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FINAL REMEDIAL ACTION PLAN FOR SHERMAN FIELD FORMER FUEL FARM UST SITE 000024 WITH TRANSMITTAL NAS PENSACOLA FL
11/25/2002
TETRA TECH

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Project Number N2827

Ms. Tracie Vaught
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Reference: CLEAN Contract Number N62467-94-D-0888
Contract Task Order (CTO) Number 0182

Subject: Final Remedial Action Plan
Sherman Field Former Fuel Farm
Underground Storage Tank (UST) Site 000024
Naval Air Station (NAS) Pensacola, Florida

Dear Ms. Vaught:

Tetra Tech NUS Inc. (TtNUS) is pleased to submit the Final Remedial Action Plan for UST Site 000024 at NAS Pensacola, Pensacola, Florida for your review. This report has been prepared for the United States Navy Southern Division, Naval Facilities Engineering Command under CTO 0182, for the Comprehensive Long-term Environmental Action Navy (CLEAN) Contract Number N62467-94-D-0888.

If you have any questions regarding the enclosed material, or if I can be of assistance in any way, please contact me at (850) 385-9899, or e-mail at walkerg@ttnus.com.

Sincerely,

/FOR

Gerald Walker, P.G.
Project Manager

Enclosures

cc: Mr. B. Glover, SOUTHNAVFACENGCOM
Mr. G. Campbell, NAS Pensacola
Ms. D. Wroblewski, TtNUS (cover letter only)
Mr. G. Roof, TtNUS(electronic only)
Mr. M. Perry, TtNUS (unbound copy)
Project Office File

Remedial Action Plan
for
Sherman Field Former Fuel Farm Underground Storage Tank Site 000024

Naval Air Station Pensacola
Pensacola, Florida

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 0182

November 2002

03JAX0006

REMEDIAL ACTION PLAN
FOR
SHERMAN FIELD FORMER FUEL FARM
UNDERGROUND STORAGE TANK SITE 000024

NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
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CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0182

NOVEMBER 2002

PREPARED UNDER THE SUPERVISION OF:

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The professional opinions rendered in this decision document identified as Remedial Action Plan for Sherman Field Former Fuel Farm, Underground Storage Tank Site 000024, Naval Air Station Pensacola, Pensacola, Florida were developed in accordance with commonly accepted procedures consistent with applicable standards of practice. Decision documents were prepared under the supervision of the signing engineer and are based on information obtained from others. If conditions are determined to exist differently than those described in this document, then the undersigned professional engineer should be notified to evaluate the effects of any additional information on the project described in this document.

11/22/02

Gregory S. Roof, P.E.
Professional Engineering Number 50842
Tetra Tech NUS, Inc. Engineering Number 7988

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ACRONYMS

A	Area
ABB-ES	ABB Environmental Services, Inc.
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
bls	Below Land Surface
CAD	Computer Aided Design
C_f	Correction Factor
CLEAN	Comprehensive Long-term Environmental Action Navy
cm/sec	Centimeters per Second
COCs	Contaminants of Concern
CSSPC	Coastal Systems Station Panama City
CTO	Contract Task Order
DE	Direct Exposure Limit
D_{fp}	Density of Free Product
DPE	Dual-Phase Extraction
DPT	Direct Push Technology
EDB	1,2-Dibromoethane
$^{\circ}F$	Degrees Fahrenheit
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FFF	Former Fuel Farm
FID	Flame Ionization Detector
FOTW	Federally Owned Treatment Works
ft	Feet (Foot)
ft^2	Square Feet
ft^3	Cubic Feet
GAC	Granular Activated Carbon
GAG	Gasoline Analytical Group
GCTLs	Groundwater Cleanup Target Levels
gpm	Gallons per Minute
HOA	Hand-On-Auto
i	Hydraulic Gradient
K	Hydraulic Conductivity
KAG	Kerosene Analytical Group
LE	Leachability Limit
lb	Pound

