrocarbons include the following COPCs: (BEQ's)

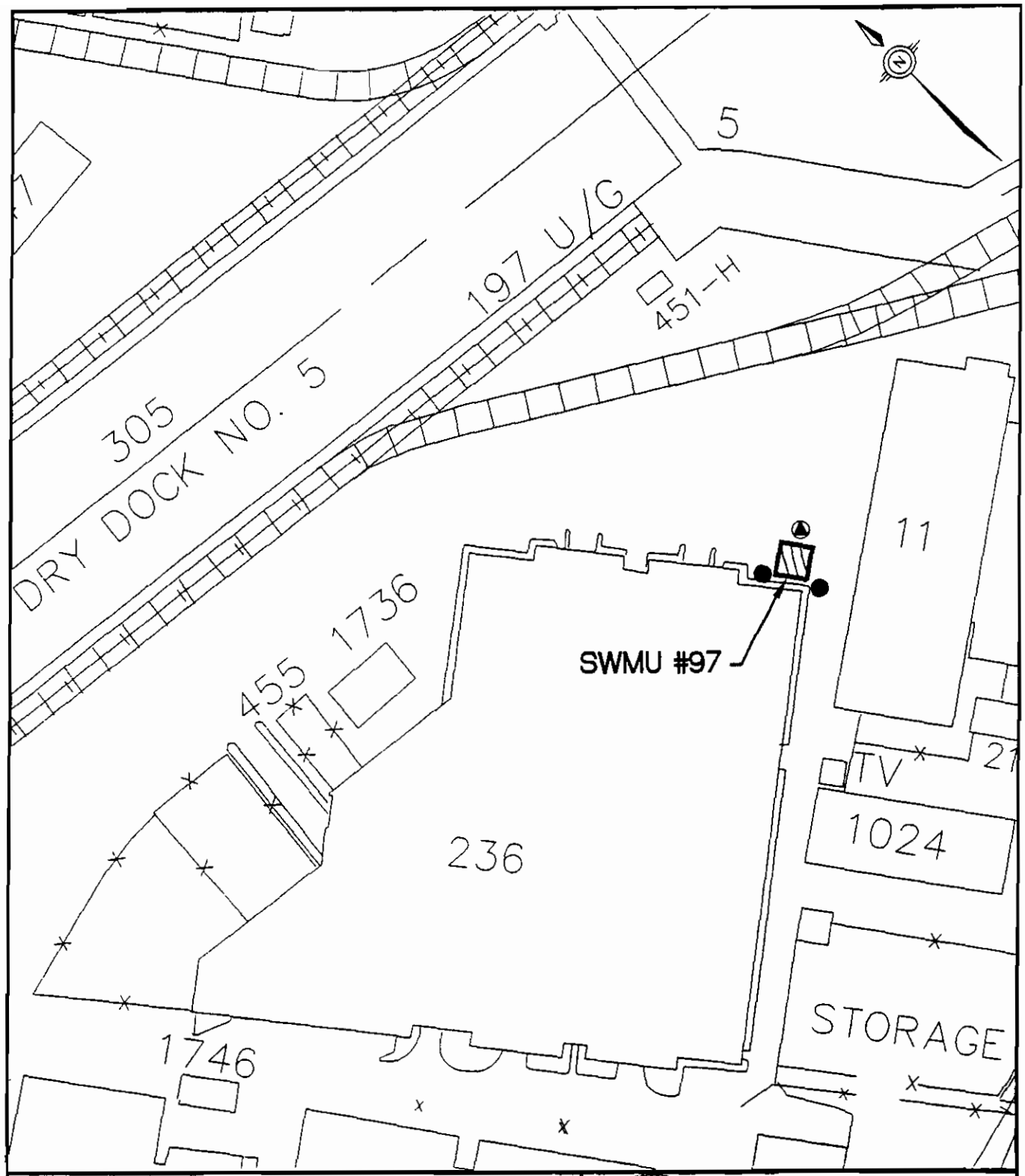
Benzo(a)anthracene	TEF 0.1
Benzo(b)fluoranthene	TEF 0.1

3-15

Dibenz(a,h)anthracene	TEF	1.0
Benzo(k)fluoranthene	TEF	0.01
Benzo(a)pyrene	TEF	1.0
Indeno(1,2,3-cd)pyrene	TEF	0.1
Chrysene	TEF	0.001

Some PAHs are toxic to the liver, kidney, and blood. However, the toxic effects of the PAHs above have not been well-established. There are no RfDs for the PAHs above due to a lack of data. All PAHs listed above are classified by USEPA as B2 carcinogens, and their carcinogenicity is addressed relative to that of BAP, having an oral SF of 7.3 $(mg/kg\text{-}day)^{-1}$. TEFs, also set by USEPA, are multipliers that are applied to the detected concentrations, which are subsequently used to calculate excess cancer risk. Most carcinogenic PAHs have been classified as such due to animal studies using large doses of purified PAHs. There is some doubt as to the validity of these listings, and the SFs listed in USEPA's RBC Table are provisional. However, these PAHs are carcinogens when the exposure involves a mixture of other carcinogenic substances (e.g., coal tar, soot, cigarette smoke, etc.). As listed in IRIS (search date 6/28/95), the BAP is classified B2 based on insufficient human data specifically linking it to a carcinogenic effect. However, multiple animal studies in many species demonstrate BAP to be carcinogenic following administration by numerous routes.

BAP has produced positive results in numerous genotoxicity assays. At the June 1992 CRAVE Work Group meeting, a revised risk estimate for BAP was verified. This section provides information on three aspects of the carcinogenic risk assessment for the agent in question, the USEPA classification, and quantitative estimates of exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in application of a low-dose extrapolation procedure and is presented as the switching per mg/kg-day. The unit risk is the quantitative estimate in terms f either risk per $\mu g/L$ drinking water or risk per $\mu g/m^3$ air breathed. The third form in which



LEGEND

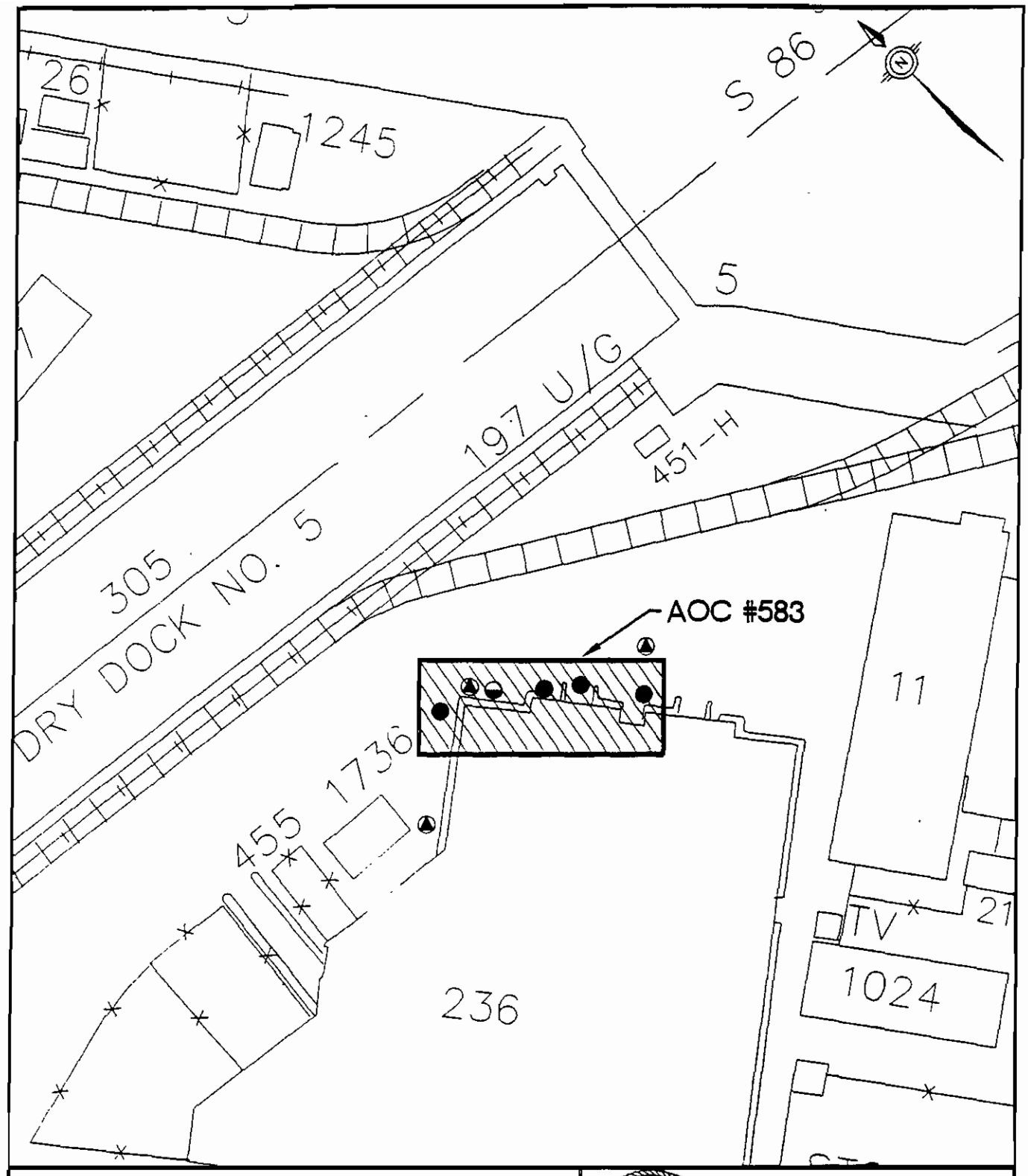
- ○ – EXISTING SOIL BORINGS
- Ⓐ – EXISTING MONITORING WELLS
- ● – PROPOSED SOIL BORINGS
- ◒ – PROPOSED DEEP MONITORING WELLS
- Ⓐ – PROPOSED SHALLOW MONITORING WELLS
- ▲ – PROPOSED SEDIMENT SAMPLES
- Ⓒ – PROPOSED CORE SAMPLES
- Ⓖ – PROPOSED SURFACE SOIL SAMPLE
- Ⓢ – PROPOSED SURFACE WATER SAMPLES
- Ⓣ – PROPOSED THICKNESS SAMPLES
- Ⓦ – PROPOSED WIPE SAMPLES

GRAPHIC SCALE 100 0 100 200

FINAL RFI
ZONE E WORKPLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2-12
SWMU #97
BUILDING 236
<90 DAY STORAGE AREA

DWG DATE: 6/2/95 | DWG NAME: FIGURE12



LEGEND

- ○ – EXISTING SOIL BORINGS
- ⓐ – EXISTING MONITORING WELLS
- ● – PROPOSED SOIL BORINGS
- ◒ – PROPOSED DEEP MONITORING WELLS
- ⓐ – PROPOSED SHALLOW MONITORING WELLS
- ▲ – PROPOSED SEDIMENT SAMPLES
- Ⓒ – PROPOSED CORE SAMPLES
- Ⓒ – PROPOSED SURFACE SOIL SAMPLE
- Ⓢ – PROPOSED SURFACE WATER SAMPLES
- Ⓣ – PROPOSED THICKNESS SAMPLES
- Ⓦ – PROPOSED WIPE SAMPLES

GRAPHIC SCALE 100 0 00 200

FINAL RFI
ZONE E WORKPLAN
NAVAL BASE CHARLESTON
CHARLESTON, S.C.

FIGURE 2-41
AOC #583
BUILDING 236

DWG DATE: 6/2/95 | DWG NAME: FIGURE41

LF 8207

REVISIONS				
LET	DESCRIPTION	PREP'D BY	DATE	APPROVED

H J

PIER 317 F

PIER 317 A

EXIST. DIESEL PIPING CAPPED WITHIN BLDG. 39 (TYP. FOR 3)

6" ABOVE GROUND

PIER K

PIER L

957

326

218

18"
12"
10"
10"

127

124

RIVER ROAD

MATCH LINE A

DRY DOCK NO 3

DRY DOCK NO 4

1195

1190

1183

95

96

1174

1277

1170

1169

1175

1176

11TH STREET

10TH STREET

13TH STREET

69

68

1201

1224

3911

3912

3913

4"

12"

18"
12"
12"

ENCASE
15'x40'x12" REENFORCE SLAB OVER

3902

132

160

161

162

HOBSON AVE

6"

PIER M

6"FUEL OIL
8"SLUDGE
12" DIESEL
20" FUEL
18"
18" F.O.
12" DO
8" DRAIN
16"
OIL
OIL
FUEL OIL

175

4" RISERS & VALVES

200,000 GAL FUEL OIL STORAGE TANK

3909

2½" F.O.S.
4" FOA

123

125

APPROACH PIER 327

HOBSON AVE

39-K

APPROACH PIER 322

MATCH LINE A

177

459-C

1197

VIADUCT ROAD

CLOVER LEAF NOT SHOWN

131

8" FOAM

CK VALVE
8" FOAM

8" FOAM CONNECTS INTO 16" F.O.

10" FOAM

55,000 BBLS

3900-E

CLARIFIED DIESEL OIL LOADING RACK

6" C.I.

3900-G

55,000 BBLS

3900

TANK

133

WATER-OIL SEPARATOR

10" JUMPOVER AND VALVE

3900-F

3900-H

55,000 BBLS

55,000 BBLS

17,640 BBLS

39-D

1193

3901-A

2,460 BBLS

98

42

ABANDONED

17,640 BBLS

39-A

BOX SEWER

ABANDONED

FOAM LINES

2-30" SEWERS

39-J

27,000 BBLS

SEE NAVFAC DWG. NO. (APPROX. 1955' NOT SHOWN)

No! See NS621-288

1 BBL. = 42 GALS.

GRAPHIC SCALE

1" = 100'

100' 50' 0 100' 200' 300'

FUEL OIL, DIESEL OIL, SLUDGE OIL, DISTRIBUTION PLAN SCALE: 1" = 100'

LEGEND			
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	FUEL OIL (BLACK)		MANHOLE
	DIESEL OIL		CHECK VALVE
	CLARIFIED DIESEL OIL		RISER
	SLUDGE & DRAIN LINES		VALVE
	FOAM LINES		PUMP
	SEWER LINES		MANIFOLD
—A—	PIPING ABANDONED		

MBTB ARCHITECTS-ENGINEERS GREENVILLE, SOUTH CAROLINA 29602

DSGN MATHIS DR POOLE CHK WOODS

SUPV WOODS CH ENGR BOWEN

SUBMITTED BY [signature] DATE 22 JUN 72
FIRM MEMBER (TITLE) V.P.

SOUTHERN DIV — DESIGN DIVISION
PDE [signature] DATE

APPROVED DATE

OFFICER IN CHARGE

APPROVED DATE

EFD FOR COMMANDER, NAVFAC

ARCH. & ENGR. SEAL

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
SOUTHERN DIVISION
CHARLESTON, S.C.

NAVAL STATION CHARLESTON, S.C.

FUEL OIL, DIESEL OIL, SLUDGE OIL, DISTRIBUTION PLAN

SIZE	CODE IDENT NO.	NAVFAC DRAWING NO.
F	80091	[illegible]

CONTR CONT NO.

SCALE AS SHOWN SPEC SHEET 1 OF 2

H3900-86

SCOTT GRAPHICS

REVISIONS				
LET	DESCRIPTION	PREP'D BY	DATE	APPROVED
V	...D TO AS-BUILT	KJW	9/22/83	

560 GALLON CONTAMINATED OIL TANK
1000 GALLON FREON RECLAIMING TANK
1000 GALLON DISTILLED WATER TANK
275 GALLON OIL TANK
275 GALLON OIL TANK
2" VENT UP TO ABOVE ROOF
VALVE & CAP I" F LINES 6" ABOVE FLOOR
I"F. LINES DN.
MEN HB137
30 GALLON PRESSURE TANK ¾" D.W. DN
STAGING OUT HB135
SEE FIRST LEVEL PLAN NE DRAWING NO 5058474 FOR CONTINUATION
FREON RECLAIMING/ STORAGE HB136
DISTILLED WATER PUMP ON 4" HIGH REINFORCED CONCRETE PAD
2" VENTS UP TO ABOVE ROOF
½" OIL SUPPLY & RETURN LINES DN.
OIL PUMPSETS ON 4" HIGH REINFORCED CONCRETE PAD
RUN LINES EXPOSED AT CLG. HOLD HIGH AS POSSIBLE
4" CONTAMINATED OIL LINE DN.
½" OIL SUPPLY LINES DN.
VALVE & CAP OIL & DRAIN LINES 6" ABOVE TABLE
2" VENT UP TO ABOVE ROOF
500 GALLON CLEAN FREON STORAGE TANK
EQUIP. STORAGE H.B. 139
560 GALLON FRESH WATER TANK
TEST/FLUSH LB127
FOR DRAINS THIS AREA SEE SHEET NO. 5058474
EQUIPMENT STORAGE HB140
STORAGE LB129
PASSAGE WAY "A"
35 G.P.M. OIL PUMPSETS ON 4" HIGH REINFORCED CONCRETE PADS
560 GALLON FREON STORAGE TANK
VALVE & CAP F.W. & F. LINES 6" ABOVE TABLE
560 GALLON WASTE OIL STORAGE TANK
2" VENT UP TO ABOVE ROOF
CLEAN ROOM LB128
OFFICE LB130
SEE FIRST LEVEL PLAN NE DRAWING NO. 5058474 FOR CONTINUATION
EQUIPMENT STORAGE HB141
VALVE & CAP LINES 6" ABOVE TABLE

▽SEE REVISED SKETCHES ON DRAWING #5058481

PART FIRST LEVEL PLAN-NORTHEAST
SCALE: 1/8"=1'-0"

VENT CAP ABOVE ROOF
OFFSET LINES TO CLEAR ROOF PARRAPET
RUN LINES EXPOSED ON INSIDE FACE OF BUILDING WALL
PRESSURE GAUGES
PRESSURE SWITCHES
10" MANHOLE W/ FILL CAP
4" FOOT VALVE (2" FROM BOTTOM)
275 GALLON OIL TANK
560 GALLON CONTAMINATED OIL TANK

OIL PIPING DIAGRAM
NOT TO SCALE

MANHOLE WALL SEE DETAIL WATERPROOFING
2" NIPPLE
3½"x2" REDUCER
FLEXIBLE TUBING SHALL BE ORDERED APPROX. CORRECT LENGTH
TANK
BACKBOARD PAINTED BLACK LIQUIDOMETER GAUGES ABOVE FIN. FLOOR
TERMINATE 3" CONDUIT AT BOTTOM OF BACKBOARD WHEN RUN IS THRU FLOOR
WATERPROOFING

DETAIL OF LIQUIDOMETER GAUGE CONNECTIONS
NOT TO SCALE

10" MANHOLE WITH BRASS MARKER (WASTE OIL)
GRANULAR FILL
CONCRETE
IRON MANHOLE FILL BOX & FITTING
ATTACHED BRASS METAL TAG TO INNER CAP
FINISH PAVING
INDICATE TANK REQUIRED
12"x12"x6" THICK CONCRETE PAD
COMPACTED EARTH

DETAIL OF MANHOLE WITH FILL CAP
NOT TO SCALE

NE
NW
SW
SE

BUILDING KEY PLAN

VENT CAP ABOVE ROOF
2" OFFSET LINE TO CLEAR ROOF PARRAPET
RUN LINE EXPOSED ON INSIDE FACE OF BUILDING WALL
10" MANHOLE W/FILL CAP
32" ANODE
¾" TO SYSTEM
1000 GALLON STAINLESS STEEL TANK.
PRESSURE GUAGE
PRESSURE SWITCH
FOOT VALVE (2" FROM BOTTOM)
32" ANODE
30 GALLON STAINLESS STEEL PRESSURE TANK
CHECK VALVE
10 G.P.M. DISTILLED WATER PUMP MOUNTED ON 4" HIGH REINFORCED CONCRETE PAD

DISTILLED WATER PIPING DIAGRAM
NOT TO SCALE

VENT CAP ABOVE ROOF
OFFSET LINE TO CLEAR ROOF PARRAPET
RUN LINE EXPOSED ON INSIDE FACE OF BUILDING WALL
10" MANHOLE WITH FILL CAP AND ADAPTOR
32" ANODE
VALVE & CAP LINE 6" ABOVE TABLE
560 GALLON FRESH WATER TANK
FOOT VALVE (2" FROM BOTTOM)
32" ANODE

FRESH WATER PIPING DIAGRAM
NOT TO SCALE

VENT CAP ABOVE ROOF
OFFSET LINES TO CLEAR ROOF PARRAPET
RUN LINES EXPOSED ON INSIDE FACE OF BUILDING WALL
10" MANHOLE WITH BRASS MARKER (WASTE OIL)
VENT CAPS ABOVE ROOF
32" ANODE
SEE FIRST LEVEL PLAN NE-1 DRAWING NO. 5058474 FOR CONTINUATION
FLOW CONTROL FITTING
560 GALLON WASTE OIL STORAGE TANK W/U.L. LABEL
200 G.P.M. OIL INTERCEPTOR W/ EXTENSION
SEE FIRST LEVEL PLAN NE-DRAWING NO. 5058474 FOR CONTINUATION

PIPING DIAGRAM FOR OIL INTERCEPTOR
NOT TO SCALE

BUS BAR SECURED TO 2" PIPE WITH COPPER CLAD U-BOLT
UNION ELBOW
DOUBLE TRAP BUSHING
2" COUPLING
2" PIPE
WELD FLANGE AT TANK
SUCTION PIPE
¾" FOOT VALVE 2" ABOVE BOTTOM

DETAIL OF SUCTION STUB ASSEMBLY
NOT TO SCALE

VENT CAPS ABOVE ROOF
CHECK VALVES
VALVE & CAP LINES 6" ABOVE TABLE
32# ANODE
32# ANODE
32# ANODE CHECK VALVES
SIGHT GLASS
32# ANODE
500 GALLON CLEAN FREON STORAGE TANKS
VALVE & CAP LINES 6" ABOVE FINISHED FLOOR
VALVE & CAP LINES 4'-0" ABOVE GROUND
VALVE & CAP LINES 4'-0" ABOVE FINISHED FLOOR
1000 GALLON CONTAMINATED FREON STORAGE TANK

▽ FREON RECLAIMING SYSTEM
N.T.S.

▽BUILD MANHOLE 1" ABOVE FINISH GRADE
FRAME WITH NON-ROCKING LID FEATURE & LOCKING DEVICE
PAVING
24" DIA. PRECAST CONCRETE PIPE GRANULAR FILL SEE DETAIL ON NAVFAC DRAWING NO. 5058397
INSTALL ROOFING FELT BETWEEN MANHOLE & TANK
STORAGE TANK
▽ACCESS AND GAUGES THRU THE WALL
SEE DETAILS FOR SIZE
3'-0"

STORAGE TANK MANHOLE DETAIL (OVER LIQUIDOMETER GAUGE CONNECTION)
NOT TO SCALE

GRAPHIC SCALES:
1/8"=1'-0" 0' 5' 10' 15'

16-3-83

STATE OF KENTUCKY — E.R. RONALD JR. — 4615 — REGISTERED PROFESSIONAL ENGINEER
ARCH. & ENGR. SEAL

YOSH NAKAZAWA AND ASSOC., INC.
ARCHITECT-ENGINEER
806 DAVIS STREET
EVANSTON, ILLINOIS 60201
AREA CODE 312-492-5810

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
SOUTHERN DIVISION
CHARLESTON, S. C.