ACRONYMS (Continued)

lbs/day	Pounds per Day
LTTD	Low Temperature Thermal Desorption
µg/L	Micrograms per Liter
MDES	Mobile Dual Phase Extraction System
mg/kg	Milligrams per Kilogram
MTBE	Methyl Tertiary Butyl Ether
msl	Mean Sea Level
NAS	Naval Air Station
Navy	United States Navy
n	Porosity
n_e	Effective Porosity
NEMA	National Electrical Manufacturers Association
O&M	Operations and Maintenance
OVA	Organic Vapor Analyzer
PAH	Polynuclear Aromatic Hydrocarbons
ppm	Parts per Million
PVC	Polyvinyl Chloride
RAP	Remedial Action Plan
ROI	Radius of Influence
SAR	Site Assessment Report
SCFM	Standard Cubic Feet per Minute
SCTL	Soil Cleanup Target Level
SVE	Soil Vapor Extraction
T	Average Observed Thickness
TOC	Top of Casing
TRPH	Total Recoverable Petroleum Hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VAC	Voltage Alternating Current
VEE	Vapor Enhanced Extraction
VOCs	Volatile Organic Compounds
Vs	Seepage Velocity
yd^3	Cubic Yards

EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. (TtNUS) has completed a Remedial Action Plan (RAP) for the Sherman Field Former Fuel Farm (FFF) Underground Storage Tank (UST) Site 000024 at Naval Air Station (NAS) Pensacola in accordance with the requirements of Chapter 62-770, Florida Administrative Code (FAC). This RAP is being submitted to the Florida Department of Environmental Protection (FDEP) for approval.

TtNUS performed the following tasks during the preparation of this RAP:

- Reviewed the information provided in the Site Assessment Report (SAR) (TtNUS, 2002).
- Evaluated remedial alternatives for soil and free product at the FFF.
- Prepared a RAP to provide a conceptual design for the remediation of soil and free product recovery and provide remedial equipment specifications.
- Specified a monitoring plan to track the remediation status of the site.
- Specified a system start-up and operation and maintenance (O&M) plan to operate the system.

Site 000024 is the FFF for Sherman Field at NAS Pensacola. The site is the location of four 588,000 gallons, cut and cover fuel tanks that formerly contained JP-4 jet fuel. An equipment malfunction led to a release of 48,000 gallons of JP-4 in 1983. The tanks were abandoned in 1995 when a new fuel facility was constructed.

This RAP identified a bioslurping system as the preferred remedial alternative to remediate the site. Bioslurping is also known as dual-phase extraction (DPE) or vapor enhanced recovery (VEE). In this document VEE will be used. Bioslurping technology both remediates soil contamination and recovers free product with a single system. A pilot study is recommended to ensure an optimal final design. Based on a similar system and similar site conditions at Coastal Systems Station, Panama City (CSSPC), it is estimated that the system should remediate the site in 15 years. O&M requirements of the system will include maintaining the system in a proper operating mode, collecting air samples from the VEE wells to verify that the system is operating as designed, monitoring water discharged to the Federally Owned Treatment Works (FOTW), groundwater sampling, and monitoring free product in monitoring wells.

This RAP includes a conceptual design that was prepared using assumed design parameters from sites with conditions similar to the subject site. These assumptions are significant enough to potentially affect system performance. Therefore, after regulatory approval of the RAP and prior to construction, TtNUS recommends that the Navy perform a pilot study and prepare a final design for the system. Section 6.1.1 provides the minimum information that should be obtained during the pilot study.