DSGN HELLER DR STANFIELD CHK HILLERICH
SUPV Heller CH ENGR Hillerich
SUBMITTED BY E. R. Ronald Jr. DATE 7/23/79
FIRM MEMBER (TITLE)
SOUTHERN DIV—DESIGN DIVISION
PDE Reed DIR
APPROVED DATE
OFFICER IN CHARGE
APPROVED C.T. Pizzano 8-9-79 DATE
EFD FOR COMMANDER, NAVFAC

U.S. NAVAL SHIPYARD CHARLESTON, S.C.
PIPE SHOP
PLUMBING DETAILS

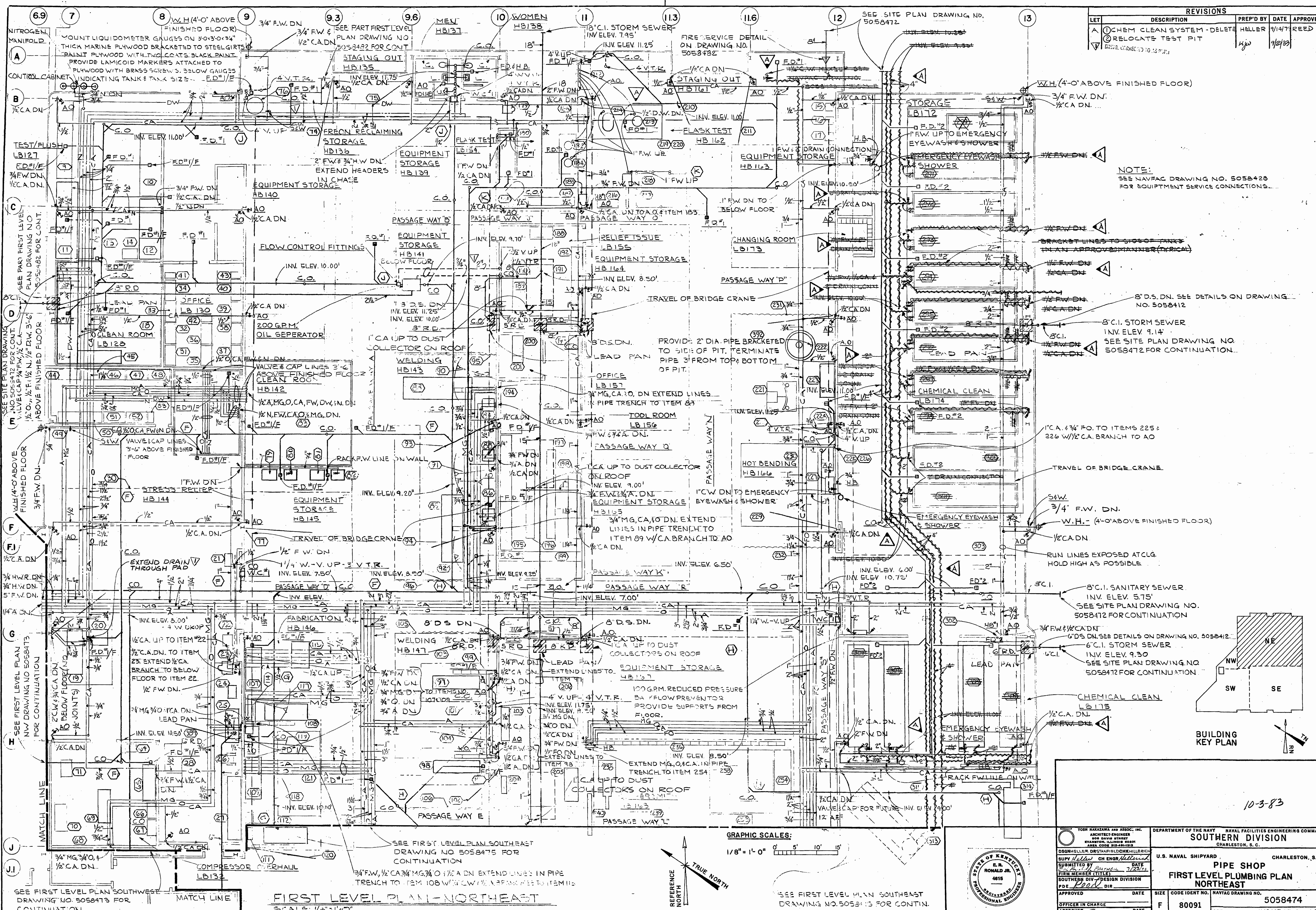
SIZE	CODE IDENT NO.	NAVFAC DRAWING NO.
F	80091	5058483

CONSTR CONTR NO. N62467-77-C-0061
SCALE AS NOTED SPEC 06-77-0061 SHEET 95 OF 129

SOUTHNAVFACENGCOMM 11012-13 (REV. 4/78)

REVISIONS

LET	DESCRIPTION	PREP'D BY	DATE	APPROVED
A	(1) CHEM CLEAN SYSTEM - DELETE (2) RELOCATE TEST PIT	HELLER	9/14/79	REED
▽1	DRWG. CORRECTED TO AS BUILT	Kjw	9/20/83	



FIRST LEVEL PLAN - NORTHEAST
SCALE: 1/8"=1'-0"

10-3-83

ARCH. & ENGR. SEAL
STATE OF KENTUCKY E. R. RONALD JR. 4615 REGISTERED PROFESSIONAL ENGINEER

YOSH NAKAZAWA AND ASSOC., INC.
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DSGN HELLER DR STANFIELD CHK HILLERICH
SUPV Heller CH ENGR Hillerich
SUBMITTED BY [signature] PARTNER DATE 7/23/79
FIRM MEMBER (TITLE)
SOUTHERN DIV - DESIGN DIVISION
PDE Reed DIR
APPROVED DATE
OFFICER IN CHARGE
APPROVED C.T. Paysinger DATE 8-9-79
EFD FOR COMMANDER, NAVFAC

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
SOUTHERN DIVISION
CHARLESTON, S. C.

U.S. NAVAL SHIPYARD CHARLESTON, S.C.

PIPE SHOP
FIRST LEVEL PLUMBING PLAN NORTHEAST

SIZE	CODE IDENT NO.	NAVFAC DRAWING NO.
F	80091	5058474

CONSTR CONTR NO. N62467-77-C-0061
SCALE AS NOTED | SPEC 06-77-0061 | SHEET 86 OF 129

SOUTHNAVFACENGCOM 11013/12 (REV. 6/75)

Building 2505 OWS

Operation
Building 2505 is a vehicle maintenance and wash bay with grease pit. Building 2505 was constructed in 1960 with some minor improvements made in 1982 and 1989. The vehicle maintenance wash bay and grease pit were added in 1993. The area is equipped with a drainage system and collection sump pumped to an 800 gallon oil water separator. Waste oil from the separation process is stored in a 275 gallon AST. No other piping was routed to this tank.

Sample and Analysis
No investigation of this area has been done by the Petroleum program.

The IR program sampled this area as part of the SWMU 161 investigation. Soil samples were taken in and around the waste oil tanks. Representative samples were analyzed for VOC, SVOC, metals, cyanide, pesticides, and PCBs and reported at DQO Level III. No exceedances were noted in surface soil samples . A monitoring well is installed adjacent to the OWS approximately 5' on the upgradient side had two exceedances of aluminum in four quarters of sampling.

Recommendations
Because of the function of the tank was to receive wastes from the vehicle maintenance facility it is likely that both petroleum constituents and solvents were discharged to the OWS. The current site assessment has failed to identify any soil and groundwater contamination near the waste oil tank. Based on the characterization accomplished to date, the Navy does not recommend additional sampling and analysis. This site is contained within an area that defined as SWMU 161 of the Zone K RFI . Any further assessment and remediation should be undertaken concurrent with that planned for the SWMU 161..

10.0 SITE-SPECIFIC EVALUATIONS

10.1 SWMU 161, Vehicle Maintenance Shop, Naval Annex

SWMU 161 consists of a gravel parking lot, a vehicle maintenance and wash bay with grease pit, and Building 2505 (Figure 10.1.1). Building 2505 was constructed in 1960; some minor improvements were made in 1982 and 1989. The vehicle maintenance and wash bay and grease pit were added in 1993. This area is equipped with a drainage system and collection sump pumped to an 800- gallon oil-water separation unit. Waste oil from the separation process is stored in a 275 gallon AST. The Marine Corps has used the facility as a vehicle maintenance shop since the Navy took possession of the building from the Air Force in 1981. It is probable that the Air Force used the facility in a similar manner.

The gravel parking area adjacent to the south side of building is periodically occupied by heavy equipment such as backhoes and trucks. The parking area is stained with oil in places. Waste oil from the oil-water separation process was stored in fifteen 55-gallon drums on pallets during the Phase I site assessment.

According to the SWMU 161 RFA report water from the oil-water separator is discharged into the Naval Annex storm sewer. Based on a records review, it was determined that water from the separator discharges to the sanitary sewer system. Before the wash bay roof was constructed, the oil-water separator's contents would have overflowed into the storm water drainage system during heavy precipitation. The site's CSI status is justified by evidence of past releases to the storm water drainage system, the presence of the oil-water separator and associated sump and tank, the use of solvents to clean automotive parts, along with the presence of stained gravel/soil in the parking area.

Materials of concern identified in the approved final RFI work plan for SWMU 161 were solvents, metals, and petroleum products. Potential receptors are current and future site users involved in invasive activities.

To fulfill CSI objectives and confirm the presence of any contamination from onsite activities, soil and groundwater were sampled in accordance with the approved final RFI work plan and Section 3 of this report.

10.1.1 Soil Sampling and Analysis

Soil was sampled in one event at SWMU 161 from the locations shown on Figure 10.1.1. The final RFI work plan proposed collection of eight soil samples from the upper-interval (0 to 1 foot) and eight for the lower-interval (3 to 5 feet) for the SWMU 161 investigation area. All proposed samples were collected. First-round samples were submitted for analysis at DQO Level III for VOCs, SVOCs, metals, pesticides, PCBs, TPH, and cyanide. One duplicate was collected from boring 161SB02's lower-interval and submitted for Appendix IX analyses at DQO Level IV. Table 10.1.1 summarizes soil sampling for SWMU 161.

Table 10.1.1
SWMU 161
Soil Sampling Summary

Sampling Round	Sampling Date	Samples Collected	Sample Analyses	Comments
1	11/20/96	Upper - 8(8)	Standard Suite, TPH	
		Lower - 8(8)	Standard Suite, TPH	
		Duplicate - 1	Appendix IX, TPH	

Note:
( ) = Parentheses indicate number of samples proposed in the RFI Work Plan.
Standard Suite = VOCs, SVOCs, metals, cyanide, pesticides and PCBs at DQO Level III.
Appendix IX = Standard Suite, plus hex-chrome, dioxins, herbicides, and OP pesticides at DQO Level IV.

10.1.2 Nature and Extent of Contamination in Soil

Organic compound analytical results for soil are summarized in Table 10.1.2. Inorganic analytical results are summarized in Table 10.1.3. Table 10.1.4 summarizes all analytes detected in soil at SWMU 161. Analyte concentrations which exceeded their screening concentrations (the applicable residential soil RBC or SSL and, when available, the associated background concentration) are listed in bold type. Appendix F is a complete analytical data report for all samples collected in Zone K, including SWMU 161.

Table 10.1.2
SWMU 161
Organics Detected In Soil (µg/kg)

Parameter	Sample Interval	Detection	Detection Range	Mean	RBC (upper) SSL (lower)	Number of Samples Exceeding RBCs or SSL
Volatile Organic Compounds (16 Samples collected, 8upper-interval, 8 lower-interval, 1 lower-interval sample duplicated)						
Acetone	Upper	0/8	ND	ND	780,000	0
	Lower	2/8	7.0-8.0	7.5	8,000	0
1,2 Dichloroethane	Upper	0/8	ND	ND	7,000	0
	Lower	1/8	4 00	4.00	10	0
Semivolatile Organic Compounds (16 samples collected, 8 upper-interval, 8 lower-interval, 1 lower-interval sample duplicated)						
Di-n-butylphthalate	Upper	0/8	ND	ND	780,000	0
	Lower	1/8	100	100	2,300,000	0
Pesticides/PCBs (16 samples collected, 8 upper-interval, 8 lower-interval, 1 lower-interval sample duplicated)						
4,4' - DDE	Upper	3/8	4.30 - 6.83	5.55	1,900	0
	Lower	0/8	ND	ND	27,000	0
4,4 - DDT	Upper	2/8	10.80 - 13.50	12.15	1,900	0
	Lower	0/8	ND	ND	16,000	0
Total Petroleum Hydrocarbons - Diesel Range Organics (mg/kg) (16 Samples collected, 8 upper-interval, 8 lower-interval, 1 lower-interval sample duplicated)						
TPH-DRO	Upper	2/8	11.8 - 314	162.9	100[a]	1
	Lower	2/8	8.3 - 11	9.65	100[a]	0
Dioxin (ng/kg) (1 lower-interval duplicate sample)						
TCDD TEQ	Upper	0/0	NA	NA	4.3	NA
	Lower	1/1	.4637	.4637	1.600	0

Notes:

a	=	Charleston Naval Complex project screening level.
µg/kg	=	Micrograms per kilogram
ng/kg	=	Nanograms per kilogram
NA	=	Not applicable/not available/not analyzed
ND	=	Not detected/not determined

Table 10.1.3
SWMU 161
Inorganics Detected In Soil (mg/kg)

Parameter	Sample Intervalal	Detection Frequency	Detection Range	Mean	Background Concentration	RBC (upper) SSL (lower)	Number of Samples Exceeding: RBC & Background (upper) or SSL & Background (lower)
Inorganics							
16 Samples Collected; 8 Upper-interval, 8 Lower-interval, and One Lower-interval Duplicate							
Aluminum	Upper	8/8	5130 - 6630	5,963	11,200	7800	0
	Lower	8/8	2750 - 5470	4,134	10,500	560,000	0
Arsenic	Upper	8/8	0.69 - 1.9	1.0	3.00	0.43[a]	0
	Lower	4/8	0 41 - 0.73	0.56	1.98	15	0
Barium	Upper	8/8	5.5 - 16.8	10.0	25.6	550	0
	Lower	8/8	1.8 - 7.5	3.3	6.83	820	0
Beryllium	Upper	6/8	0.03 - 0.07	0.05	0.17	16	0
	Lower	1/8	0.03	0.03	0.12	32	0
Cadmium	Upper	1/8	0.11	0 11	0.13	3.9	0
	Lower	0/8	ND	ND	**	4	0
Calcium	Upper	8/8	2490 - 67400	16,719	NA	NL	NA
	Lower	8/8	64.8 - 22700	3,742	NA	NL	NA
Chromium	Upper	8/8	3.5 - 5.6	4.6	8.4	23	0
	Lower	8/8	3.1 - 4.7	3.8	8.76	19	0
Cobalt	Upper	4/8	0.17 - 1.5	0.6	0.34	470	0
	Lower	7/8	0.17 - 0.42	0.31	0.62	990	0
Copper	Upper	7/8	0.27 - 1.5	0.9	3.86	310	0
	Lower	7/8	0.23 - 0 88	0.41	0.34	5,600	0
Iron	Upper	8/8	2470 - 3250	2,864	7060	2300	0
	Lower	8/8	421 - 1710	990	5130	NL	0
Lead[b]	Upper	8/8	2.6 - 19.5	8.6	39.6	400[b]	0
	Lower	8/8	2 - 10	3	6.43	400[b]	0
Magnesium	Upper	8/8	111 - 1220	381	NA	NL	NA
	Lower	8/8	23.5 - 519	124	NA	NL	NA
Manganese	Upper	8/8	5.6 - 58.4	18.5	26.4	160	0
	Lower	8/8	3.2 - 25.6	6.6	5.93	480	0
Mercury	Upper	1/8	0.15	0.15	**	2.3	0
	Lower	0/8	ND	ND	**	1.0	0

Table 10.1.3
SWMU 161
Inorganics Detected In Soil (mg/kg)

Parameter	Sample Intervalal	Detection Frequency	Detection Range	Mean	Background Concentration	RBC (upper) SSL (lower)	Number of Samples Exceeding: RBC & Background (upper) or SSL & Background (lower)
Nickel	Upper	8/8	1.3 - 3.6	2.2	1.70	160	0
	Lower	8/8	0.81 - 2.7	1.9	2.64	65	0
Potassium	Upper	8/8	33.3 - 246	94	NA	NL	NA
	Lower	8/8	17.2 - 100	42	NA	NL	NA
Selenium	Upper	1/8	0.44	0.44	0.84	39	0
	Lower	0/8	ND	NA	0.52	2.60	0
Silver	Upper	1/8	0.25	0.25	0.44	39	0
	Lower	0/8	ND	ND	0.42	17	0
Sodium	Upper	8/8	18.2 - 58.5	30.4	NA	NL	NA
	Lower	8/8	12.7 - 36	22	NA	NL	NA
Vanadium	Upper	8/8	6.6 - 8.4	7.6	15.8	55	0
	Lower	8/8	2.2 - 7.6	4.4	12.2	3,000	0
Zinc	Upper	1/8	5	5	14.8	2,300	0
	Lower	0/8	ND	ND	**	6,200	0

Notes:
a = RBC for arsenic as a carcinogen.
b = RBC not available for lead. USEPA residential soil cleanup level used for comparison (OSWER Directive 9355 4-12).
** = Number of nondetects prevented determination of reference concentration.
NA = Not applicable/not available/not analyzed
ND = Not detected/not determined
NL = Not listed
mg/kg = Milligrams per kilogram

Table 10.1.4
SWMU 161
Analytes Detected in Surface and Subsurface Soil

Parameter	Location	Surface Conc.	Residential RBC (THQ=0.1)	Surface Background	Subsurface Conc.	Soil-to-Groundwater SSL (DAF=10)	Subsurface Background
Volatile Organic Compounds (µg/kg)							
1,2-Dichloroethane	161SB004	ND	7,000	NA	4	10	NA
Acetone	161SB002	ND	780,000	NA	8	8,000	NA
	161SB006	ND			7		
Semivolatile Organic Compounds (µg/kg)							
Di-n-butylphthalate	161SB005	ND	780,000	NA	100	2,300,000	NA
Pesticides/PCBs (µg/kg)							
4,4-DDE	161SB005	4.3	1,900	NA	ND	27,000	NA
	161SB006	6.83			ND		
	161SB008	5.51			ND		
4,4-DDT	161SB006	10.8	1,900	NA	ND	16,000	NA
	161SB008	13.5			ND		
Dioxin Compounds (ng/kg)							
TCDD TEQ	161SB002	NT	4 3	NA	0	1,600	NA
1234678-HpCDD	161SB002	NT	430	NA	4.97	110,000	NA
OCDD	161SB002	NT	4,300	NA	414	1,100,000	NA
TPH-DRO (mg/kg)							
Diesel	161SB005	ND	100	NA	8.3	100	NA
	161SB006	11.8			11		
	161SB007	314			ND		

3-26

Table 10.1.4
SWMU 161
Analytes Detected in Surface and Subsurface Soil

Parameter	Location	Surface Conc.	Residential RBC (THQ=0.1)	Surface Background	Subsurface Conc.	Soil-to-Groundwater SSL (DAF=10)	Subsurface Background
Inorganics (mg/kg)							
Aluminum (Al)	161SB001	6,220	7,800	11,200	2,800	560,000	10,500
	161SB002	6,000			3,830		
	161SB003	5,450			5,470		
	161SB004	6,630			4,550		
	161SB005	5,970			2,750		
	161SB006	5,130			4,680		
	161SB007	6,460			4,050		
	161SB008	5,840			4,940		
Arsenic (As)	161SB001	0.85	0.43*	3	ND	15.0	1.98
	161SB002	0.69			0.6		
	161SB003	0.7			0.5		
	161SB004	1			ND		
	161SB005	0.94			ND		
	161SB006	1.1			ND		
	161SB007	1.1			0.41		
	161SB008	1.9			0.73		
Barium (Ba)	161SB001	10.5	550	25.6	1.8	820	6.83
	161SB002	8			2.2		
	161SB003	5.5			2 6		
	161SB004	9.2			3.4		
	161SB005	13.7			1.8		
	161SB006	16.8			4.5		
	161SB007	7.2			2.5		
	161SB008	9.1			7.5		

Table 10.1.4
SWMU 161
Analytes Detected in Surface and Subsurface Soil

Parameter	Location	Surface Conc.	Residential RBC (THQ=0.1)	Surface Background	Subsurface Conc.	Soil-to-Groundwater SSL (DAF=10)	Subsurface Background
Beryllium (Be)	161SB001	0.04	16	0.17	ND	32	0.12
	161SB004	0.06			ND		
	161SB005	0.07			ND		
	161SB006	0.03			ND		
	161SB007	0.04			ND		
	161SB008	0.07			0.03		
Cadmium (Cd)	161SB008	0.11	3.9	0.13	ND	4	NA
Calcium (Ca)	161SB001	2,490	NL	NA	64.8	NL	NA
	161SB002	7,770			2,030		
	161SB003	2,860			2,620		
	161SB004	9,390			772		
	161SB005	31,000			755		
	161SB006	2,990			384		
	161SB007	9,850			614		
	161SB008	67,400			22,700		
Chromium (Cr)	161SB001	4.7	23	8.4	3.7	19	8 76
	161SB002	4			3 2		
	161SB003	4 3			3.7		
	161SB004	5			3.6		
	161SB005	4.5			3.1		
	161SB006	3.5			4.4		
	161SB007	4 8			4		
	161SB008	5.6			4.7		

Table 10.1.4
SWMU 161
Analytes Detected in Surface and Subsurface Soil

Parameter	Location	Surface Conc.	Residential RBC (THQ=0.1)	Surface Background	Subsurface Conc.	Soil-to-Groundwater SSL (DAF=10)	Subsurface Background
Cobalt (Co)	161SB001	1.5	470	0.34	0.42	990	0.62
	161SB002	ND			0.17		
	161SB003	ND			0.25		
	161SB004	0.18			0.4		
	161SB005	0.17			ND		
	161SB006	ND			0.22		
	161SB007	ND			0.42		
	161SB008	0.51			0.28		
Copper (Cu)	161SB001	0.94	310	3.86	0.28	5600	0 34
	161SB002	0.27			0.33		
	161SB003	ND			0.35		
	161SB004	0.5			0.23		
	161SB005	0.92			0.56		
	161SB006	1.3			ND		
	161SB007	0.68			0.27		
	161SB008	1.5			0.88		
Iron (Fe)	161SB001	2,830	2,300	7060	467	NA	5130
	161SB002	2,650			666		
	161SB003	2,470			739		
	161SB004	3,090			1,480		
	161SB005	2,890			421		
	161SB006	2,960			1,610		
	161SB007	3,250			828		
	161SB008	2,770			1,710		

Table 10.1.4
SWMU 161
Analytes Detected in Surface and Subsurface Soil

Parameter	Location	Surface Conc.	Residential RBC (THQ=0.1)	Surface Background	Subsurface Conc.	Soil-to-Groundwater SSL (DAF=10)	Subsurface Background
Lead (Pb)	161SB001	5.8	400[b]	39.6	2.9	400[b]	6.43
	161SB002	4.1			2		
	161SB003	2.6			2.3		
	161SB004	6.2			2.5		
	161SB005	14.1			2.3		
	161SB006	19.5			3		
	161SB007	4			2.5		
	161SB008	12.3			10		
Magnesium (Mg)	161SB001	196	NL	NA	23.5	NL	NA
	161SB002	219			62.5		
	161SB003	111			66.1		
	161SB004	309			89.3		
	161SB005	517			67.2		
	161SB006	171			95.9		
	161SB007	304			68.5		
	161SB008	1,220			519		
Manganese (Mn)	161SB001	10.1	160	26.4	3.8	480	5.93
	161SB002	10.6			3.2		
	161SB003	5.6			3.5		
	161SB004	14			3.8		
	161SB005	29.5			3.3		
	161SB006	7.4			5.7		
	161SB007	12.2			3.7		
	161SB008	58.4			25.6		
Mercury (Hg)	161SB003	0.15	2.3	NA	ND	1	NA

Table 10.1.4
SWMU 161
Analytes Detected in Surface and Subsurface Soil

Parameter	Location	Surface Conc.	Residential RBC (THQ=0.1)	Surface Background	Subsurface Conc.	Soil-to-Groundwater SSL (DAF=10)	Subsurface Background
Nickel (Ni)	161SB001	2.7	160	1.7	0.81	65	2.64
	161SB002	1.7			1.4		
	161SB003	1.3			2.5		
	161SB004	2.2			2.7		
	161SB005	2.6			0.89		
	161SB006	1.4			2.3		
	161SB007	2			2.2		
	161SB008	3.6			2.4		
Potassium (K)	161SB001	95.8	NL	NA	17.2	NL	NA
	161SB002	60			23.4		
	161SB003	33 3			29.6		
	161SB004	73.9			49.6		
	161SB005	124			31.3		
	161SB006	43.4			39.7		
	161SB007	77.1			42.1		
	161SB008	246			100		
Selenium (Se)	161SB006	0 44	39	0.84	ND	2.6	0.52
Silver (Ag)	161SB004	0.25	39	0.44	ND	17.0	0.42
Sodium (Na)	161SB001	27 5	NL	NA	12.7	NL	NA
	161SB002	27.9			13.3		
	161SB003	25.5			25 2		
	161SB004	27.3			22 3		
	161SB005	29.4			15.1		
	161SB006	18.2			27.1		
	161SB007	29.1			20.6		
	161SB008	58.5			36		

Table 10.1.4
SWMU 161
Analytes Detected in Surface and Subsurface Soil

Parameter	Location	Surface Conc.	Residential RBC (THQ=0.1)	Surface Background	Subsurface Conc.	Soil-to-Groundwater SSL (DAF=10)	Subsurface Background
Vanadium (V)	161SB001	7.7	55	15.8	2.9	3,000	12.2
	161SB002	7			2.9		
	161SB003	6.6			3.6		
	161SB004	8.4			6		
	161SB005	7.7			2.2		
	161SB006	7.5			7.6		
	161SB007	8			4.3		
	161SB008	7.7			6.1		
Zinc (Zn)	161SB001	5	2300	14.8	ND	6,200	NA

Notes:
Bold concentrations exceed the RBCs, SSL, and the zone background
All background values for Zone K are based on twice the means of the grid sample concentrations.

DAF = Dilution attenuation factor
NA = Not applicable/not available
ND = Not detected/not determined
NT = Not taken
RBC = Risk-based concentration
SSL = Soil screening level
THQ = Target hazard quotient
µg/kg = Micrograms per kilogram
mg/kg = Milligrams per kilogram
ng/kg = Nanograms per kilogram

Volatile Organic Compounds in Soil

Two VOCs (acetone and 1,2-dichloroethane) were detected in soil samples collected at SWMU 161. Neither one exceeded its RBC screening concentration. All VOC detections were in lower-interval soil samples.

Semivolatile Organic Compounds in Soil

One SVOC (di-n-butylphthalate) was detected in a lower-interval soil sample collected at SWMU 161. No SVOCs were detected in the upper-interval soil samples. The concentration of di-n-butylphthalate was four orders of magnitude less than its RBC.

Pesticides/PCBs in Soil

Two pesticides (4,4'-DDE and 4,4'-DDT) were detected in upper- interval soil samples at SWMU 161. No pesticides were detected in the lower-interval soil samples. All pesticide concentrations were below their RBC screening concentrations.

No PCBs were detected in the SWMU 161 soil samples.

Other Organic Compounds in Soil

TPH-Diesel Range Organics (DROs) were detected in two of eight upper-interval and two of eight lower-interval samples. One TPH-DRO concentraion, 314 mg/kg, which was collected from a surface soil sample location (161SB007) exceeded the CNC screening level (100 mg/kg). TPH-DRO concentrations below the screening level were detected in the upper-interval and lower-interval samples at 161SB006 and the lower- interval sample at 161SB005.

Dioxin was detected in the one duplicate sample. The TCDD TEQ for the dioxin detection was several orders of magnitude below the RBC screening concentration.

Inorganics in Soil

Several inorganic analytes were detected in SWMU 161 soil samples. Arsenic and iron exceeded their RBCs. However, all arsenic and iron concentrations were below their respective surface and subsurface soil background concentrations.

10.1.3 Groundwater Sampling and Analysis

The final RFI work plan proposed the installation of one shallow monitoring well for SWMU 161. This well (NBCK161001) was installed adjacent to the oil-water separator in the northeastern corner of the property (Figure 10.1.1).

This monitoring well was developed in December 1996, and the first round of groundwater samples was collected from in January 1997 and analyzed for VOCs, SVOCs, metals, pesticides, PCBs, and TPH at DQO Level III. A duplicate sample was also collected from NBCK161001 and submitted for herbicide, dioxin, organophosphorus pesticide, and hexavalent chromium analyses, in addition to the standard suite of analyses.

Second-round groundwater for SWMU 161 was also analyzed for VOCs, SVOCs, metals, pesticides, PCBs, and TPH at DQO Level III. Second-round samples were collected by the CEERD in April 1997. Third-round and fourth-round samples were collected in July and October 1997, and analyzed for VOCs, SVOCs, metals, cyanide, pesticides, and PCBs. Duplicate samples were also collected from NBCK161001 during each of these rounds. Fifth-round samples were collected for dioxins and TSS to confirm the dioxin detection in the first-round duplicate sample. Filtered and unfiltered samples were analyzed to determine the potential effects of suspended solids on groundwater dioxin results. Table 10.1.5 summarizes groundwater sampling at SWMU 161.

Table 10.1.5
SWMU 161
Groundwater Sampling Summary

Sampling Round	Sampling Date	Wells Sampled	Sample Analyses	Comments
1	1/3/97	161001[a]	Standard Suite and TPH	
2	4/18/97	161001[b]	Standard Suite and TPH	
3	7/25/97	161001[b]	Standard Suite	
4	10/22/97	161001[b]	Standard Suite	
5	1/9/99	161001	Dioxins, TSS	Filtered and unfiltered samples taken for dioxins

Notes:
a = Duplicate sample collected and analyzed for Appendix IX parameters and TPH.
b = Duplicate sample collected and analyzed for same parameters.
Standard suite = VOCs, SVOCs, metals, cyanide, pesticides, and PCBs, at DQO Level III.
Appendix IX = Standard Suite plus hex-chrome, dioxins, herbicides, and OP Pesticides at DQO Level IV.

The monitoring well was installed at 16 feet bgs in the water table aquifer. The well was installed as described in Section 3.3 of this report.

10.1.4 Nature and Extent of Contamination in Groundwater

Table 10.1.6 summarizes organic groundwater analytical results and Table 10.1.7 summarizes groundwater inorganic analytical results for SWMU 161. Table 10.1.8 summarizes all analytes detected in shallow groundwater at SWMU 161. Appendix F is a complete analytical data report for all samples collected in Zone K, including those collected at SWMU 161.

Table 10.1.6
SWMU 161
Organics Detected In Groundwater (pg/L)

Parameter	Sampling Round	Detection	Detection Range	Mean	Tap-water	Number of Samples Exceeding RBC or MCL
Dioxins						
TCDD TEQ	First	1/1	0.0069	NA	0.45/30	0
	Second	0/1	NA	NA	NA	
	Third	NA	NA	NA	NA	
	Fourth	NA	NA	NA	NA	
	Fifth	0/1	ND	NA	0	

Notes:
NA - Not applicable/not available/not analyzed
pg/L - Picograms per liter

Table 10.1.7
SWMU 161
Inorganics Detected In Groundwater (µg/L)

Parameter	Sampling Round	Detection Frequency	Detection Range	Mean	Tap-water RBC/ MCL	Shallow Groundwater Background	Number of Samples Exceeding Lower of RBC or MCL and background
Inorganics (1 Shallow groundwater sample collected during each event)							
Aluminum	First (Jan. 97)	1/1	540	540	3,700/50	471	1
	Second (April 97)	0/1	ND	ND			0
	Third ((July 97)	1/1	381	381			0
	Fourth (Oct. 97)	1/1	674	674			1
Barium	First (Dec. 95)	1/1	16.4	16.4	260/2,000	31.2	0
	Second (April 97)	1/1	17.5	17.5			0
	Third ((July 97)	1/1	14.15	14.15			0
	Fourth (Oct. 97)	1/1	13.75	13.75			0
Calcium	First (Dec. 95)	1/1	50,300	50,300	NL/NL	NA	NA
	Second (April 97)	1/1	30,800	30,800			NA
	Third ((July 97)	1/1	48,600	48,600			NA
	Fourth (Oct. 97)	1/1	45,750	45,750			NA
Copper	First (Dec. 95)	0/1	ND	ND	150/1,000	2.81	0
	Second (April 97)	0/1	ND	ND			0
	Third ((July 97)	1/1	1 7	1.7			0
	Fourth (Oct. 97)	0/1	ND	ND			0

Table 10.1.7
SWMU 161
Inorganics Detected In Groundwater (µg/L)

Parameter	Sampling Round	Detection Frequency	Detection Range	Mean	Tap-water RBC/ MCL	Shallow Groundwater Background	Number of Samples Exceeding Lower of RBC or MCL and background
Inorganics (1 Shallow groundwater sample collected during each event)							
Iron	First (Dec. 95)	1/1	150	150	1,100/300	235	NA
	Second (April 97)	1/1	285	285			NA
	Third ((July 97)	1/1	38.45	38.45			NA
	Fourth (Oct. 97)	1/1	88.1	88.1			NA
Lead	First (Dec. 95)	0/1	ND	ND	NL/15	1.94	0
	Second (April 97)	0/1	ND	ND			0
	Third ((July 97)	1/1	2.1	2.1			0
	Fourth (Oct. 97)	0/1	ND	ND			0
Magnesium	First (Dec. 95)	1/1	806	806	NL/NL	NA	NA
	Second (April 97)	1/1	1,730	1,730			NA
	Third ((July 97)	1/1	820.5	820.5			NA
	Fourth (Oct. 97)	1/1	685	685			NA
Manganese	First (Dec. 95)	1/1	6.9	6.9	73/50	9.33	0
	Second (April 97)	0/1	ND	ND			0
	Third ((July 97)	1/1	1.1	1.1			0
	Fourth (Oct. 97)	0/1	ND	ND			0
Potassium	First (Dec. 95)	1/1	985	985	NL/NL	NA	NA
	Second (April 97)	0/1	ND	ND			NA
	Third ((July 97)	1/1	447.5	447.5			NA
	Fourth (Oct. 97)	1/1	650.5	650.5			NA
Silver	First (Dec. 95)	1/1	1.6	1.6	18/100	NA	NA
	Second (April 97)	0/1	ND	ND			NA
	Third ((July 97)	0/1	ND	ND			NA
	Fourth (Oct. 97)	0/1	ND	ND			NA
Sodium	First (Dec. 95)	1/1	2,185	2,185	NL/NL	NA	NA
	Second (April 97)	0/1	ND	ND			NA
	Third ((July 97)	1/1	3,380	3,380			NA
	Fourth (Oct. 97)	0/1	ND	ND			NA
Zinc	First (Dec. 95)	0/1	ND	ND	1,100/5,000	NA	NA
	Second (April 97)	0/1	ND	ND			NA
	Third ((July 97)	1/1	26.75	26.75			NA
	Fourth (Oct. 97)	0/1	ND	ND			NA

Notes:
NA = Not applicable/not available/not analyzed
NL = Not Listed
ND = Not detected/not determined
µg/L = Micrograms per liter

Table 10.1.8
SWMU 161
Analytes Detected in Shallow Groundwater

Parameter	Location	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Tap-water RBC/MCL	Shallow Background
Inorganics (µg/L) (1 Shallow groundwater sample collected during each event)							
Aluminum	161001	539.5	ND	381	673.5	3,700/50	471
Barium	161001	16.35	17.5	14.15	13.75	260/2,000	31.2
Calcium	161001	50,300	30,800	48,600	45,750	NA	NL/NL
Copper	161001	ND	ND	1.7	ND	150/1,000	2.81
Iron	161001	149.5	285	38.45	88.1	1,100/300	235
Lead	161001	ND	ND	2.1	ND	NL/15	1.94
Magnesium	161001	806	1,730	820.5	685	NA	NL/NL
Manganese	161001	6.85	ND	1.1	ND	73/50	9.33
Potassium	161001	984.5	ND	447.5	650.5	NL/NL	NA
Silver	161001	1.55	ND	ND	ND	18/100	NA
Sodium	161001	2,185	ND	3,380	ND	NL/NL	NA
Zinc	161001	ND	ND	26.75	ND	1,100/5,000	NA
Dioxins (pg/L)							
OCDD	161001	6.9	ND	ND	ND	450/NL	NA

Notes:
µg/L = Micrograms per liter
pg/L = Picograms per liter
NA = Not applicable/not available/not analyzed
ND = Not detected/not determined
NL = Not listed

Volatile Organic Compounds in Groundwater

No VOCs were detected in groundwater samples collected at SWMU 161.

Semivolatile Organic Compounds in Groundwater

No SVOCs were detected in groundwater samples collected at SWMU 161.

Pesticides/PCBs in Groundwater

No pesticides or PCBs were detected in the groundwater sample collected at SWMU 161.

Other Organic Compounds in Groundwater

No herbicides, organophosphorus pesticides, or TPH concentrations were detected in the groundwater samples collected at SWMU 161. One dioxin congener(OCDD) was detected in the first-round groundwater sample at a concentration of 6.9 pg/L. The TEQ calculated for this location was 0.0069 pg/L

Inorganics in Groundwater

Several inorganics were detected in each of the four rounds of SWMU 161 groundwater samples. Only aluminum exceeded its SMCL and background concentrations. Aluminum concentrations ranged from 381 to 673 μg/L. However, all inorganic detections were below the applicable RBCs during all groundwater sampling rounds.

10.1.5 Fate and Transport Assessment for SWMU 161

Environmental media sampled as part of the SWMU 161 RFI are surface soil, subsurface soil, and shallow groundwater. Potential constituent migration pathways investigated for SWMU 161 are soil-to-groundwater, groundwater-to-surface-water, and emission of volatiles from surface soil-to-air.

10.1.5.1 SWMU 161 Soil to Groundwater Cross-Media Transport

Tables 10.1.9 and 10.1.10 compare maximum detected organic and inorganic constituent concentrations in surface soil and subsurface soil samples to risk-based soil screening levels considered protective of groundwater. To provide a conservative screen, generic soil screening levels are used; leachate entering the aquifer is assumed to be diluted by a ratio of 10:1, with no attenuation of constituents in soil (DAF=10).

Table 10.1.9
Organic Compounds Detected in Surface Soil, Subsurface Soil, and Shallow Groundwater
Comparison to Soil to Groundwater SSLs, Tap Water RBCs, and Soil to Air SSLs
Charleston Naval Complex, Zone K, Naval Annex: SWMU 161
Charleston, South Carolina

Parameter	Maximum Concentration			Screening Concentration *							
	Surface Soil	Subsurfac Soil	Shallow GW	Soil to GW SSL	Tap Water RBC	Soil to Air SSL	Soil Units	Water Units	Leaching Potential	Ground-Water Migration Concern	Volatil-ization Potential
Volatile Organic Compounds											
Acetone	ND	8	ND	8000	3700	1E+08	UG/KG	UG/L	NO	NO	NO
1,2-Dichloroethane (EDC) c	ND	4	ND	10	0 12	400	UG/KG	UG/L	NO	NO	NO
Semivolatile Organic Compounds											
Di-n-butylphthalate	ND	100	ND	2300000	3700	2300000	UG/KG	UG/L	NO	NO	NO
Pesticides/PCB Compounds											
4,4'-DDE c	6 83	ND	ND	27000	0.2	NA	UG/KG	UG/L	NO	NO	NO
4,4'-DDT c	13 5	ND	ND	16000	0.2	1 0E+09	UG/KG	UG/L	NO	NO	NO
Dioxin Compounds											
2378-TCDD Equivalents (TEQs)	NA	0 464	0 0069	1600 a	0 45	NA	NG/KG	PG/L	NO	NO	NO
1234678-HpCDD c	NA	4.97	ND	110000 a	45	NA	NG/KG	PG/L	NO	NO	NO
OCDD c	NA	414	6 9	1100000 a	450	NA	NG/KG	PG/L	NO	NO	NO
TPH - Diesel Range Organics											
Diesel	314000	11000	ND	NA	NA	NA	UG/KG	UG/L	NO	NO	NO

Notes
Sources of screening concentrations appear in Table 5.6
Explanations of fate and transport screening procedures appear in Section 6 2
Frequency and range of detections, average detected concentrations, and number of screening concentration exceedances appear in Tables 10 1.2 and 10 1 6

a - Calculated soil to groundwater SSL value (See Table 6 x)
b - Based on surrogate compound, see table 5.6
c - Carcinogen
NA - Not available/Not applicable
ND - Not detected
RBC - Risk-based concentration
SSL - Soil screening level
MG/KG - Milligrams per kilogram
NG/KG - Nanograms per kilogram
UG/KG - Micrograms per kilogram
PG/L - Picograms per liter
UG/L - Micrograms per liter

Table 10.1.10
Inorganic Chemicals Detected in Surface Soil, Subsurface Soil, and Shallow Groundwater
Comparison to Soil to Groundwater SSLs, Tap Water RBCs, Soil to Air SSLs, and Background Reference Values
Charleston Naval Complex, Zone K, Naval Annex: SWMU 161
Charleston, South Carolina

Parameter	Maximum Concentration			Screening Concentration									
	Surface Soil	Subsurface Soil	Shallow GW	Soil to GW SSL	Soil Background Reference	Soil to Air SSL	Tap Water RBC	GW Background Reference	Soil Units	Water Units	Leaching Potential	Ground-Water Migration Concern	Fugitive Particulate Inhalation Concern
Inorganics													
Aluminum	6630	5470	674	560000 a	11200	NA	37000	471	MG/KG	UG/L	NO	NO	NO
Arsenic c	1.9	0.73	ND	15	3	750	0.045	NA	MG/KG	UG/L	NO	NO	NO
Barium	16.8	7.5	17.5	820	25.6	690000	2600	31.2	MG/KG	UG/L	NO	NO	NO
Beryllium	0.07	0.03	ND	32	0.17	1300	73	NA	MG/KG	UG/L	NO	NO	NO
Cadmium	0.11	ND	ND	3.8	0.13	1800	18	NA	MG/KG	UG/L	NO	NO	NO
Chromium (total)	5.6	4.7	ND	19 b	8.76	270	110	NA	MG/KG	UG/L	NO	NO	NO
Cobalt	1.5	0.42	ND	990 a	0.62	NA	2200	NA	MG/KG	UG/L	NO	NO	NO
Copper	1.5	0.88	1.7	5600 a	3.86	NA	1500	2.8	MG/KG	UG/L	NO	NO	NO
Lead	19.5	10	2.1	400 d	39.6	400	15	1.9	MG/KG	UG/L	NO	NO	NO
Manganese	58.4	25.6	6.9	480 a	26.4	NA	730	9.3	MG/KG	UG/L	NO	NO	NO
Mercury	0.15	ND	ND	1	NA	10	11	NA	MG/KG	UG/L	NO	NO	NO
Nickel	3.6	2.7	ND	65	2.64	13000	730	NA	MG/KG	UG/L	NO	NO	NO
Selenium	0.44	ND	ND	2.6	0.84	NA	180	NA	MG/KG	UG/L	NO	NO	NO
Silver	0.25	ND	1.6	17	0.44	NA	180	NA	MG/KG	UG/L	NO	NO	NO
Vanadium	8.4	7.6	ND	3000	15.8	NA	260	0.8	MG/KG	UG/L	NO	NO	NO
Zinc	5	ND	26.8	6200	14.8	NA	11000	NA	MG/KG	UG/L	NO	NO	NO

Notes:
Sources of screening concentrations appear in Table 5.7
Explanations of fate and transport screening procedures appear in Section 6.2.
Frequency and range of detections, average detected concentrations, and number of screening concentration exceedances appear in Tables 10.1 3 and 10.1.7.

Background reference values for soil are shown for comparison purposes only.
Maximum groundwater concentrations are screened against the greater of tap water RBCs or corresponding background reference values to determine groundwater migra

a - Calculated soil to groundwater SSL value (See Table 6.4)
b - Assumes hexachrome
c - Carcinogen
d - USEPA de facto residential soil level
GW - Groundwater
NA - Not available/Not applicable
ND - Not detected
RBC - Risk-based concentration
SSL - Soil screening level
MG/KG - Milligrams per kilogram
UG/L - Micrograms per liter

No SWMU 161 soil organics or inorganics exceeded their groundwater protection SSLs. Therefore, this pathway is considered invalid at SWMU 161.

10.1.5.2 SWMU 161 Risk-based Groundwater Transport

Table 10.1.9 and 10.1.10 also compare maximum detected organic and inorganic concentrations in shallow groundwater samples to risk-based concentrations for drinking water. To provide a conservative screen, no attenuation or dilution of in groundwater is assumed before comparison to the relevant standards.

No organics or inorganics in SWMU 161 groundwater exceeded risk-based drinking water concentrations. As a result, this pathway is not considered valid at SWMU 161.