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

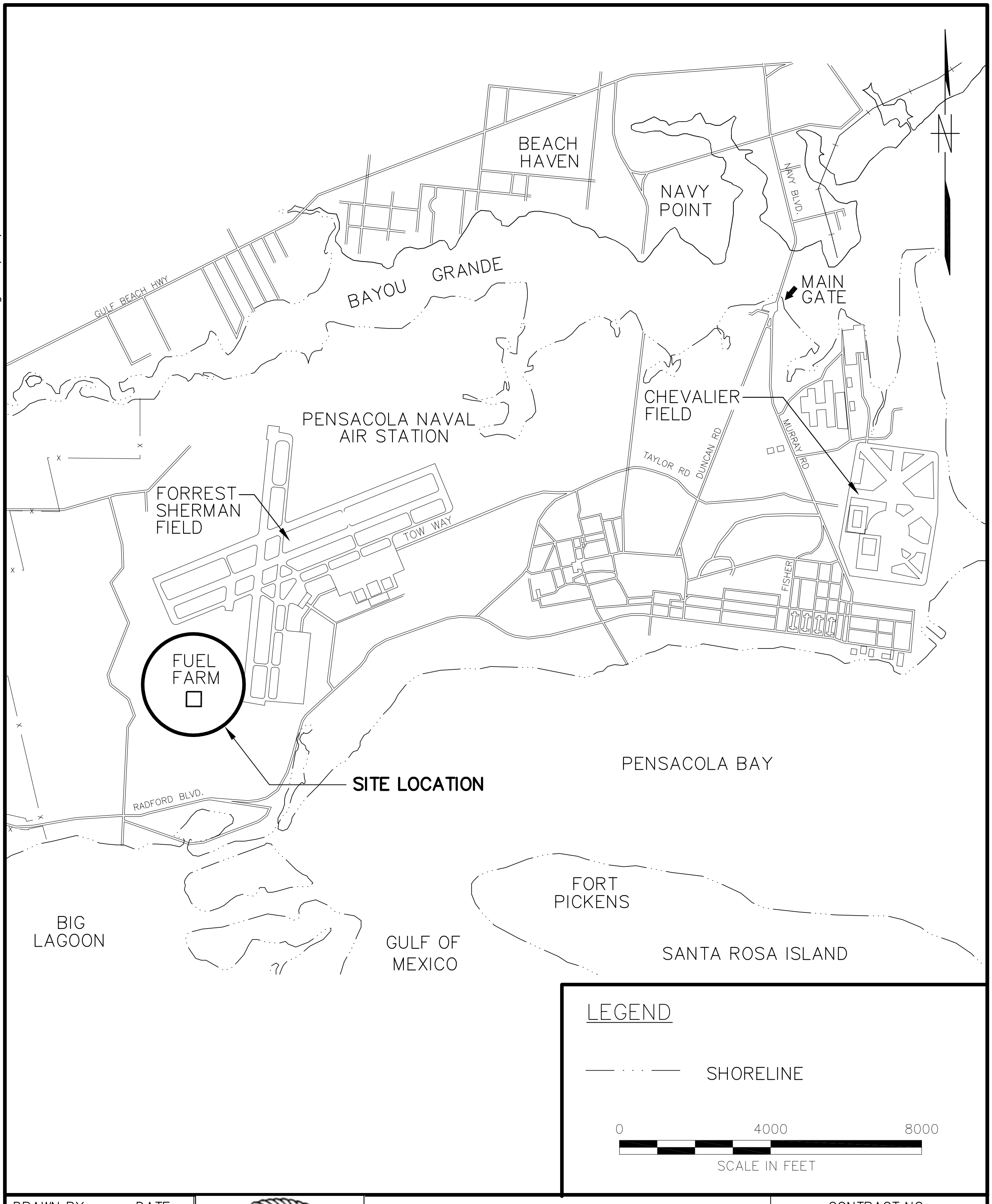
This RAP was prepared by TtNUS for the United States Navy (Navy) Southern Division Naval Facilities Engineering Command under Contract Task Order (CTO) 0182, for the Comprehensive Long-term Environmental Action Navy (CLEAN) III, Contract Number N62467-94-D-0888. The RAP was prepared to evaluate and recommend treatment options for the contaminated soil and free product present at Sherman Field FFF at NAS Pensacola, Pensacola, Florida (Figure 1-1).

In 2001, TtNUS performed site assessment field activities and completed a SAR in 2002 to document the findings at the FFF. The SAR recommended the preparation of a RAP to remove free product and remediate soil at the site. After free product removal and soil remediation, the SAR recommended that on-site groundwater be evaluated for natural attenuation.

The purpose of this RAP is to select an alternative to remediate soil and remove free product to meet the requirements of Chapter 62-770, FAC. This RAP evaluates applicable alternatives to protect human health and the environment, reduce contaminant concentrations within impacted soil, and remove free product from the water table. This RAP recommends the preferred alternative to remediate the site and provides a conceptual design for the selected alternative.

1.2 SITE DESCRIPTION

The FFF, UST Site 000024, is the location of the FFF located at Sherman Field, NAS Pensacola and is adjacent to the new fuel farm. NAS Pensacola is located in northwest Florida on the western side of Pensacola Bay, approximately 2 miles south of Pensacola, Florida, on Navy Boulevard. The site is located on the western perimeter of the base approximately 2400 feet (ft) north of Radford Boulevard, as shown on the Fort Barrancas, Florida, United States Geological Survey Quadrangle Map (Figure 1-2). UST Site 000024 (Figure 1-3), is an approximately 3.5-acre fenced area including four cut-and-cover storage tanks (Tank Numbers 1884, 1886, 1887, and 1888). The petroleum storage tank system was installed in approximately 1945 and used to store JP-4 jet fuel. The fuel storage tanks were abandoned in place in 1995 when a new fuel facility was constructed adjacent to the south of the original fuel farm.