10.1.5.3 SWMU 161 Soil-to-Air Cross-Media Transport

Table 10.1.9 also compares VOCs detected in SWMU 161 surface soil samples to corresponding soil-to-air volatilization screening levels. No VOC exceeded its soil-to-air volatilization screening level. As a result, the soil-to-air migration pathway is not expected to be valid at SWMU 161.

10.1.5.4 SWMU 161 Fate and Transport Summary

No contaminant fate and transport concerns were identified at SWMU 161.

10.1.6 Human Health Risk Assessment for SWMU 161

10.1.6.1 Site Background and Investigative Approach

SWMU 161 is the location of a vehicle maintenance shop at the Naval Annex. Materials released or disposed at the SWMU, which consists of a vehicle wash bay and an oil-water separator, include, petroleum products, metals, and solvents.

During the RFI, eight soil samples were collected from the upper and lower-intervals to identify potential impacts from the activities listed above. Surface and subsurface soil samples were analyzed for VOCs, SVOCs, metals, cyanide, pesticides, PCBs, and TPH. Surface soil data were used to quantitatively assess soil pathways. One monitoring well was installed in the shallow aquifer and sampled for the same parameters as soil. Data from the four quarterly sampling events were used to quantitatively assess groundwater exposure pathways. Sections 10.1.1 and 10.1.3 summarize the sampling effort for SWMU 161 soil and groundwater.

10.1.6.2 COPC Identification

Soil

Based on the screening comparisons described in Section 7 of this RFI and presented in Table 10.1.11, no COPCs were identified in surface soil samples collected at SWMU 161. However, diesel range TPH was detected at a concentration exceeding 100 mg/kg in one surface soil sample at SWMU 161 (161SB007). Arsenic was detected in surface soil samples at concentrations exceeding its RBC, but lower than its background concentration. As a result, arsenic was eliminated as a COPC based on comparison to its background concentration. Wilcoxon rank sum test analysis did not result in the inclusion of any parameter that had been screened out on the basis of background concentration.

Groundwater

Based on the screening comparisons described in Section 7 of this RFI and presented in Table 10.1.12, no COPCs were identified in four quarters of groundwater samples collected at SWMU 161. Wilcoxon rank sum test analysis did not result in the inclusion of any parameter that had been screened out on the basis of background concentration.

Table 10.1.11
Chemicals Present in Site Samples
SWMU 161 - Surface Soil
Charleston Naval Complex, Zone K
Charleston, South Carolina

Parameter	Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration Residential RBC	Screening Concentration Reference	Units	Number Exceeding RBC	Number Exceeding Ref
TPH - Diesel Range Organics												
Diesel	2	8	11 8	314	162.9	2.61	2.75	100	NA	MG/KG		
Inorganics												
Aluminum (Al)	8	8	5130	6630	5963	NA	NA	7800	11200	MG/KG		
Arsenic (As)	8	8	0.69	1.9	1.04	NA	NA	0 43	3	MG/KG	8	
Barium (Ba)	8	8	5 5	16.8	10	NA	NA	550	25.6	MG/KG		
Beryllium (Be)	6	8	0.03	0.07	0 052	0.01	0 01	16	0.17	MG/KG		
Cadmium (Cd)	1	8	0.11	0.11	0.11	0.02	0.02	3.9	0.13	MG/KG		
Calcium (Ca)	8	8	2490	67400	16719	NA	NA	NA	NA	MG/KG		
Chromium (Cr)	8	8	3.5	5 6	4.55	NA	NA	23	8.4	MG/KG		
Cobalt (Co)	4	8	0.17	1.5	0.59	0.06	0.065	470	0.34	MG/KG		2
Copper (Cu)	7	8	0.27	1.5	0.87	0.085	0.085	310	3.86	MG/KG		
Iron (Fe)	8	8	2470	3250	2864	NA	NA	NA	NA	MG/KG		
Lead (Pb)	8	8	2.6	19.5	8.58	NA	NA	400	39.6	MG/KG		
Magnesium (Mg)	8	8	111	1220	381	NA	NA	NA	NA	MG/KG		
Manganese (Mn)	8	8	5 6	58 4	18.5	NA	NA	1100	26.4	MG/KG		2
Mercury (Hg)	1	8	0.15	0.15	0.15	0 025	0.03	2.3	NA	MG/KG		
Nickel (Ni)	8	8	1.3	3.6	2.19	NA	NA	160	1.7	MG/KG		6
Potassium (K)	8	8	33.3	246	94.2	NA	NA	NA	NA	MG/KG		
Selenium (Se)	1	8	0.44	0.44	0.44	0.19	0.205	39	0.84	MG/KG		
Silver (Ag)	1	8	0.25	0.25	0.25	0 09	0.1	39	0.44	MG/KG		
Sodium (Na)	8	8	18.2	58.5	30.4	NA	NA	NA	NA	MG/KG		
Vanadium (V)	8	8	6 6	8.4	7.58	NA	NA	55	15.8	MG/KG		
Zinc (Zn)	1	8	5	5	5	1.85	6.7	2300	14.8	MG/KG		
Pesticides												
4,4'-DDE	3	8	4.3	6.83	5.55	1.72	1.80	1900	NA	UG/KG		
4,4'-DDT	2	8	10.8	13.5	12.2	1.72	1.80	1900	NA	UG/KG		

Notes:
SQL - Sample quantitation limit
RBC - Risk-based concentration
UG/KG - micrograms per kilogram
MG/KG - milligrams per kilogram
NA - Not applicable or not available

Table 10.1.12
Chemicals Present in Site Samples
SWMU 161 - Shallow Groundwater
Charleston Naval Complex, Zone K
Charleston, South Carolina

Parameter	Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration Residential RBC	Screening Concentration Reference	Units	Number Exceeding RBC	Number Exceeding Ref
TCDD Equivalents												
Dioxin Equiv.	1	2	0.0069	0.0069	0.0069	0.003	0.003	0.45	NA	PG/L		
OCDD	1	2	6.9	6.9	6.9	3.273	3.273	450	NA	PG/L		
Inorganics												
Aluminum (Al)	3	4	304 5	673.5	506	153	153	3700	NA	UG/L		
Barium (Ba)	4	4	13.75	17 5	15.4	NA	NA	260	31.4	UG/L		
Calcium (Ca)	4	4	30800	50300	43863	NA	NA	NA	NA	UG/L		
Copper (Cu)	1	4	1.7	1.7	1.7	0.89	4.3	150	NA	UG/L		
Iron (Fe)	4	4	38.45	285	140	NA	NA	NA	NA	UG/L		
Lead (Pb)	1	4	2.1	2.1	2.1	0.89	1.9	15	NA	UG/L		
Magnesium (Mg)	4	4	685	1730	1010	NA	NA	NA	NA	UG/L		
Manganese (Mn)	2	4	1.1	6.85	4.0	2.2	8.5	73	15.5	UG/L		
Potassium (K)	3	4	447.5	984.5	694	661	661	NA	NA	UG/L		
Silver (Ag)	1	4	1.55	1.55	1.6	1.7	3.2	18	NA	UG/L		
Sodium (Na)	2	4	2185	3380	2783	2500	7500	NA	NA	UG/L		
Zinc (Zn)	1	4	26 75	26.75	26.8	4.6	60 2	1100	NA	UG/L		

Notes:
SQL - Sample quantitation limit
RBC - Risk-based concentration
UG/L - micrograms per liter
NA - Not applicable or not available

10.1.6.3 Risk Uncertainty

Soil Screening

A conservative screening process was used to identify COPCs for SWMU 161. The potential for eliminating CPSSs with the potential for a cumulative HI greater than 1 was addressed for noncarcinogens through the use of RBCs that were reduced one order of magnitude, equating with an HQ of 0.1. For carcinogens, the RBCs are based on a conservative target risk of 1E-06. Use Combining conservative RBCs with maxium detected concentrations minimizes the likelihood of a significant contribution to risk/hazard based on eliminated CPSSs. Of the CPSSs screened and eliminated from formal assessment, only arsenic was reported at concentrations exceeding its RBC (0.43 mg/kg), but was below its background reference value (3 mg/kg). No other soil constituent was reported at a concentration within 10% of its RBC.

Groundwater Screening

The same conservative screening process used for soil was also used for groundwater. Of the CPSSs screened and eliminated from formal assessment, none was reported at a concentration within 10% of its RBC.

Background-related Risk

Arsenic was detected in SWMU 161 surface soil at concentrations exceeding its RBC. This element was eliminated from consideration in the risk assessment, however, based on comparison to its background concentration. It is not unusual for naturally occurring or background concentrations of some elements to exceed risk-based concentrations. It is the risk assessment's function to identify excess risk and/or hazard, or that which exceeds background levels. The following discusses of the residential scenario risk/hazard associated with background arsenic concentrations.

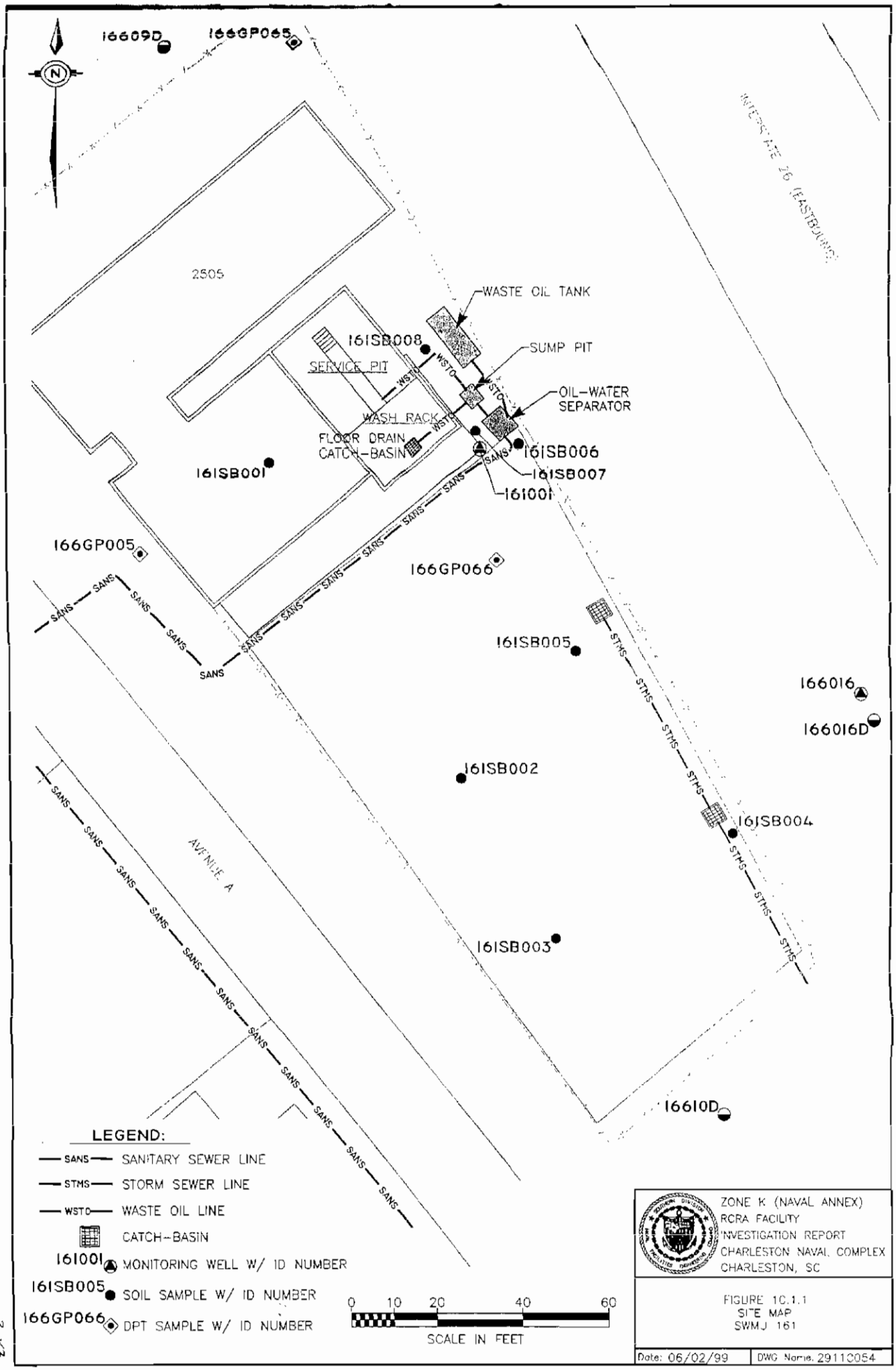
The maximum arsenic surface soil concentration (1.9 mg/kg) for SWMU 161 equates with an ILCR of 6E-06 for the site resident and 7E-07 for the site worker. Projected hazard quotients were estimated to be 0.09 and 0.004 for the residential child and site worker, respectively.

10.1.6.4 Risk Summary

No COCs were identified in surface soil or four quarters of groundwater samples at SWMU 161, indicating that there is no threat to human health at SWMU 161 via the surface soil or shallow groundwater exposure pathways.

10.1.7 Corrective Measures Considerations

For SWMU 161, the upper-interval and lower-soil intervals and shallow groundwater were investigated. In all, eight soil samples were collected to identify potential impact from activities conducted at the site. One groundwater monitoring well was installed from which four quarters of samples were collected. Based on the analytical results and the human health risk assessment, no COCs were identified as requiring further evaluation through the CMS process for the upper-soil interval or shallow groundwater.


166609D
166GP065
INTERSTATE 26 (EASTBOUND)
2505
WASTE OIL TANK
SUMP PIT
OIL-WATER SEPARATOR
161SB008
SERVICE PIT
WASH RACK
FLOOR DRAIN CATCH-BASIN
WSTO
161SB006
161SB007
161001
161SB001
SANS
166GP005
166GP066
STMS
161SB005
166016
166016D
161SB002
161SB004
AVENUE A
161SB003
166610D
LEGEND:
SANS SANITARY SEWER LINE
STMS STORM SEWER LINE
WSTO WASTE OIL LINE
CATCH-BASIN
161001 MONITORING WELL W/ ID NUMBER
161SB005 SOIL SAMPLE W/ ID NUMBER
166GP066 DPT SAMPLE W/ ID NUMBER
0 10 20 40 60
SCALE IN FEET
ZONE K (NAVAL ANNEX)
RCRA FACILITY
INVESTIGATION REPORT
CHARLESTON NAVAL COMPLEX
CHARLESTON, SC
FIGURE 10.1.1
SITE MAP
SWMU 161
Date: 06/02/99
DWG Name: 29110054

2.1 SWMU 161, Vehicle Maintenance Shop, Naval Annex

SWMU 161 consists of a gravel parking lot, a vehicle maintenance and wash bay with greasc pit, and Building 2505 (Figure 2.1). Building 2505 was constructed in 1960; somc minor improvcments were made in 1982 and 1989. The vehicle maintenance and wash bay and grease pit were added in 1993. This area is equipped with a drainage system and collection sump that connects to an 800 gallon oil-water separation (OWS) unit. Waste oil from the separation process is stored in a 275 gallon aboveground storage tank (AST). The Marine Corps has used the facility as a vehicle maintenance shop since the Navy took possession of the building from the Air Force in 1981. It is probable that the Air Force used the facility in a similar manner. The gravel parking area adjacent to the south side of the building is periodically occupied by heavy equipment such as backhoes and trucks. The parking area is stained with oil in places. SWMU 161 was identified in the RCRA Facility Assessment (RFA) as a site which only required confirmation sampling. However, since COPCs were detected during the confirmation sampling event, the scope of the investigation for the SWMU has changed to an RFI. Please refer to Section 10.1 of the *Draft-Final Zone K RCRA Facility Investigation Report* for additional site information.

2.1.1 Previous Field Work

Soil

The sampling approach for SWMU 161 was aimed at assessing the OWS and associated AST, sump, and piping, the garage and parking area, and the storm drainage system. During the initial phase of the RFI, eight upper (0 to 1 feet below ground surface [ft bgs]) and eight lower (3 to 5 ft bgs) samples were collected and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, cyanide, pesticides, Polychlorinated biphenyls (PCBs), and total petroleum hydrocarbons (TPH) at data quality objective (DQO) Level III to assess the presence of any soil contamination at the site (Figure 2.1). One lower interval sample (161SB002) was duplicated and analyzed at DQO Level IV for Appendix IX parameters which included hexavalent chromium, dioxins, Organophosphorous (OP) pesticides, and herbicides in

addition to the parameters listed above. A summary of the soil data set can be found in Section 10.1.2 of the *Draft-Final Zone K RCRA Facility Investigation Report*. The data was reviewed with respect to satisfying the RFI requirement for delineating the nature and extent of contamination. Soil data gaps that were identified are discussed below.

Groundwater

Well 161001 was installed adjacent to the OWS in the northeastern corner of the property (Figure 2.1) at 16 ft bgs in the water table aquifer. Samples were collected in five rounds during the investigation. First and second round samples were analyzed for VOCs, SVOCs, metals, cyanide, pesticides, PCBs, and TPH at DQO Level III. A duplicate sample was also collected from 161001 during round one and submitted for Appendix IX (herbicide, dioxin, OP pesticides, and hexavalent chromium) analyses, in addition to the standard suite of analyses listed above.

Third and fourth-round samples were analyzed for VOCs, SVOCs, metals, cyanide, pesticides, and PCBs. Duplicate samples were also collected from 161001 during each of these rounds but only for the same parameters as the primary samples. Fifth-round samples were collected for dioxins and total suspended solids (TSS) to confirm the dioxin detection in the first-round duplicate sample. Filtered and unfiltered samples were analyzed to determine the potential effects of suspended solids on groundwater dioxin results. A summary of the groundwater dataset can be found in Section 10.1.4 of the *Draft-Final Zone K RCRA Facility Investigation Report*.

2.1.2 Data Gaps

Surface Soil

No VOCs, SVOCs, or PCBs were detected in surface soil at SWMU 161. Two pesticides, 4,4-DDE and 4,4-DDT, were detected at three locations (161SB005, 161SB006, and 161SB008) but were well below their respective residential RBCs. TPH was detected in two surface samples at locations 161SB006 and 161SB007. Concentrations exceeded the CNC screening criteria of 100 parts per million (ppm) at location 161SB007. Twenty-one metals were detected in surface soils. Arsenic and iron were detected at concentrations exceeding their respective residential RBCs; however, these concentrations were below their respective Zone K background concentrations. No surface soil samples were analyzed for dioxins.

Based on a review of the data, possible petroleum contamination from the OWS unit and associated tank and piping has not been fully characterized and delineated downgradient of the site. Additionally, since no dioxin analysis was performed on surface soil samples and dioxins were detected in the subsurface sample 161SB002 and in the groundwater, dioxins analysis will be performed at proposed surface soil sample locations. Figure 2.1 presents the distribution of analytes which exceeded their respective screening levels. These constituents detected at individual locations are listed in parentheses below the sample identification number at each location. There were either no COPCs detected or the COPC detections were below their respective screening levels at those boring locations where no analyte is listed in parentheses.

Subsurface Soil/Soil Leachability

Two VOCs, acetone and 1,2-dichloroethylene (DCE) were detected in subsurface soils. 1,2-DCE was detected in subsurface sample 161SB004 exceeding the generic SSL based on a dilution attenuation factor (DAF) of 1. Dioxins and the SVOC, di-n-butylphthalate, were detected in subsurface samples; however, concentrations were well below their respective SSLs (DAF = 1). Manganese was detected in the surface sample at 161SB008 exceeding its' generic SSL (DAF =

1). Additional samples were collected in October 1999 where these exceedances occurred and analyzed for metals and VOCs using the Synthetic Precipitation Leaching Procedure (SPLP) and Total Organic Carbon (TOC) for development of site-specific SSLs according to United States Environmental Protection Agency (USEPA) soil screening guidance. All soil data will be reevaluated with respect to the calculated SSLs and additional data gaps may be identified based on the outcome of the site- specific SSL evaluations. Development of the site-specific SSLs and subsequent screening for contaminant migration (CM) COCs should be complete by the end of November 1999.

Shallow Groundwater

The groundwater data was reviewed with respect to analyte detections, comparison to applicable screening levels, data trends, spatial distribution, and groundwater flow direction. Based on this evaluation, no groundwater COCs were identified. However, only one well was installed at the site and no data exist downgradient of the OWS. Based on results of the proposed soil sampling, additional wells downgradient of the site may be required.

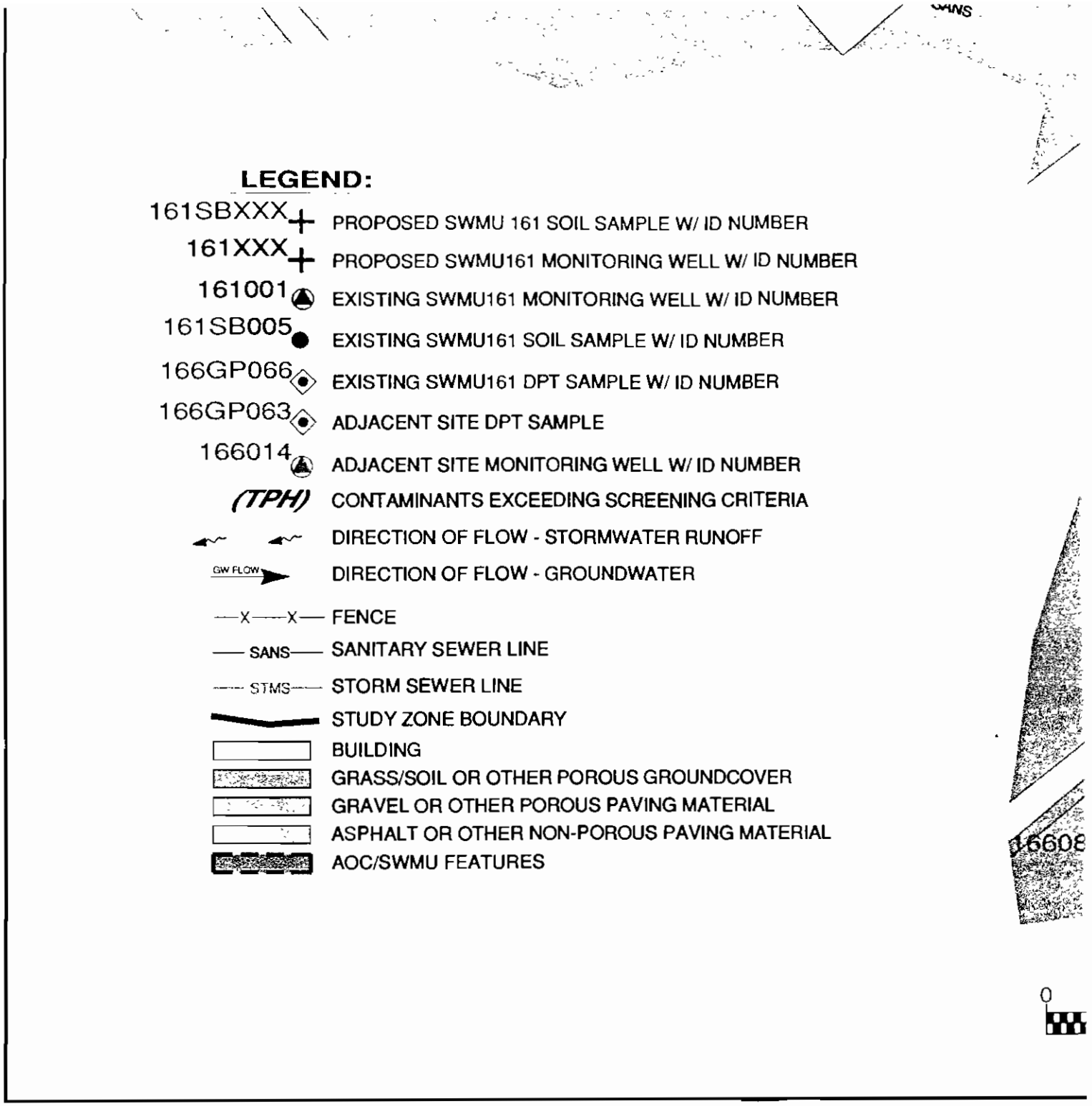
2.1.3 Sampling and Analysis Plan

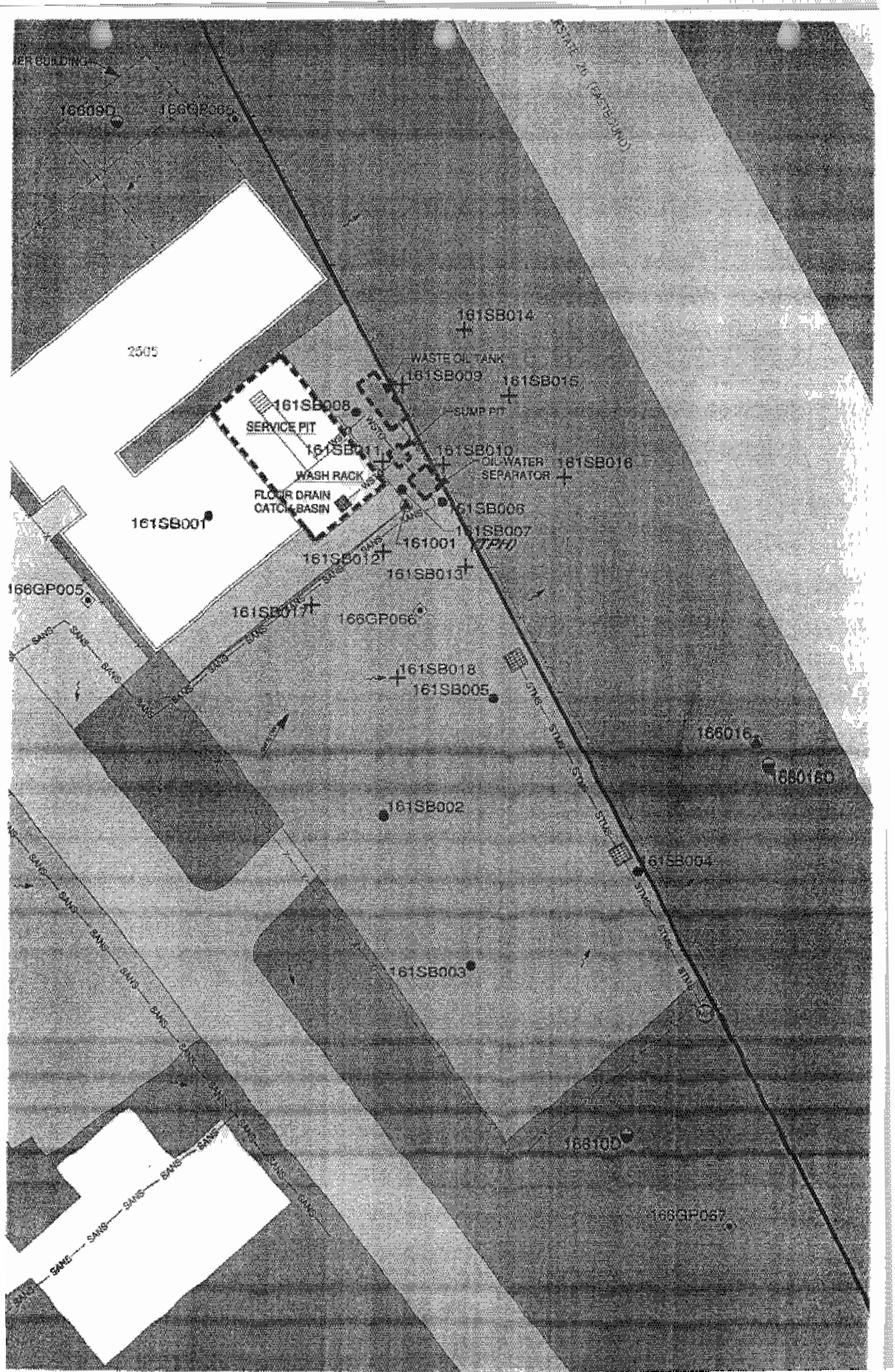
Table 2-1 summarizes the additional sampling proposed to delineate contaminants exceeding screening levels at SWMU 161. Three borings are proposed to define the extent of possible petroleum contamination in the area and downgradient of the OWS. Samples will be collected at two depth intervals for each boring (0-1' bgs) and (3-5' bgs) and analyed for VOCs at DQO Level III. Two additional borings will be completed to delineate potential petroleum contamination in 161SB007 and investigate the potential of dioxin contamination in site soil. Samples from these borings will be collected at the two depth intervals discussed above and analyzed for VOCs and dioxins. Each proposed sampling location is illustrated on Figure 2.1. All sampling procedures will adhere to the CNC *Final Comprehensive RFI Work Plan.*

Table 2-1
SWMU 161
Proposed Sampling and Analysis Plan

Proposed Sampling Location	Matrix/ Interval	Quantity	Analysis	Rationale
161SB009 - 161SB011	Soil (0-1' bgs)	3	VOCs	Investigate potential soil contamination northeast of OWS, AST, and piping
161SB009 - 161SB011	Soil (3-5' bgs)	3	VOCs	Investigate potential soil contamination northeast of OWS, AST, and piping
161SB012 - 161SB013	Soil (0-1' bgs)	2	VOCs, Dioxins	Delineate potential soil contamination southeast of 161SB007 and investigate potential dioxin contamination in soil
161SB012 - 161SB013	Soil (3-5' bgs)	2	VOCs, Dioxins	Delineate potential soil contamination southeast of 161SB007 and investigate potential dioxin contamination in soil
161SB014 - 161SB016	Soil (0-1' bgs)	3	VOCs	Contingency samples downgradient (northeast) of OWS
161SB014 - 161SB016	Soil (3-5' bgs)	3	VOCs	Contingeney samples downgradient (northeast) of OWS
161SB017 - 161SB018	Soil (0-1' bgs)	2	VOCs, dioxins	Contingency samples for delineation of VOCs and dioxins south and southwest of 161SB007
161SB017 - 161SB018	Soil (3-5' bgs)	2	VOCs, dioxins	Contingency samples for delineation of VOCs and dioxins south and southwest of 161SB007
161001	Groundwater, Existing Shallow Well	1	VOCs, Dioxins	Confirm/Deny the presence of VOCs and dioxins in shallow groundwater

Note:
All analyses will be performed per SW-846, except where other methods are specified. DQO Level III analyses will be performed as specified in Final Comprehensive RFI Work Plan, with a minimum of 10% duplicates. The sample quantities presented do not include Quality Assurance/Quality Control (QA/QC) samples.


LEGEND:
161SBXXX
PROPOSED SWMU 161 SOIL SAMPLE W/ ID NUMBER
161XXX
PROPOSED SWMU161 MONITORING WELL W/ ID NUMBER
161001
EXISTING SWMU161 MONITORING WELL W/ ID NUMBER
161SB005
EXISTING SWMU161 SOIL SAMPLE W/ ID NUMBER
166GP066
EXISTING SWMU161 DPT SAMPLE W/ ID NUMBER
166GP063
ADJACENT SITE DPT SAMPLE
166014
ADJACENT SITE MONITORING WELL W/ ID NUMBER
(TPH)
CONTAMINANTS EXCEEDING SCREENING CRITERIA
DIRECTION OF FLOW - STORMWATER RUNOFF
GW FLOW
DIRECTION OF FLOW - GROUNDWATER
FENCE
SANS
SANITARY SEWER LINE
STMS
STORM SEWER LINE
STUDY ZONE BOUNDARY
BUILDING
GRASS/SOIL OR OTHER POROUS GROUNDCOVER
GRAVEL OR OTHER POROUS PAVING MATERIAL
ASPHALT OR OTHER NON-POROUS PAVING MATERIAL
AOC/SWMU FEATURES
0


166090
166GP065
2505
161SB014
WASTE OIL TANK
161SB009
161SB015
161SB008
SUMP PIT
SERVICE PIT
161SB011
161SB010
OIL-WATER SEPARATOR
161SB016
WASH RACK
FLOOR DRAIN CATCH BASIN
161SB006
161SB001
161SB007
161001
161SB012
161SB013
166GP005
161SB017
166GP066
161SB018
161SB005
166016
166016D
161SB002
161SB004
161SB003
166010D
166GP067
SANS
STMS
STATE 20 (EASTBOUND)

Facility 3913 OWS

Operation
AST 3913 is a tanker truck loading/unloading shelter. The oil-water separator services the loading/unloading shelter by providing containment in the case of a spill while the tanker truck is loading/unloading fuel.

Sample and Analysis
The Fuel Distribution System Contamination Assessment, Areas 9 and 10, addresses the truck loading/unloading shelter area. The nearest groundwater samples were taken approximately 80' up-gradient and downgradient of the separator. The soil analysis was more indicative of the RCRA analysis. Soil samples were analyzed for VOCs, SVOCs, pesticides, PCBs and metals. Ground water analytes were the same suites. Total naphthalene in one soil sample exceeded the RBSL of 210 ppb at 250 ppb. This concentration is below the generic SSL of 84 ppm. Two additional rounds of groundwater sampling are recommended. Fuel Distribution system wells FDS10A, FDS10B, and FDS10C are downgradient of this area.

No additional IR program samples were taken at this site. No other IR monitoring wells are near enough to provide representative analysis of samples.

Recommendations
Because of the function of the OWS was to receive wastes from tanker truck loading and unloading it is unlikely that other constituents besides petroleum products were captured by the drain piping. Any further assessment and remediation should be accomplished concurrent with the corrective action taken for the loading and unloading facility.

Areas 9 and 10

(SCDHEC No. 01184)

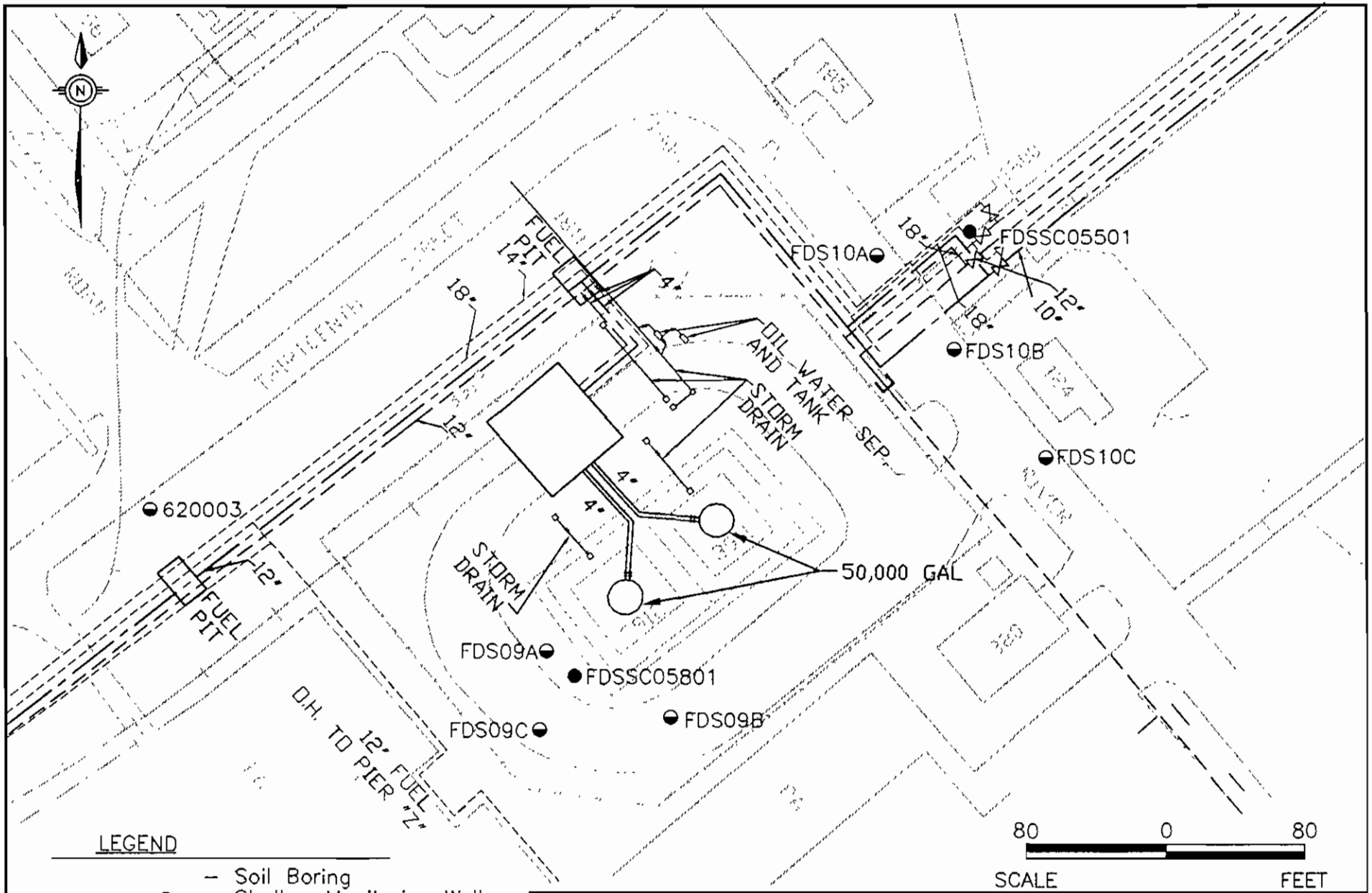
Background

The combined Areas 9 and 10 of the Fuel Distribution System (FDS) are associated with Phase I soil samples FDSSC05501 and FDSSC05801. As reported in the *FDS Contamination Assessment Report* (CAR), these samples exhibited total petroleum hydrocarbons-gasoline range organics of 63.7 micrograms per kilogram (μg/kg) at FDSSC05501 and 10 μg/kg at FDSSC05801, which prompted Phase II soil and groundwater sampling within Areas 9 and 10. Phase II soil sampling revealed total naphthalenes of 250 μg/kg in sample FDSSC05801 which exceeded the risk-based screening level (RBSL) of 210 μg/kg. To determine if groundwater has been adversely impacted by these petroleum chemicals of concern (COCs), 6 shallow groundwater monitoring wells were installed and sampled in the combined area during Phase II. No COCs exceeded their respective RBSLs at the combined area during the Phase II groundwater investigation (CAR EnSafe 1998). Figure 1 depicts the Areas 9 and 10 sample locations.

No follow-on investigative activities were performed at Areas 9 and 10.

Conclusions and Recommendations

As reported in the CAR, the total naphthalene concentration detected in soil sample FDSSC5801 was 250 μg/kg which exceeds the RBSL of 210 μg/kg. Because this sample was collected below the water table at a depth of 5 to 9 feet, it is effectively a sample of the aquifer matrix, and therefore Site Specific Target Levels would not apply. This concentration is also below the generic soil-to-groundwater soil screening level (SSL [DAF=20]) of 84,000 μg/kg (from the *Soil Screening Guidance: Technical Background Document* [USEPA 1996]), suggesting migration to groundwater is unlikely. This is further substantiated by the fact that no naphthalene was detected in the Phase II groundwater sampling at Areas 9 and 10 in two sampling events.


FUEL PIT
14'
18"
4"
FDS10A
FDSSC05501
18"
12"
10"
18"
FDS10B
OIL WATER SEP. AND TANK
STORM DRAIN
12"
FDS10C
620003
4"
4"
12"
FUEL PIT
STORM DRAIN
50,000 GAL
FDS09A
FDSSC05801
FDS09B
FDS09C
O.H. 12' FUEL TO PIER "Z"
80
0
80
SCALE
FEET
LEGEND
– Soil Boring
– Shallow Monitoring Well
– Valve
– Fence
– Diesel Line
– Fuel Line
– Sludge Line
FUEL DISTRIBUTION SYSTEM
LETTER REPORT
CHARLESTON NAVAL COMPLEX
CHARLESTON, S.C.
FIGURE 1
AREAS 9 AND 10
SAMPLE LOCATIONS
DWG DATE: 06/07/99
DWG NAME: 2907N006

3-57

No groundwater COCs exceeded their RBSLs at Areas 9 and 10, and there is an apparent lack of leaching of RBSL parameters from soil-to-groundwater. To demonstrate that the naphthalene in soil is not adversely impacting groundwater, the Navy proposes to monitor groundwater at this site. The program will consist of two quarterly sampling events during which the wells surrounding FDSSC05801 (FDS09A, FDS09B, FDS09C) will be sampled for polycyclic aromatic hydrocarbon COCs. If no RBSLs are exceeded in these monitoring samples, the site should be considered for no further action.

Facility 3926 OWS

Operation
Facility 3926 is a Ballast Water Treatment Facility. AST 3901A is used as a sludge collection tank for oil separated from ballast water discharged to the sanitary sewer.

Sample and Analysis
The Fuel Distribution System Contamination Assessment, Area 15, addresses the contamination in this area. Soil sample near the separator and groundwater samples from 20' to 40' from the separator was taken. The soil analysis was more indicative of the RCRA analysis. Soil samples were analyzed for VOCs, SVOCs, pesticides, PCBs and metals. Ground water analytes were the same suites. No constituents were found to exceed their respective RBSL or Tap Water RBCs. Napthalene was found to exceed the groundwater protection RBSL. A NFA was recommended and approved by SCDHEC UST Program on 11 April 2000.

No additional IR program samples were taken at this site. No other IR monitoring wells are near enough to provide representative analysis of samples.

Recommendations
Because of the function of the OWS was to receive wastes from operations within the bermed area of the ballast water treatment facility, it is unlikely that other constituents besides petroleum products were captured by the drain piping. This facility has been determined to require no further action under the UST program.

Area 15
(SCDHEC #01187)

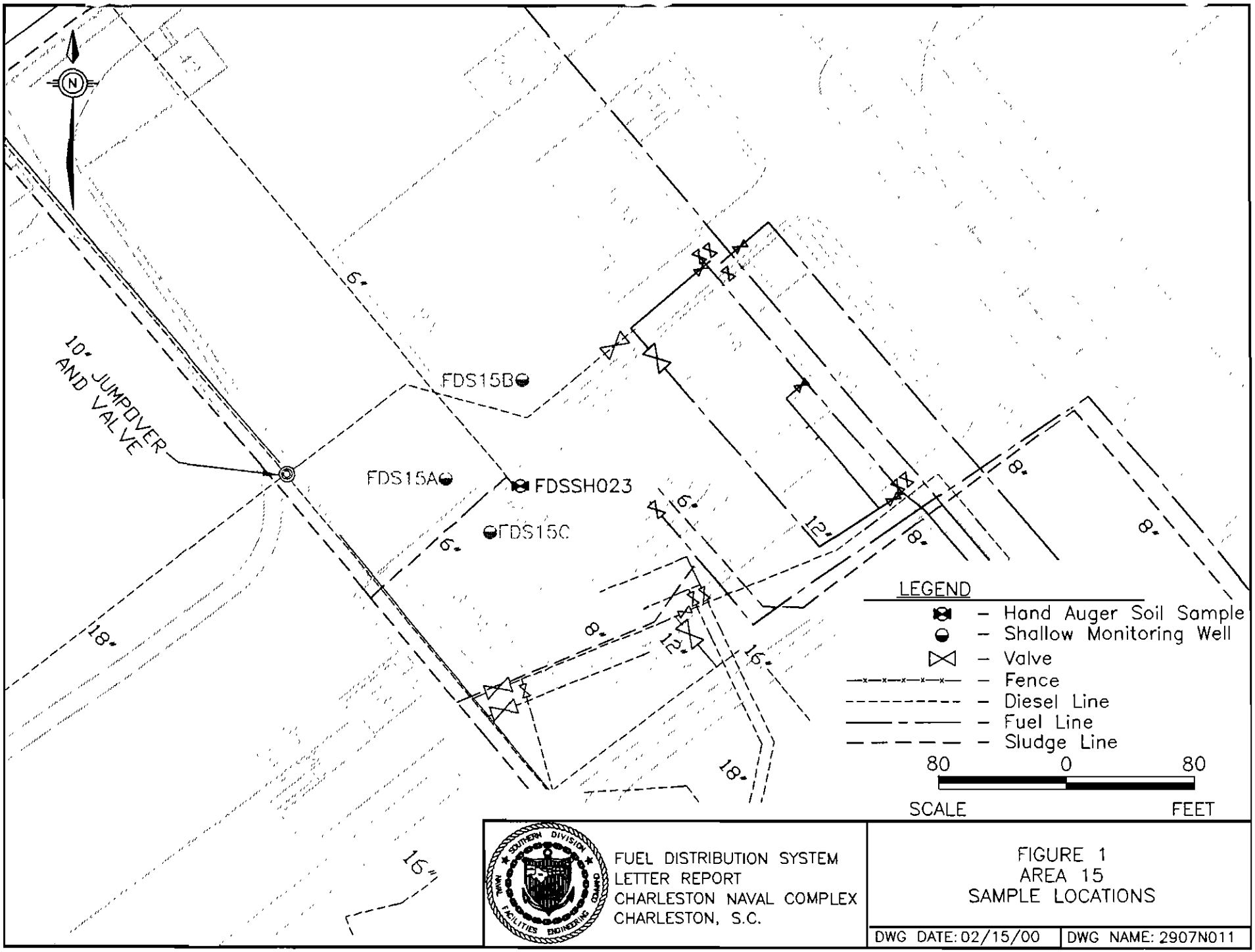
Background

Area 15 of the Fuel Distribution System (FDS) is associated with Phase I surface soil sample FDSSH02301. The sample was located just outside the western corner of the containment dike for Facility 3901A, on the north side of Building 3926. Six-inch pipelines intersect and connect to Building 3926 approximately three feet from FDSSH02301. Figure 1 presents the site features.

Facility 3901A is a 103,194 gallon welded steel ballast and sludge storage tank, which has been used for waste oil storage since 1945. The tank is connected to sludge lines which extend to various parts of the base, paralleling the fuel lines of the FDS. Building 3926 is a 15-foot high metal oil water separator mounted on a concrete pad. The facility originally used a Wemco unit to treat ballast water from tanks 39A and 39D. The Wemco unit was replaced with the current baffle operated system in 1991.

Soil Sample Results

Surface soil was sampled at Area 15 because it was most likely to be impacted by area activities or associated with a release at the site. As reported in the FDS *Contamination Assessment Report* (CAR), sample FDSSH02301 exhibited total petroleum hydrocarbons-gasoline range organics of 501 micrograms per kilogram (μg/kg), which prompted Phase II soil and groundwater sampling within Area 15. Phase II soil sampling revealed surface soil naphthalene (1,700 μg/kg) and total naphthalenes (8,500 μg/kg) above the respective groundwater protective Risk-Based Screening Levels (RBSLs) for these analytes (210 μg/kg for each analyte) at FDSSH02301. The ingestion and dermal contact RBSLs for napthalenes and total naphthalenes (3.1E+06 μg/kg for each analyte) was not exceeded.



FUEL DISTRIBUTION SYSTEM
LETTER REPORT
CHARLESTON NAVAL COMPLEX
CHARLESTON, S.C.

FIGURE 1
AREA 15
SAMPLE LOCATIONS

DWG DATE: 02/15/00 | DWG NAME: 2907N011

Based on these results, a subsurface soil sample from the 3- to 5-foot below ground surface (bgs) interval, sample FDSSH02302, was collected and analyzed to determine the vertical extent and leachability potential of naphthalenes in subsurface soil at Area 15. Table 1 presents the surface soil results, as published in the CAR, and the recently acquired subsurface soil results. As presented in the CAR and Table 1, surface soil analytical results exceeded the groundwater protective RBSLs for napthalene and total napthlenes (210 μg/kg each analyte). No groundwater protective RBSLs were exceeded in the subsurface soil data. These results document that the naphthalene detected in the surficial interval is limited to that interval, thus delineating the vertical extent of this Contaminant of Concern (COC).

Groundwater Sample Results

Table 2 presents the groundwater analytical results, as published in the CAR. No groundwater organic RBSL parameters were detected during the most recent sampling event of the Phase II groundwater investigation at Area 15. Specifically, no naphthalene compounds were detected in shallow groundwater. No groundwater inorganic detection at Area 15 exceeded a RBSL during any sampling event. Figure 1 also depicts the Area 15 sample locations.

Conclusions and Recommendations

A review of analytical results from the surface soil data reveals that naphthalene and total naphthalenes in surficial soil exceeded the groundwater protective RBSL, but did not exceed the ingestion and dermal contact RBSL. The subsurface soil results document that these exceedances are limited to the surficial interval. In addition, an evaluation of Phase II groundwater results reveals that no naphthalenes were detected in shallow groundwater at Area 15. No other analytes detected in shallow groundwater exceeded their respective groundwater RBSLs.

Groundwater is not currently used at Charleston Naval Complex (CNC) as a source of potable or process water; a base wide potable water system provides drinking and process water to buildings

at CNC. This system is to remain in operation under the current base reuse plan. In addition, the shallow aquifer for this investigation contains significant concentrations of naturally occurring chlorides and elevated total dissolved solids, which makes this water-bearing unit a questionable potable water source.

Area 15 is currently zoned for marine industrial use, and will likely remain a fuel farm under this usage scenario. Since the napthalene detected in surficial soil does not exceed the ingestion and dermal contact RBSL and is not leaching to shallow groundwater at the site, no further action is recommended for Area 15.

Table 1
Analytes Detected in Surface and Subsurface Soil
Area 15
Fuel Distribution System

Parameters	Location	Surface Conc.	Ingestion/Dermal Contact RBSL	Subsurface Conc.	Groundwater Protection RBSL	Exceeds Ingestion-Dermal RBSL/Groundwater Protection RBSL
TPH - GRO (µg/kg)						
Gasoline	FDSSH023	501	NL	NT	NL	NA/NA
Volatile Organic Compounds (µg/kg)						
1,1-Dichloroethane	FDSSH023	85	NL	ND	NL	NA/NA
1,1,1-Trichloroethane	FDSSH023	48	NL	ND	NL	NA/NA
Benzene	FDSSH023	ND	22,000	2	5	No/No
Ethylbenzene	FDSSH023	130	7.8E+06	ND	1,260	No/No
Methylene chloride	FDSSH023	ND	NL	ND	NL	NA/NA
Tetrachloroethene	FDSSH023	13	NL	ND	NL	NA/NA
Toluene	FDSSH023	22	1.6E+06	ND	1,622	No/No
Xylene (Total)	FDSSH023	1800	1.6E+08	ND	42,471	No/No
Semivolatile Organic Compounds (µg/kg)						
Total Naphthalenes	FDSSH023	**8500**	3.1E+06	ND	210	No/Yes
2-Methylnaphthalene	FDSSH023	6800	NL	ND	NL	NA/NA
Naphthalene	FDSSH023	**1700**	3.1E+06	ND	210	No/Yes
bis(2-ethylhexyl)phthalate	FDSSH023	ND	NL	ND	NL	NA/NA
Chrysene	FDSSH023	240	88,000	ND	12,998	No/No

3-64

Table 1
Analytes Detected in Surface and Subsurface Soil
Area 15
Fuel Distribution System

Parameters	Location	Surface Conc.	Ingestion/Dermal Contact RBSL	Subsurface Conc.	Groundwater Protection RBSL	Exceeds Ingestion-Dermal RBSL/Groundwater Protection RBSL
Fluorene	FDSSH023	1900	NL	ND	NL	NA/NA
Phenanthrene	FDSSH023	1900	NL	ND	NL	NA/NA
Pyrene	FDSSH023	590	NL	ND	NL	NA/NA
Pesticides/PCB (µg/kg)						
4,4'-DDE	FDSSH023	ND	NL	12	NL	NA/NA
Aroclor- 1260	FDSSH023	ND	NL	53	NL	NA/NA
Endrin	FDSSH023	20	NL	ND	NL	NA/NA
Heptachlor	FDSSH023	5.3	NL	ND	NL	NA/NA
Heptachlor epoxide	FDSSH023	ND	NL	ND	NL	NA/NA
gamma-Chlordane	FDSSH023	3.4	NL	3.2	NL	NA/NA
Inorganics (mg/kg)						
Aluminum (Al)	FDSSH023	2820	NL	6,950	NL	NA/NA
Arsenic (As)	FDSSH023	1.8	NL	2.4	NL	NA/NA
Barium (Ba)	FDSSH023	13.1	NL	31.3	NL	NA/NA
Beryllium (Be)	FDSSH023	ND	NL	0.31	NL	NA/NA
Cadmium (Cd)	FDSSH023	0.19	NL	ND	NL	NA/NA
Calcium (Ca)	FDSSH023	13,100	NL	1,220	NL	NA/NA

Table 1
Analytes Detected in Surface and Subsurface Soil
Area 15
Fuel Distribution System

Parameters	Location	Surface Conc.	Ingestion/Dermal Contact RBSL	Subsurface Conc.	Groundwater Protection RBSL	Exceeds Ingestion-Dermal RBSL/Groundwater Protection RBSL
Chromium (Cr)	FDSSH023	9.3	NL	13.5	NL	NA/NA
Cobalt (Co)	FDSSH023	1.3	NL	1.5	NL	NA/NA
Copper (Cu)	FDSSH023	ND	NL	2.4	NL	NA/NA
Iron (Fe)	FDSSH023	4,860	NL	10,500	NL	NA/NA
Lead (Pb)	FDSSH023	29.5	NL	7.9	NL	NA/NA
Magnesium (Mg)	FDSSH023	499	NL	646	NL	NA/NA
Manganese (Mn)	FDSSH023	29.6	NL	34.3	NL	NA/NA
Mercury (Hg)	FDSSH023	0.07	NL	0.05	NL	NA/NA
Nickel (Ni)	FDSSH023	4.2	NL	2.9	NL	NA/NA
Potassium (K)	FDSSH023	240	NL	321	NL	NA/NA
Selenium (Se)	FDSSH023	ND	NL	0.51	NL	NA/NA
Sodium (Na)	FDSSH023	ND	NL	249	NL	NA/NA
Thallium (Tl)	FDSSH023	0.47	NL	ND	NL	NA/NA
Tin (Sn)	FDSSH023	ND	NL	ND	NL	NA/NA
Vanadium (V)	FDSSH023	10.6	NL	16.1	NL	NA/NA
Zinc (Zn)	FDSSH023	66.8	NL	14.8	NL	NA/NA

Notes:
NL = Not listed
NA = Not applicable
NT = Not taken
µg/kg = Micrograms per kilogram
mg/kg = Milligrams per kilogram
RBSLs for ingestion or dermal contact with surficial soil from the *South Carolina Risk-Based Corrective Action for Petroleum Releases* (SCDHEC, January 5, 1998) were used as reference concentrations.
Bolded concentrations exceed RBSL.

3-6-7

Table 2
Analytes Detected in Shallow Groundwater
Area 15
Fuel Distribution System

Parameters	Location	First Sampling Event	Second Sampling Event	RBSL/Tap Water RBC (µg/L)	Shallow Background
Volatile Organic Compounds (µg/L)					
Toluene	FDS15A	3	ND	1000/75	NA
Chlorobenzene	FDS15A	*6*	ND	NL/3.9	NA
Semivolatile Organic Compounds (µg/L)					
Phenol	FDS15A	1	ND	NL/2200	NA
4-Methylphenol (p-cresol)	FDS15A	*23*	2	NL/18	NA
Benzoic acid	FDS15A	6	ND	NL/15000	NA
Pesticides/PCBs (µg/L)					
beta-BHC	FDS15A	*0.057*	ND	NL/0.037	NA
Inorganics (µg/L)					
Aluminum (Al)	FDS15A	100	503	NL/3700	692
	FDS15B	3,010	209		
	FDS15C	962	474		
Antimony (Sb)	FDS15C	3.5	ND	NL/1.5	4.85
Arsenic (As)	FDS15A	19.4	*26.7*	50/0.045	17.8
	FDS15B	4.1	4.6		
Barium (Ba)	FDS15A	55.2	94.5	2000/260	31
	FDS15B	68.6	70.6		
	FDS15C	159	153		
Calcium (Ca)	FDS15A	126000	235000	NL/NL	NL
	FDS15B	98800	119000		
	FDS15C	268000	284000		
Chromium (Cr)	FDS15A	0 92	1.5	100/11	3.88
	FDS15B	4.7	ND		
	FDS15C	1.9	ND		
Cobalt (Co)	FDS15B	8.1	6.8	NL/220	1.45
	FDS15C	1.3	ND		
Copper (Cu)	FDS15A	3.6	ND	NL/150	8.33
Cyanide (CN)	FDS15A	3	NT	NL/73	3.8
	FDS15B	7	NT		
Iron (Fe)	FDS15A	4920	6620	NL/1100	30,400
	FDS15B	2060	675		
	FDS15C	1920	3040		

Table 2
Analytes Detected in Shallow Groundwater
Area 15
Fuel Distribution System

Parameters	Location	First Sampling Event	Second Sampling Event	RBSL/Tap Water RBC (µg/L)	Shallow Background
Magnesium (Mg)	FDS15A	12200	15800	NL/NL	NL
	FDS15B	26200	22800		
	FDS15C	19300	14000		
Manganese (Mn)	FDS15A	721	515	NL/73	2906
	FDS15B	1050	813		
	FDS15C	806	465		
Nickel (Ni)	FDS15A	3.7	0.84	NL/73	4.08
	FDS15B	3.2	1.6		
	FDS15C	1.7	0.9		
Potassium (K)	FDS15A	10800	5130	NL/NL	NL
	FDS15B	7410	8050		
	FDS15C	3440	3450		
Sodium (Na)	FDS15A	78300	157000	NL/NL	NL
	FDS15B	92400	158000		
	FDS15C	117000	114000		
Thallium (Tl)	FDS15C	*3.3*	ND	NL/0.26	ND
Vanadium (V)	FDS15A	1.3	1.6	NL/26	15.4
	FDS15B	6	1.1		
	FDS15C	1.9	1.6		

Notes:
NL = Not listed
NA = Not applicable
ND = Not detected
NT = Not taken
µg/L = Micrograms per liter
RBSLs from the *South Carolina Risk-Based Corrective Action for Petroleum Releases* (SCDHEC, January 5, 1998) and tap water RBCs (THQ=0.1) from *Risk Based Concentration Table* (USEPA, October 7, 1999) were used as reference concentrations.
Italicized concentrations exceed the Tap Water RBC. For inorganics, italicized concentrations exceed the shallow groundwater background concentration and the tap water RBC.
All background values for Zone G are based on twice the means of the grid sample concentrations. Background values for groundwater are based on two sampling rounds in two wells at each depth.

Attachment A
Analytical Data

DATALCP3
02/18/00

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

Time: 10:44

CYANIDE							
	SAMPLE ID ------>	FDS-S-H023-01					
	ORIGINAL ID ----->	FDSSH02301					
	LAB SAMPLE ID --->	27355.10					
	ID FROM REPORT -->	FDSSH02301					
	SAMPLE DATE ----->	10/17/96					
	DATE EXTRACTED -->	10/21/96					
	DATE ANALYZED --->	10/24/96					
	MATRIX ---------->	Soil					
	UNITS ----------->	MG/KG					
CAS #	Parameter	27339	VAL				
57-12-5	Cyanide (CN)	0.53	U				

3.74

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

SW846-META

SAMPLE ID ------->	FDS-S-H023-01
ORIGINAL ID ----->	FDSSH02301
LAB SAMPLE ID --->	27355.10
ID FROM REPORT -->	FDSSH02301
SAMPLE DATE ----->	10/17/96
DATE EXTRACTED -->	10/22/96
DATE ANALYZED --->	10/24/96
MATRIX ---------->	Soil
UNITS ----------->	MG/KG

CAS #	Parameter	27339	VAL
7439-97-6	Mercury (Hg)	0.07	
7429-90-5	Aluminum (Al)	2820.	
7439-92-1	Lead (Pb)	29.5	
7440-36-0	Antimony (Sb)	0.33	U
7439-95-4	Magnesium (Mg)	499.	
7440-38-2	Arsenic (As)	1.8	
7782-49-2	Selenium (Se)	0.33	U
7440-39-3	Barium (Ba)	13.1	
7440-41-7	Beryllium (Be)	0.23	U
7440-43-9	Cadmium (Cd)	0.19	J
7440-70-2	Calcium (Ca)	13100.	
7440-47-3	Chromium (Cr)	9.3	
7440-48-4	Cobalt (Co)	1.3	J
7440-50-8	Copper (Cu)	10.6	U
7439-89-6	Iron (Fe)	4860.	
7439-96-5	Manganese (Mn)	29.6	
7440-02-0	Nickel (Ni)	4.2	J
7440-09-7	Potassium (K)	240.	J
7440-22-4	Silver (Ag)	0.21	U
7440-23-5	Sodium (Na)	164.	U
7440-28-0	Thallium (Tl)	0.47	J
7440-31-5	Tin (Sn)	2.	U
7440-62-2	Vanadium (V)	10.6	
7440-66-6	Zinc (Zn)	66.8	

3-72

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

SW846-PEST

SAMPLE ID ------->	FDS-S-H023-01
ORIGINAL ID ----->	FDSSH02301
LAB SAMPLE ID --->	FDSSH02301
ID FROM REPORT -->	FDSSH02301
SAMPLE DATE ----->	10/17/96
DATE EXTRACTED -->	10/20/96
DATE ANALYZED --->	10/28/96
MATRIX ---------->	Soil
UNITS ----------->	UG/KG

CAS #	Parameter	27339	VAL
319-84-6	alpha-BHC	1.4	U
319-85-7	beta-BHC	1.4	U
319-86-8	delta-BHC	1.4	U
58-89-9	gamma-BHC (Lindane)	1.4	U
76-44-8	Heptachlor	5.3	J
309-00-2	Aldrin	1.4	U
1024-57-3	Heptachlor epoxide	1.4	U
959-98-8	Endosulfan I	1.4	U
60-57-1	Dieldrin	2.8	U
72-55-9	4,4'-DDE	2.8	U
72-20-8	Endrin	20.	
33213-65-9	Endosulfan II	2.8	U
72-54-8	4,4'-DDD	2.8	U
1031-07-8	Endosulfan sulfate	2.8	U
50-29-3	4,4'-DDT	11.	U
72-43-5	Methoxychlor	14.	U
53494-70-5	Endrin ketone	2.8	U
7421-93-4	Endrin aldehyde	2.8	U
5103-71-9	alpha-Chlordane	1.4	U
5103-74-2	gamma-Chlordane	3.4	
8001-35-2	Toxaphene	92.	U
12674-11-2	Aroclor-1016	37.	U
11104-28-2	Aroclor-1221	37.	U
11141-16-5	Aroclor-1232	37.	U
53469-21-9	Aroclor-1242	37.	U
12672-29-6	Aroclor-1248	37.	U
11097-69-1	Aroclor-1254	74.	U
11096-82-5	Aroclor-1260	170.	U

3-73

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

SW846-SVOA

SAMPLE ID ------->	FDS-S-H023-01
ORIGINAL ID ----->	FDSSH02301
LAB SAMPLE ID --->	27355.10
ID FROM REPORT -->	FDSSH02301
SAMPLE DATE ----->	10/17/96
DATE EXTRACTED -->	10/20/96
DATE ANALYZED --->	11/01/96
MATRIX ---------->	Soil
UNITS ----------->	UG/KG

CAS #	Parameter	27339	VAL
108-95-2	Phenol	1800.	U
111-44-4	bis(2-Chloroethyl)ether	1800.	U
95-57-8	2-Chlorophenol	1800.	U
541-73-1	1,3-Dichlorobenzene	1800.	U
106-46-7	1,4-Dichlorobenzene	1800.	U
100-51-6	Benzyl alcohol	1800.	U
95-50-1	1,2-Dichlorobenzene	1800.	U
95-48-7	2-Methylphenol (o-Cresol)	1800.	U
108-60-1	2,2'-oxybis(1-Chloropropane)	1800.	U
106-44-5	4-Methylphenol (p-Cresol)	1800.	U
621-64-7	N-Nitroso-di-n-propylamine	1800.	U
67-72-1	Hexachloroethane	1800.	U
98-95-3	Nitrobenzene	1800.	U
78-59-1	Isophorone	1800.	U
88-75-5	2-Nitrophenol	1800.	U
105-67-9	2,4-Dimethylphenol	1800.	U
65-85-0	Benzoic acid	8900.	U
111-91-1	bis(2-Chloroethoxy)methane	1800.	U
120-83-2	2,4-Dichlorophenol	1800.	U
120-82-1	1,2,4-Trichlorobenzene	1800.	U
91-20-3	Naphthalene	1700.	J
106-47-8	4-Chloroaniline	1800.	U
87-68-3	Hexachlorobutadiene	1800.	U
59-50-7	4-Chloro-3-methylphenol	1800.	U
91-57-6	2-Methylnaphthalene	6800.	
77-47-4	Hexachlorocyclopentadiene	1800.	U
88-06-2	2,4,6-Trichlorophenol	1800.	U
95-95-4	2,4,5-Trichlorophenol	8900.	U
91-58-7	2-Chloronaphthalene	1800.	U
88-74-4	2-Nitroaniline	8900.	U
131-11-3	Dimethyl phthalate	1800.	U
208-96-8	Acenaphthylene	1800.	U
606-20-2	2,6-Dinitrotoluene	1800.	U
99-09-2	3-Nitroaniline	8900.	U
83-32-9	Acenaphthene	1800.	U
51-28-5	2,4-Dinitrophenol	8900.	U

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

SW846-SVOA	SAMPLE ID ------->	FDS-S-H023-01					
	ORIGINAL ID ----->	FDSSH02301					
	LAB SAMPLE ID --->	27355.10					
	ID FROM REPORT -->	FDSSH02301					
	SAMPLE DATE ----->	10/17/96					
	DATE EXTRACTED -->	10/20/96					
	DATE ANALYZED --->	11/01/96					
	MATRIX ---------->	Soil					
	UNITS ----------->	UG/KG					
CAS #	Parameter	27339	VAL				
100-02-7	4-Nitrophenol	8900.	U				
132-64-9	Dibenzofuran	1800.	U				
121-14-2	2,4-Dinitrotoluene	1800.	U				
84-66-2	Diethylphthalate	1800.	U				
7005-72-3	4-Chlorophenylphenylether	1800.	U				
86-73-7	Fluorene	1900.					
100-01-6	4-Nitroaniline	8900.	U				
534-52-1	2-Methyl-4,6-Dinitrophenol	8900.	U				
86-30-6	N-Nitrosodiphenylamine	1800.	U				
101-55-3	4-Bromophenyl-phenylether	1800.	U				
118-74-1	Hexachlorobenzene	1800.	U				
87-86-5	Pentachlorophenol	8900.	U				
85-01-8	Phenanthrene	1900.					
120-12-7	Anthracene	1800.	U				
84-74-2	Di-n-butylphthalate	1800.	U				
206-44-0	Fluoranthene	1800.	U				
129-00-0	Pyrene	590.	J				
85-68-7	Butylbenzylphthalate	1800.	U				
91-94-1	3,3'-Dichlorobenzidine	3700.	U				
56-55-3	Benzo(a)anthracene	1800.	U				
218-01-9	Chrysene	240.	J				
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	1800.	U				
117-84-0	Di-n-octyl phthalate	1800.	U				
205-99-2	Benzo(b)fluoranthene	1800.	U				
207-08-9	Benzo(k)fluoranthene	1800.	U				
50-32-8	Benzo(a)pyrene	1800.	U				
193-39-5	Indeno(1,2,3-cd)pyrene	1800.	U				
53-70-3	Dibenz(a,h)anthracene	1800.	U				
191-24-2	Benzo(g,h,i)perylene	1800.	U				

3-25

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

SW846-VOA

SAMPLE ID ------>	FDS-S-H023-01
ORIGINAL ID ----->	FDSSH02301
LAB SAMPLE ID --->	27355.10
ID FROM REPORT -->	FDSSH02301
SAMPLE DATE ----->	10/17/96
DATE ANALYZED --->	10/22/96
MATRIX ---------->	Soil
UNITS ----------->	UG/KG

CAS #	Parameter	27339	VAL
74-87-3	Chloromethane	56.	U
74-83-9	Bromomethane	56.	U
75-01-4	Vinyl chloride	56.	U
75-00-3	Chloroethane	56.	U
75-09-2	Methylene chloride	28.	U
67-64-1	Acetone	56.	U
75-15-0	Carbon disulfide	28.	U
75-35-4	1,1-Dichloroethene	28.	U
75-34-3	1,1-Dichloroethane	85.	J
540-59-0	1,2-Dichloroethene (total)	28.	U
67-66-3	Chloroform	28.	U
107-06-2	1,2-Dichloroethane	28.	U
78-93-3	2-Butanone (MEK)	56.	U
71-55-6	1,1,1-Trichloroethane	48.	J
56-23-5	Carbon tetrachloride	28.	U
75-27-4	Bromodichloromethane	28.	U
78-87-5	1,2-Dichloropropane	28.	U
10061-01-5	cis-1,3-Dichloropropene	28.	U
79-01-6	Trichloroethene	28.	U
124-48-1	Dibromochloromethane	28.	U
79-00-5	1,1,2-Trichloroethane	28.	U
71-43-2	Benzene	28.	U
10061-02-6	trans-1,3-Dichloropropene	28.	U
75-25-2	Bromoform	28.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	56.	U
591-78-6	2-Hexanone	56.	UJ
127-18-4	Tetrachloroethene	13.	J
79-34-5	1,1,2,2-Tetrachloroethane	28.	UJ
108-88-3	Toluene	22.	J
108-90-7	Chlorobenzene	28.	UJ
100-41-4	Ethylbenzene	130.	J
100-42-5	Styrene	28.	UJ
1330-20-7	Xylene (Total)	1800.	J
108-05-4	Vinyl acetate	56.	UJ
110-75-8	2-Chloroethyl vinyl ether	56.	UR

3-26

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

TPH-DRO

SAMPLE ID ------->	FDS-S-H023-01
ORIGINAL ID ----->	FDSSH02301
LAB SAMPLE ID --->	27355.10
ID FROM REPORT -->	FDSSH02301
SAMPLE DATE ----->	10/17/96
DATE EXTRACTED -->	10/24/96
DATE ANALYZED --->	11/04/96
MATRIX ---------->	Soil
UNITS ----------->	MG/KG

CAS #	Parameter	27339	VAL
68334-30-5	Diesel	55.6	U
8008-20-6	Kerosene	55.6	U
9999000-35-1	JP-4 C6-C14	55.6	U
9999000-48-6	NAPHTHA C6-C12	55.6	U
68553-00-4	Fuel oil no. 6	55.6	U

3.27

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

TPH-GRO							
	SAMPLE ID ------->	FDS-S-H023-01					
	ORIGINAL ID ----->	FDSSH02301					
	LAB SAMPLE ID --->	FDSSH02301					
	ID FROM REPORT -->	FDSSH02301					
	SAMPLE DATE ----->	10/17/96					
	DATE ANALYZED --->	10/22/96					
	MATRIX ---------->	Soil					
	UNITS ----------->	UG/KG					
CAS #	Parameter	27339	VAL				
86290-81-5	Gasoline	501.	J				

3-Pg

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

CYANIDE

SAMPLE ID ------->	FDS-S-H023-02
ORIGINAL ID ----->	FDSSH02302
LAB SAMPLE ID --->	40518.01
ID FROM REPORT -->	FDSSH02302
SAMPLE DATE ----->	09/30/99
DATE EXTRACTED -->	10/07/99
DATE ANALYZED --->	10/08/99
MATRIX ---------->	Soil
UNITS ----------->	MG/KG

CAS #	Parameter	40518	VAL
57-12-5	Cyanide (CN)	0.17	U

3-79

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

SW-METHOD							
	SAMPLE ID ------->	FDS-S-H023-02					
	ORIGINAL ID ----->	FDSSH02302					
	LAB SAMPLE ID --->	40518.01					
	ID FROM REPORT -->	FDSSH02302					
	SAMPLE DATE ----->	09/30/99					
	DATE EXTRACTED -->	10/06/99					
	DATE ANALYZED --->	10/07/99					
	MATRIX ---------->	Soil					
	UNITS ----------->	MG/KG					
CAS #	Parameter	40518	VAL				
7439-97-6	Mercury (Hg)	0.05	J				
7440-38-2	Arsenic (As)	2.4	J				
7440-39-3	Barium (Ba)	31.3					
7440-43-9	Cadmium (Cd)	0.03	U				
7440-47-3	Chromium (Cr)	13.5					
7439-92-1	Lead (Pb)	7.9					
7782-49-2	Selenium (Se)	0.51	J				
7440-22-4	Silver (Ag)	0.14	U				
7440-36-0	Antimony (Sb)	0.31	UJ				
7440-41-7	Beryllium (Be)	0.31	J				
7440-70-2	Calcium (Ca)	1220.					
7440-48-4	Cobalt (Co)	1.5	J				
7440-50-8	Copper (Cu)	2.4					
7439-89-6	Iron (Fe)	10500.					
7439-95-4	Magnesium (Mg)	646.					
7439-96-5	Manganese (Mn)	34.3	J				
7440-02-0	Nickel (Ni)	2.9	J				
7440-09-7	Potassium (K)	321.					
7440-23-5	Sodium (Na)	249.	J				
7440-28-0	Thallium (Tl)	0.4	U				
7440-62-2	Vanadium (V)	16.1					
7440-66-6	Zinc (Zn)	14.8					
7440-31-5	Tin (Sn)	4.9	U				
7429-90-5	Aluminum (Al)	6950.					

3.3C

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

SW-SVOA

SAMPLE ID ------->	FDS-S-H023-02
ORIGINAL ID ----->	FDSSH02302
LAB SAMPLE ID --->	40518.01
ID FROM REPORT -->	FDSSH02302
SAMPLE DATE ----->	09/30/99
DATE EXTRACTED -->	10/11/99
DATE ANALYZED --->	10/12/99
MATRIX ---------->	Soil
UNITS ----------->	UG/KG

CAS #	Parameter	40518	VAL
108-95-2	Phenol	380.	U
111-44-4	bis(2-Chloroethyl)ether	380.	U
95-57-8	2-Chlorophenol	380.	U
541-73-1	1,3-Dichlorobenzene	380.	U
106-46-7	1,4-Dichlorobenzene	380.	U
100-51-6	Benzyl alcohol	380.	U
95-50-1	1,2-Dichlorobenzene	380.	U
95-48-7	2-Methylphenol (o-Cresol)	380.	U
108-60-1	2,2'-oxybis(1-Chloropropane)	380.	U
106-44-5	4-Methylphenol (p-Cresol)	380.	U
621-64-7	N-Nitroso-di-n-propylamine	380.	U
67-72-1	Hexachloroethane	380.	U
98-95-3	Nitrobenzene	380.	U
78-59-1	Isophorone	380.	U
88-75-5	2-Nitrophenol	380.	U
105-67-9	2,4-Dimethylphenol	380.	U
65-85-0	Benzoic acid	380.	U
111-91-1	bis(2-Chloroethoxy)methane	380.	U
120-83-2	2,4-Dichlorophenol	380.	U
120-82-1	1,2,4-Trichlorobenzene	380.	U
91-20-3	Naphthalene	380.	U
106-47-8	4-Chloroaniline	380.	U
87-68-3	Hexachlorobutadiene	380.	U
59-50-7	4-Chloro-3-methylphenol	380.	U
91-57-6	2-Methylnaphthalene	380.	U
77-47-4	Hexachlorocyclopentadiene	380.	U
88-06-2	2,4,6-Trichlorophenol	380.	U
95-95-4	2,4,5-Trichlorophenol	950.	U
91-58-7	2-Chloronaphthalene	380.	U
88-74-4	2-Nitroaniline	950.	U
131-11-3	Dimethyl phthalate	380.	U
208-96-8	Acenaphthylene	380.	U
99-09-2	3-Nitroaniline	950.	U
83-32-9	Acenaphthene	380.	U
51-28-5	2,4-Dinitrophenol	950.	UR
100-02-7	4-Nitrophenol	950.	U

3-831

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

SW-SVOA

SAMPLE ID ------->	FDS-S-H023-02
ORIGINAL ID ----->	FDSSH02302
LAB SAMPLE ID --->	40518.01
ID FROM REPORT -->	FDSSH02302
SAMPLE DATE ----->	09/30/99
DATE EXTRACTED -->	10/11/99
DATE ANALYZED --->	10/12/99
MATRIX ---------->	Soil
UNITS ----------->	UG/KG

CAS #	Parameter	40518	VAL
132-64-9	Dibenzofuran	380.	U
121-14-2	2,4-Dinitrotoluene	380.	U
606-20-2	2,6-Dinitrotoluene	380.	U
84-66-2	Diethylphthalate	380.	U
7005-72-3	4-Chlorophenylphenylether	380.	U
86-73-7	Fluorene	380.	U
100-01-6	4-Nitroaniline	950.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	950.	UR
86-30-6	N-Nitrosodiphenylamine	380.	U
101-55-3	4-Bromophenyl-phenylether	380.	U
118-74-1	Hexachlorobenzene	380.	U
87-86-5	Pentachlorophenol	950.	U
85-01-8	Phenanthrene	380.	U
120-12-7	Anthracene	380.	U
84-74-2	Di-n-butylphthalate	380.	U
206-44-0	Fluoranthene	380.	U
129-00-0	Pyrene	380.	U
85-68-7	Butylbenzylphthalate	380.	U
91-94-1	3,3'-Dichlorobenzidine	380.	U
56-55-3	Benzo(a)anthracene	380.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	380.	U
218-01-9	Chrysene	380.	U
117-84-0	Di-n-octyl phthalate	380.	U
205-99-2	Benzo(b)fluoranthene	380.	U
207-08-9	Benzo(k)fluoranthene	380.	U
50-32-8	Benzo(a)pyrene	380.	U
193-39-5	Indeno(1,2,3-cd)pyrene	380.	U
53-70-3	Dibenz(a,h)anthracene	380.	U
191-24-2	Benzo(g,h,i)perylene	380.	U

3-232

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

SW-VOA

SAMPLE ID ------->	FDS-S-H023-02
ORIGINAL ID ----->	FDSSH02302
LAB SAMPLE ID --->	40518.01
ID FROM REPORT -->	FDSSH02302
SAMPLE DATE ----->	09/30/99
DATE ANALYZED --->	10/08/99
MATRIX ---------->	Soil
UNITS ----------->	UG/KG

CAS #	Parameter	40518	VAL
71-43-2	Benzene	2.	J
100-41-4	Ethylbenzene	7.	U
108-88-3	Toluene	7.	U
1330-20-7	Xylene (Total)	7.	U
74-87-3	Chloromethane	7.	U
74-83-9	Bromomethane	7.	U
75-01-4	Vinyl chloride	7.	U
75-00-3	Chloroethane	7.	U
75-09-2	Methylene chloride	7.	U
67-64-1	Acetone	7.	U
75-15-0	Carbon disulfide	7.	U
75-35-4	1,1-Dichloroethene	7.	U
75-34-3	1,1-Dichloroethane	7.	U
540-59-0	1,2-Dichloroethene (total)	7.	U
67-66-3	Chloroform	7.	U
107-06-2	1,2-Dichloroethane	7.	U
78-93-3	2-Butanone (MEK)	7.	U
71-55-6	1,1,1-Trichloroethane	7.	U
56-23-5	Carbon tetrachloride	7.	U
108-05-4	Vinyl acetate	7.	U
75-27-4	Bromodichloromethane	7.	U
78-87-5	1,2-Dichloropropane	7.	U
10061-01-5	cis-1,3-Dichloropropene	7.	U
79-01-6	Trichloroethene	7.	U
124-48-1	Dibromochloromethane	7.	U
79-00-5	1,1,2-Trichloroethane	7.	U
10061-02-6	trans-1,3-Dichloropropene	7.	U
75-25-2	Bromoform	7.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	7.	U
591-78-6	2-Hexanone	7.	U
127-18-4	Tetrachloroethene	7.	U
79-34-5	1,1,2,2-Tetrachloroethane	7.	U
108-90-7	Chlorobenzene	7.	U
100-42-5	Styrene	7.	U
110-75-8	2-Chloroethyl vinyl ether	7.	U

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 SOIL SAMPLE RESULTS

SW846-PEST

SAMPLE ID ------->	FDS-S-H023-02
ORIGINAL ID ----->	FDSSH02302
LAB SAMPLE ID --->	40518.01
ID FROM REPORT -->	FDSSH02302
SAMPLE DATE ----->	09/30/99
DATE EXTRACTED -->	10/03/99
DATE ANALYZED --->	10/05/99
MATRIX ---------->	Soil
UNITS ----------->	UG/KG

CAS #	Parameter	40518	VAL
12674-11-2	Aroclor-1016	39.	U
11104-28-2	Aroclor-1221	39.	U
11141-16-5	Aroclor-1232	39.	U
53469-21-9	Aroclor-1242	39.	U
12672-29-6	Aroclor-1248	39.	U
11097-69-1	Aroclor-1254	39.	U
11096-82-5	Aroclor-1260	53.	
319-84-6	alpha-BHC	1.5	U
319-85-7	beta-BHC	1.5	U
319-86-8	delta-BHC	1.5	U
58-89-9	gamma-BHC (Lindane)	1.5	U
76-44-8	Heptachlor	1.5	U
309-00-2	Aldrin	1.5	U
1024-57-3	Heptachlor epoxide	2.8	U
959-98-8	Endosulfan I	1.5	U
60-57-1	Dieldrin	3.	U
72-55-9	4,4'-DDE	12.	
72-20-8	Endrin	3.	U
33213-65-9	Endosulfan II	3.	U
72-54-8	4,4'-DDD	3.	U
1031-07-8	Endosulfan sulfate	3.	U
50-29-3	4,4'-DDT	3.	U
7421-93-4	Endrin aldehyde	3.	U
72-43-5	Methoxychlor	15.	U
5103-71-9	alpha-Chlordane	1.5	U
5103-74-2	gamma-Chlordane	3.2	
8001-35-2	Toxaphene	99.	U
53494-70-5	Endrin ketone	3.	U

3-84

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 GROUNDWATER SAMPLE RESULTS

CYANIDE								
	SAMPLE ID ------>	FDS-G-W15A-01		FDS-G-W15B-01		FDS-G-W15C-01		
	ORIGINAL ID ----->	FDSGW15A01		FDSGW15B01		FDSGW15C01		
	LAB SAMPLE ID --->	28308.01		28308.02		28308.03		
	ID FROM REPORT -->	FDSGW15A01		FDSGW15B01		FDSGW15C01		
	SAMPLE DATE ----->	01/28/97		01/28/97		01/28/97		
	DATE EXTRACTED -->	01/31/97		01/31/97		01/31/97		
	DATE ANALYZED --->	02/01/97		02/01/97		02/01/97		
	MATRIX ---------->	Water		Water		Water		
	UNITS ---------->	UG/L		UG/L		UG/L		
CAS #	Parameter	28308	VAL	28308	VAL	28308	VAL	
57-12-5	Cyanide (CN)	3.	J	7.	J	2.	U	

3-85

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 GROUNDWATER SAMPLE RESULTS

SW846-META													
	SAMPLE ID ------>	FDS-G-W15A-01		FDS-G-W15A-02		FDS-G-W15B-01		FDS-G-W15B-02		FDS-G-W15C-01		FDS-G-W15C-02	
	ORIGINAL ID ----->	FDSGW15A01		FDSGW15A02		FDSGW15B01		FOSGW15B02		FDSGW15C01		FOSGW15C02	
	LAB SAMPLE ID --->	28308.01		29707.04		28308.02		29730.06		28308.03		29730.07	
	ID FROM REPORT -->	FDSGW15A01		FOSGW15A02		FDSGW15B01		FDSGW15B02		FDSGW15C01		FDSGW15C02	
	SAMPLE DATE ----->	01/28/97		06/13/97		01/28/97		06/16/97		01/28/97		06/16/97	
	DATE EXTRACTED -->	01/31/97		06/20/97		01/31/97		06/20/97		01/31/97		06/20/97	
	DATE ANALYZED --->	01/31/97		07/02/97		01/31/97		07/02/97		01/31/97		07/02/97	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	28308	VAL	29707	VAL	28308	VAL	29707	VAL	28308	VAL	29707	VAL
7429-90-5	Aluminum (Al)	100.	J	503.		3010.		209.		962.		474.	
7440-36-0	Antimony (Sb)	2.1	U	1.6	U	2.1	U	1.6	U	3.5	J	1.6	U
7440-38-2	Arsenic (As)	19.4		26.7		4.1	J	4.6	J	2.5	U	2.1	U
7440-39-3	Barium (Ba)	55.2	J	94.5		68.6	J	70.6		159.	J	153.	
7440-41-7	Beryllium (Be)	0.34	U	0.35	U	0.59	U	0.29	U	0.59	U	0.42	U
7440-43-9	Cadmium (Cd)	0.5	U	0.3	U	0.5	U	0.3	U	0.5	U	0.3	U
7440-70-2	Calcium (Ca)	126000.	J	235000.		98800.	J	119000.		268000.	J	284000.	
7440-47-3	Chromium (Cr)	0.92	J	1.5	J	4.7	J	1.	U	1.9	J	1.	U
7440-48-4	Cobalt (Co)	0.9	U	0.8	U	8.1	J	6.8	J	1.3	J	0.8	U
7440-50-8	Copper (Cu)	3.6	J	1.4	U	1.2	U	1.4	U	0.6	U	1.4	U
7439-89-6	Iron (Fe)	4920.	J	6620.		2060.	J	675.		1920.	J	3040.	
7439-92-1	Lead (Pb)	1.7	U	0.9	U	1.7	U	0.9	U	1.7	U	0.9	U
7439-95-4	Magnesium (Mg)	12200.	J	15800.		26200.	J	22800.		19300.	J	14000.	
7439-96-5	Manganese (Mn)	721.	J	515.		1050.	J	813.		806.	J	465.	
7439-97-6	Mercury (Hg)	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
7440-02-0	Nickel (Ni)	3.7	J	0.84	J	3.2	J	1.6	J	1.7	J	0.9	J
7440-09-7	Potassium (K)	10800.		5130.		7410.		8050.		3440.	J	3450.	J
7782-49-2	Selenium (Se)	2.8	U	3.4	U	2.8	U	3.4	U	2.8	U	3.4	U
7440-22-4	Silver (Ag)	1.2	U	1.	U	1.2	U	1.	U	1.2	U	1.	U
7440-23-5	Sodium (Na)	78300.		157000.		92400.		158000.		117000.		114000.	
7440-28-0	Thallium (Tl)	2.7	U	5.3	U	2.7	U	5.1	U	3.3	J	5.7	U
7440-31-5	Tin (Sn)	2.6	U	14.	U	2.6	U	14.	U	2.6	U	14.	U
7440-62-2	Vanadium (V)	1.3	J	1.6	J	6.	J	1.1	J	1.9	J	1.6	J
7440-66-6	Zinc (Zn)	35.6	U	5.8	U	7.1	U	11.9	U	5.3	U	9.8	U

3-86

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 GROUNDWATER SAMPLE RESULTS

SW846-PEST													
	SAMPLE ID ------>	FDS-G-W15A-01		FDS-G-W15A-02		FDS-G-W15B-01		FDS-G-W15B-02		FDS-G-W15C-01		FDS-G-W15C-02	
	ORIGINAL ID ----->	FDSGW15A01		FDSGW15A02		FDSGW15B01		FDSGW15B02		FDSGW15C01		FDSGW15C02	
	LAB SAMPLE ID --->	28308.01		29707.04		28308.02		29730.06		28308.03		29730.07	
	ID FROM REPORT -->	FDSGW15A01		FDSGW15A02		FDSGW15B01		FDSGW15B02		FDSGW15C01		FDSGW15C02	
	SAMPLE DATE ----->	01/28/97		06/13/97		01/28/97		06/16/97		01/28/97		06/16/97	
	DATE EXTRACTED -->	01/29/97		06/16/97		01/29/97		06/18/97		01/29/97		06/18/97	
	DATE ANALYZED --->	01/31/97		06/19/97		01/31/97		06/20/97		01/31/97		06/20/97	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ----------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	28308	VAL	29707	VAL	28308	VAL	29707	VAL	28308	VAL	29707	VAL
319-84-6	alpha-BHC	0.04	UJ	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U
319-85-7	beta-BHC	0.057	J	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U
319-86-8	delta-BHC	0.04	UJ	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U
58-89-9	gamma-BHC (Lindane)	0.04	UJ	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U
76-44-8	Heptachlor	0.04	UJ	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U
309-00-2	Aldrin	0.04	UJ	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U
1024-57-3	Heptachlor epoxide	0.04	UJ	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U
959-98-8	Endosulfan I	0.04	UJ	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U
60-57-1	Dieldrin	0.08	UJ	0.08	U	0.08	U	0.08	U	0.08	U	0.08	U
72-55-9	4,4'-DDE	0.08	UJ	0.08	U	0.08	U	0.08	U	0.08	U	0.08	U
72-20-8	Endrin	0.08	UJ	0.08	U	0.08	U	0.08	U	0.08	U	0.08	U
33213-65-9	Endosulfan II	0.08	UJ	0.08	U	0.08	U	0.08	U	0.08	U	0.08	U
72-54-8	4,4'-DDD	0.08	UJ	0.08	U	0.08	U	0.08	U	0.08	U	0.08	U
1031-07-8	Endosulfan sulfate	0.08	UJ	0.08	U	0.08	U	0.08	U	0.08	U	0.08	U
50-29-3	4,4'-DDT	0.08	UJ	0.08	U	0.08	U	0.08	U	0.08	U	0.08	U
72-43-5	Methoxychlor	0.38	UJ	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U
53494-70-5	Endrin ketone	0.08	UJ	0.08	U	0.08	U	0.08	U	0.08	U	0.08	U
7421-93-4	Endrin aldehyde	0.08	UJ	0.08	U	0.08	U	0.08	U	0.08	U	0.08	U
5103-71-9	alpha-Chlordane	0.04	UJ	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U
5103-74-2	gamma-Chlordane	0.04	UJ	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U
8001-35-2	Toxaphene	2.5	UJ	2.5	U	2.5	U	2.5	U	2.5	U	2.5	U
12674-11-2	Aroclor-1016	1.	UJ	1.	U	1.	U	1.	U	1.	U	1.	U
11104-28-2	Aroclor-1221	1.	UJ	1.	U	1.	U	1.	U	1.	U	1.	U
11141-16-5	Aroclor-1232	1.	UJ	1.	U	1.	U	1.	U	1.	U	1.	U
53469-21-9	Aroclor-1242	1.	UJ	1.	U	1.	U	1.	U	1.	U	1.	U
12672-29-6	Aroclor-1248	1.	UJ	1.	U	1.	U	1.	U	1.	U	1.	U
11097-69-1	Aroclor-1254	2.	UJ	2.	U	2.	U	2.	U	2.	U	2.	U
11096-82-5	Aroclor-1260	2.	UJ	2.	U	2.	U	2.	U	2.	U	2.	U

3-8-97

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 GROUNDWATER SAMPLE RESULTS

SW846-SVOA	SAMPLE ID ------->	FDS-G-W15A-01		FDS-G-W15A-02		FDS-G-W15B-01		FDS-G-W15B-02		FDS-G-W15C-01		FDS-G-W15C-02	
	ORIGINAL ID ----->	FDSGW15A01		FDSGW15A02		FDSGW15B01		FDSGW15B02		FDSGW15C01		FDSGW15C02	
	LAB SAMPLE ID --->	28308.01		29707.04		28308.02		29730.06		28308.03		29730.07	
	ID FROM REPORT -->	FDSGW15A01		FDSGW15A02		FOSGW15B01		FDSGW15B02		FDSGW15C01		FDSGW15C02	
	SAMPLE DATE ----->	01/28/97		06/13/97		01/28/97		06/16/97		01/28/97		06/16/97	
	DATE EXTRACTED -->	01/29/97		06/16/97		01/29/97		06/18/97		01/29/97		06/18/97	
	DATE ANALYZED --->	01/31/97		06/23/97		01/30/97		06/25/97		01/30/97		06/25/97	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	28308	VAL	29707	VAL	28308	VAL	29707	VAL	28308	VAL	29707	VAL
108-95-2	Phenol	1.	J	10.	U	10.	U	12.	U	10.	U	12.	U
111-44-4	bis(2-Chloroethyl)ether	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
95-57-8	2-Chlorophenol	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
541-73-1	1,3-Dichlorobenzene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
106-46-7	1,4-Dichlorobenzene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
100-51-6	Benzyl alcohol	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
95-50-1	1,2-Dichlorobenzene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
95-48-7	2-Methylphenol (o-Cresol)	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
108-60-1	2,2'-oxybis(1-Chloropropane)	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
106-44-5	4-Methylphenol (p-Cresol)	23.		2.	J	10.	U	12.	U	10.	U	12.	U
621-64-7	N-Nitroso-di-n-propylamine	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
67-72-1	Hexachloroethane	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
98-95-3	Nitrobenzene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
78-59-1	Isophorone	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
88-75-5	2-Nitrophenol	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
105-67-9	2,4-Dimethylphenol	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
65-85-0	Benzoic acid	6.	J	50.	U	50.	U	62.	U	50.	U	60.	U
111-91-1	bis(2-Chloroethoxy)methane	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
120-83-2	2,4-Dichlorophenol	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
120-82-1	1,2,4-Trichlorobenzene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
91-20-3	Naphthalene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
106-47-8	4-Chloroaniline	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
87-68-3	Hexachlorobutadiene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
59-50-7	4-Chloro-3-methylphenol	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
91-57-6	2-Methylnaphthalene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
77-47-4	Hexachlorocyclopentadiene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
88-06-2	2,4,6-Trichlorophenol	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
95-95-4	2,4,5-Trichlorophenol	50.	U	50.	U	50.	U	62.	U	50.	U	60.	U
91-58-7	2-Chloronaphthalene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
88-74-4	2-Nitroaniline	50.	U	50.	U	50.	U	62.	U	50.	U	60.	U
131-11-3	Dimethyl phthalate	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
208-96-8	Acenaphthylene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
606-20-2	2,6-Dinitrotoluene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
99-09-2	3-Nitroaniline	50.	U	50.	U	50.	U	62.	U	50.	U	60.	U
83-32-9	Acenaphthene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
51-28-5	2,4-Dinitrophenol	50.	U	50.	U	50.	U	62.	U	50.	U	60.	U

3 of 33

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 GROUNDWATER SAMPLE RESULTS

SW846-SVOA	SAMPLE ID ------->	FDS-G-W15A-01		FDS-G-W15A-02		FDS-G-W15B-01		FDS-G-W15B-02		FDS-G-W15C-01		FDS-G-W15C-02	
	ORIGINAL ID ----->	FDSGW15A01		FDSGW15A02		FDSGW15B01		FDSGW15B02		FDSGW15C01		FDSGW15C02	
	LAB SAMPLE ID --->	28308.01		29707.04		28308.02		29730.06		28308.03		29730.07	
	ID FROM REPORT -->	FDSGW15A01		FDSGW15A02		FDSGW15B01		FDSGW15B02		FDSGW15C01		FDSGW15C02	
	SAMPLE DATE ----->	01/28/97		06/13/97		01/28/97		06/16/97		01/28/97		06/16/97	
	DATE EXTRACTED -->	01/29/97		06/16/97		01/29/97		06/18/97		01/29/97		06/18/97	
	DATE ANALYZED --->	01/31/97		06/23/97		01/30/97		06/25/97		01/30/97		06/25/97	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ---------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	28308	VAL	29707	VAL	28308	VAL	29707	VAL	28308	VAL	29707	VAL
100-02-7	4-Nitrophenol	50.	U	50.	U	50.	U	62.	U	50.	U	60.	U
132-64-9	Dibenzofuran	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
121-14-2	2,4-Dinitrotoluene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
84-66-2	Diethylphthalate	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
7005-72-3	4-Chlorophenylphenylether	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
86-73-7	Fluorene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
100-01-6	4-Nitroaniline	50.	U	50.	U	50.	U	62.	U	50.	U	60.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	50.	U	50.	U	50.	U	62.	U	50.	U	60.	U
86-30-6	N-Nitrosodiphenylamine	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
101-55-3	4-Bromophenyl-phenylether	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
118-74-1	Hexachlorobenzene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
87-86-5	Pentachlorophenol	50.	U	50.	U	50.	U	62.	U	50.	U	60.	U
85-01-8	Phenanthrene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
120-12-7	Anthracene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
84-74-2	Di-n-butylphthalate	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
206-44-0	Fluoranthene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
129-00-0	Pyrene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
85-68-7	Butylbenzylphthalate	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
91-94-1	3,3'-Dichlorobenzidine	20.	U	20.	U	20.	U	25.	U	20.	U	24.	U
56-55-3	Benzo(a)anthracene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
218-01-9	Chrysene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
117-84-0	Di-n-octyl phthalate	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
205-99-2	Benzo(b)fluoranthene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
207-08-9	Benzo(k)fluoranthene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
50-32-8	Benzo(a)pyrene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
193-39-5	Indeno(1,2,3-cd)pyrene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
53-70-3	Dibenz(a,h)anthracene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U
191-24-2	Benzo(g,h,i)perylene	10.	U	10.	U	10.	U	12.	U	10.	U	12.	U

3-89

*** Validation Complete ***

CHARLESTON CTO-0144 FUEL DISTRIBUTION
LETTER REPORT
AREA 15 GROUNDWATER SAMPLE RESULTS

SW846-VOA													
	SAMPLE ID ------->	FDS-G-W15A-01		FDS-G-W15A-02		FDS-G-W15B-01		FDS-G-W15B-02		FDS-G-W15C-01		FDS-G-W15C-02	
	ORIGINAL ID ----->	FDSGW15A01		FDSGW15A02		FDSGW15B01		FDSGW15B02		FDSGW15C01		FDSGW15C02	
	LAB SAMPLE ID --->	28308.01		29707.04		28308.02		29730.06		28308.03		29730.07	
	ID FROM REPORT -->	FDSGW15A01		FOSGW15A02		FDSGW15B01		FDSGW15B02		FDSGW15C01		FDSGW15C02	
	SAMPLE DATE ----->	01/28/97		06/13/97		01/28/97		06/16/97		01/28/97		06/16/97	
	DATE ANALYZED --->	01/30/97		06/17/97		01/30/97		06/19/97		01/30/97		06/19/97	
	MATRIX ---------->	Water		Water		Water		Water		Water		Water	
	UNITS ----------->	UG/L		UG/L		UG/L		UG/L		UG/L		UG/L	
CAS #	Parameter	28308	VAL	29707	VAL	28308	VAL	29707	VAL	28308	VAL	29707	VAL
74-87-3	Chloromethane	10.	U	10.	U	10.	U	10.	U	10.	U	10.	U
74-83-9	Bromomethane	10.	U	10.	U	10.	U	10.	U	10.	U	10.	U
75-01-4	Vinyl chloride	10.	U	10.	U	10.	U	10.	U	10.	U	10.	U
75-00-3	Chloroethane	10.	U	10.	U	10.	U	10.	U	10.	U	10.	U
75-09-2	Methylene chloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-64-1	Acetone	13.	U	10.	U	10.	U	10.	U	10.	U	10.	U
75-15-0	Carbon disulfide	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-35-4	1,1-Dichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-34-3	1,1-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
540-59-0	1,2-Dichloroethene (total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
67-66-3	Chloroform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
107-06-2	1,2-Dichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-93-3	2-Butanone (MEK)	10.	U	10.	U	10.	U	10.	U	10.	U	10.	U
71-55-6	1,1,1-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
56-23-5	Carbon tetrachloride	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-27-4	Bromodichloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
78-87-5	1,2-Dichloropropane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-01-5	cis-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-01-6	Trichloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
124-48-1	Dibromochloromethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-00-5	1,1,2-Trichloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
71-43-2	Benzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
10061-02-6	trans-1,3-Dichloropropene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
75-25-2	Bromoform	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	10.	U	10.	U	10.	U	10.	U	10.	U	10.	U
591-78-6	2-Hexanone	10.	U	10.	U	10.	U	10.	U	10.	U	10.	U
127-18-4	Tetrachloroethene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
79-34-5	1,1,2,2-Tetrachloroethane	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-88-3	Toluene	3.	J	5.	U	5.	U	5.	U	5.	U	5.	U
108-90-7	Chlorobenzene	6.		5.	U	5.	U	5.	U	5.	U	5.	U
100-41-4	Ethylbenzene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
100-42-5	Styrene	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
1330-20-7	Xylene (Total)	5.	U	5.	U	5.	U	5.	U	5.	U	5.	U
108-05-4	Vinyl acetate	10.	U	10.	U	10.	U	10.	U	10.	U	10.	U
110-75-8	2-Chloroethyl vinyl ether	10.	U	10.	U	10.	U	10.	U	10.	U	10.	U

*** Validation Complete ***

REVISIONS				
LET	DESCRIPTION	PREP'D BY	DATE	APPROVED

PIER K
PIER L
PIER 317 F
PIER 317 A
EXIST. DIESEL PIPING CAPPED WITHIN BLDG. 39 (TYP. FOR 3)
6" ABOVE GROUND
RIVER ROAD
DRY DOCK NO 3
DRY DOCK NO 4
MATCH LINE A
HOBSON AVE.
ENCASE 15'X40'X12" REINFORCE SLAB OVER
10TH STREET
11TH STREET
13TH STREET
VIADUCT ROAD
APPROACH PIER 327
PIER M
APPROACH PIER 325
MATCH LINE A
200,000 GAL. FUEL OIL STORAGE TANK
3909
17,640 BBLS
39-D
2,460 BBLS
3901-A
55,000 BBLS
3900-E
55,000 BBLS
3900-G
17,640 BBLS
39-A
55,000 BBLS
3900-F
55,000 BBLS
3900-H
27,000 BBLS
39-J
10" JUMPOVER AND VALVE
WATER-OIL SEPARATOR
CK VALVE
8" FOAM CONNECTS INTO 16" EO.
SEE NAVFAC DWG. NO. (APPROX. 1955' NOT SHOWN)
Clover Leaf NOT SHOWN
No! See NS621-288

1 BBL. = 42 GALS.

GRAPHIC SCALE
1" = 100'
100' 50' 0 100' 200' 300'

FUEL OIL, DIESEL OIL, SLUDGE OIL, DISTRIBUTION PLAN SCALE: 1" = 100'

LEGEND			
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	FUEL OIL (BLACK)		MANHOLE
	DIESEL OIL		CHECK VALVE
	CLARIFIED DIESEL OIL		RISER
	SLUDGE & DRAIN LINES		VALVE
	FOAM LINES		PUMP
	SEWER LINES		MANIFOLD
—A—	PIPING ABANDONED		

MBTB ARCHITECTS-ENGINEERS
ORIGINAL: SOUTH CAROLINA 1936

DSGN MATHIS DR POOLE CHK WOODS
SUPV WOODS CH ENGR BOWEN
SUBMITTED BY DATE
FIRM MEMBER (TITLE)
SOUTHERN DIV — DESIGN DIVISION
PDE
APPROVED DATE
OFFICER IN CHARGE
APPROVED DATE
EFD FOR COMMANDER, NAVFAC

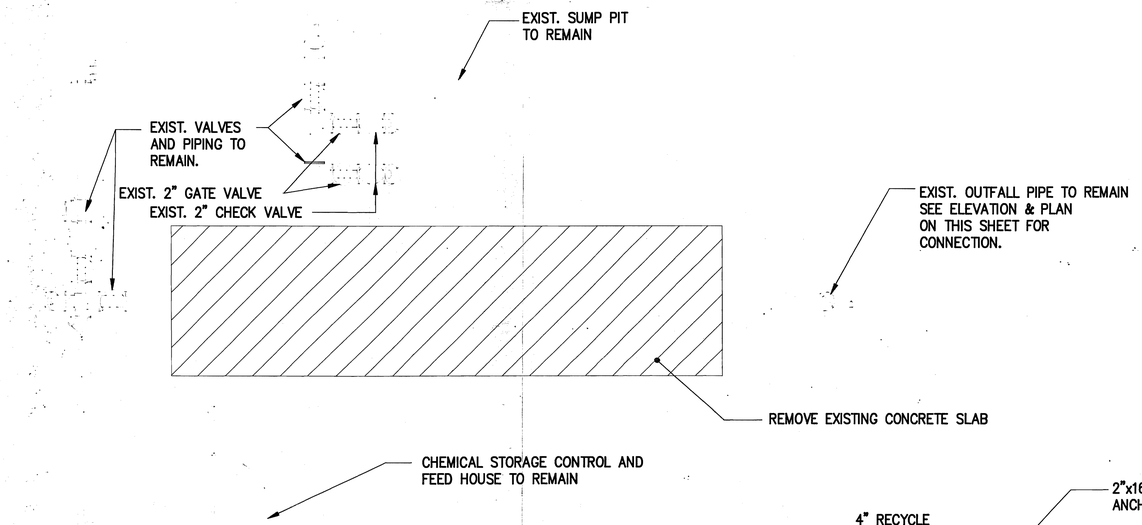
ARCH. & ENGR. SEAL

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
SOUTHERN DIVISION
CHARLESTON, S.C.

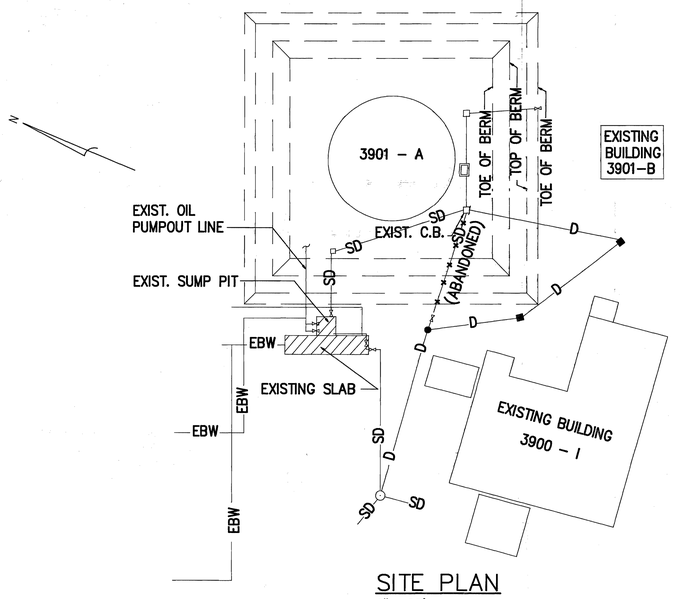
NAVAL STATION - CHARLESTON, S.C.
FUEL OIL, DIESEL OIL, SLUDGE OIL, DISTRIBUTION PLAN

SIZE | CODE IDENT NO. 80091 | NAVFAC DRAWING NO.
CONTR CONT NO.
SCALE AS SHOWN | SPEC | SHEET 1 OF 2

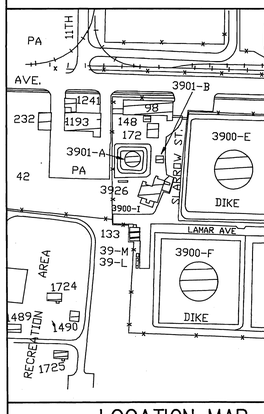
H3900-86



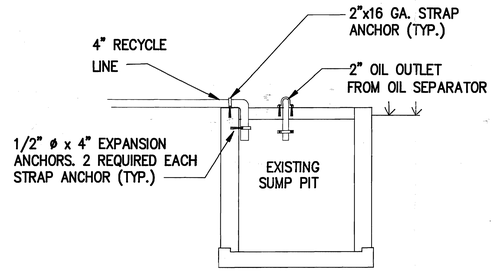
A C1|C1 REMOVAL PLAN
3/8" = 1'-0"



SITE PLAN
1"= 20'

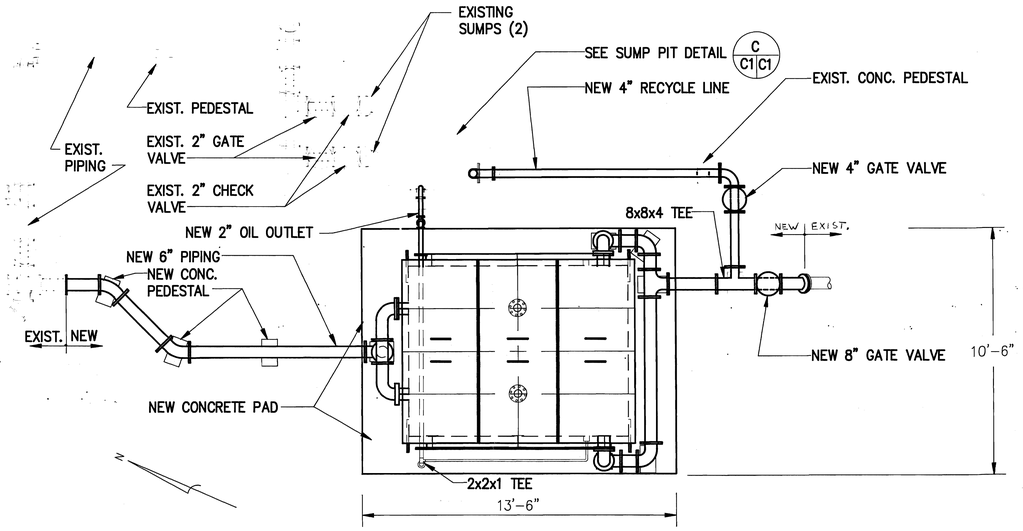


LOCATION MAP

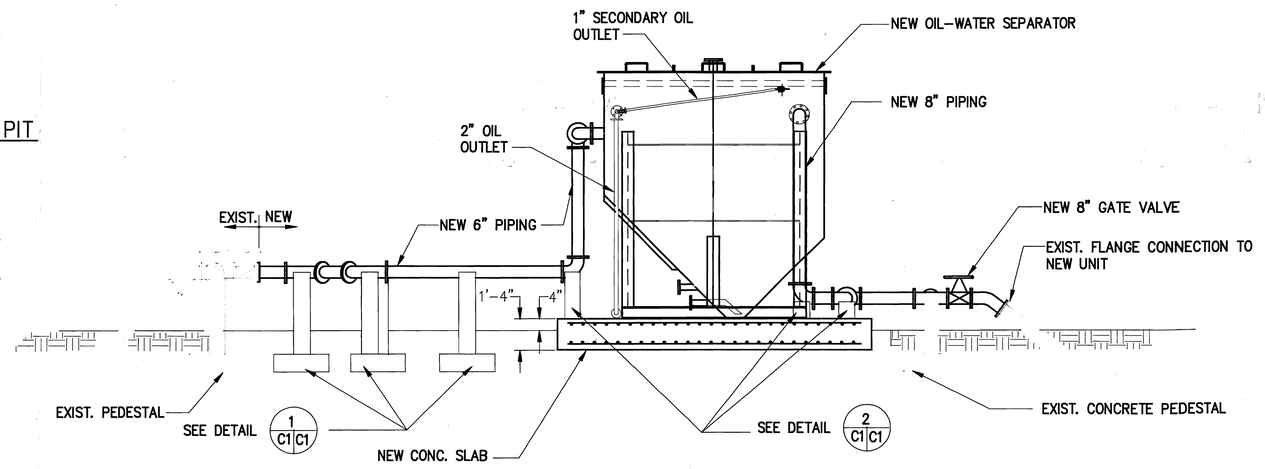


NOTE: ALL PIPING TO SUMP PIT TO BE SLOPED 1/4" PER FT. MIN. ANCHORED AND STRAPPED DOWN

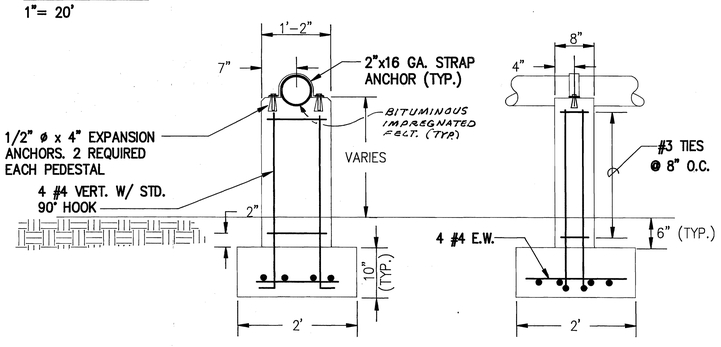
C C1|C1 SECTION @ SUMP PIT
3/8" = 1'-0"



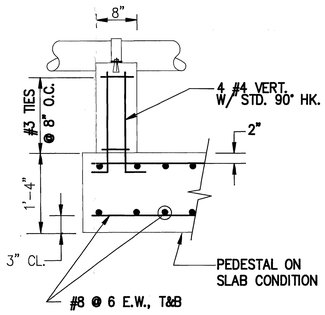
B C1|C1 PLAN
3/8" = 1'-0"



D C1|C1 ELEVATION
3/8" = 1'-0"

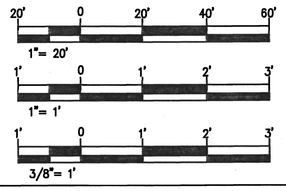


1 C1|C1 PEDESTAL ON FOOTING
1" = 1'-0"



2 C1|C1 PEDESTAL @ SLAB
1" = 1'-0"

GRAPHIC SCALES



NOTES:

1. ALL CAST IN PLACE CONCRETE 28-DAY COMPRESSIVE STRENGTH SHALL BE 3500 PSI.
2. ALL REINFORCING STEEL SHALL BE ASTM A615 GRADE GRADE 60.
3. ALL STRAP ANCHORS AND EXPANSION ANCHORS SHALL BE GALVANIZED.

SYMBOL	DESCRIPTION REVISIONS	DATE	APPROVAL

THE LPA GROUP, INC.
COLUMBIA, S.C.

P.W. DWG. NO.	H3900-144
DESIGNED:	GKG
DRAWN:	GCC\KJF
SECT. HDR:	GKG 7/19/90
BR. MGR.	DAVIS
APPROVED:	7/23/90 DATE
DIRECTOR ENGR. DIVISION APPROVED:	DATE
OFFICER IN CHARGE SATISFACTORY TO:	DATE 7/19/90
REQUEST NO.	8-6139
SCALE	AS NOTED

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON NAVAL SHIPYARD, CHARLESTON, S.C.

OIL-WATER SEPARATOR REMOVAL AND REPLACEMENT

SITE PLAN & DETAILS

NAV. FAC. DRAWING NO.	
CONSTR. CONTR. NO.	N62467-90-C-4438
SPEC.	06-90-4438
SHEET	1 OF 1