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CHECKED BY / DATE			APPROVED BY / DATE
COST/SCHED-AREA			APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-1 / REV. 0

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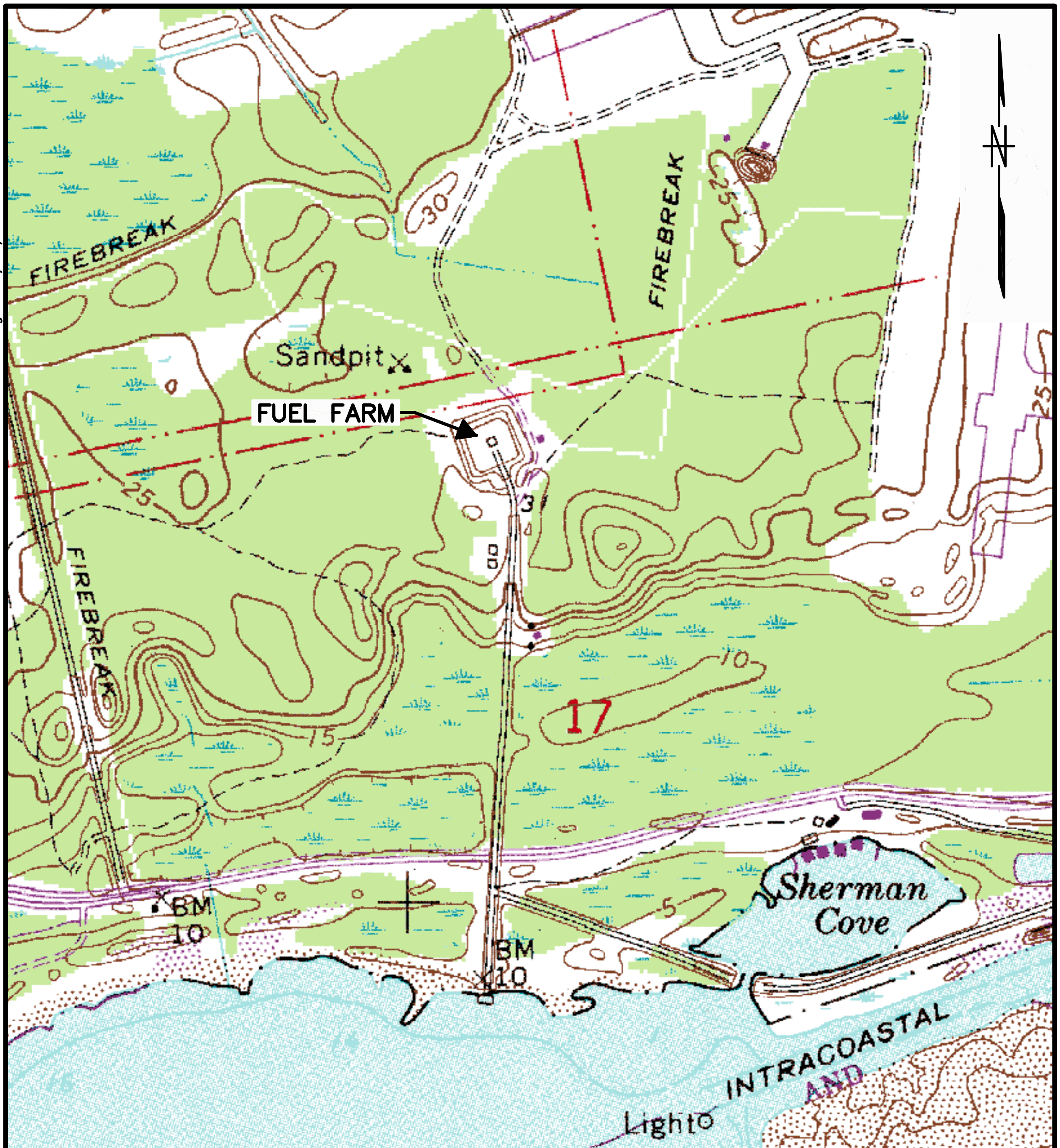

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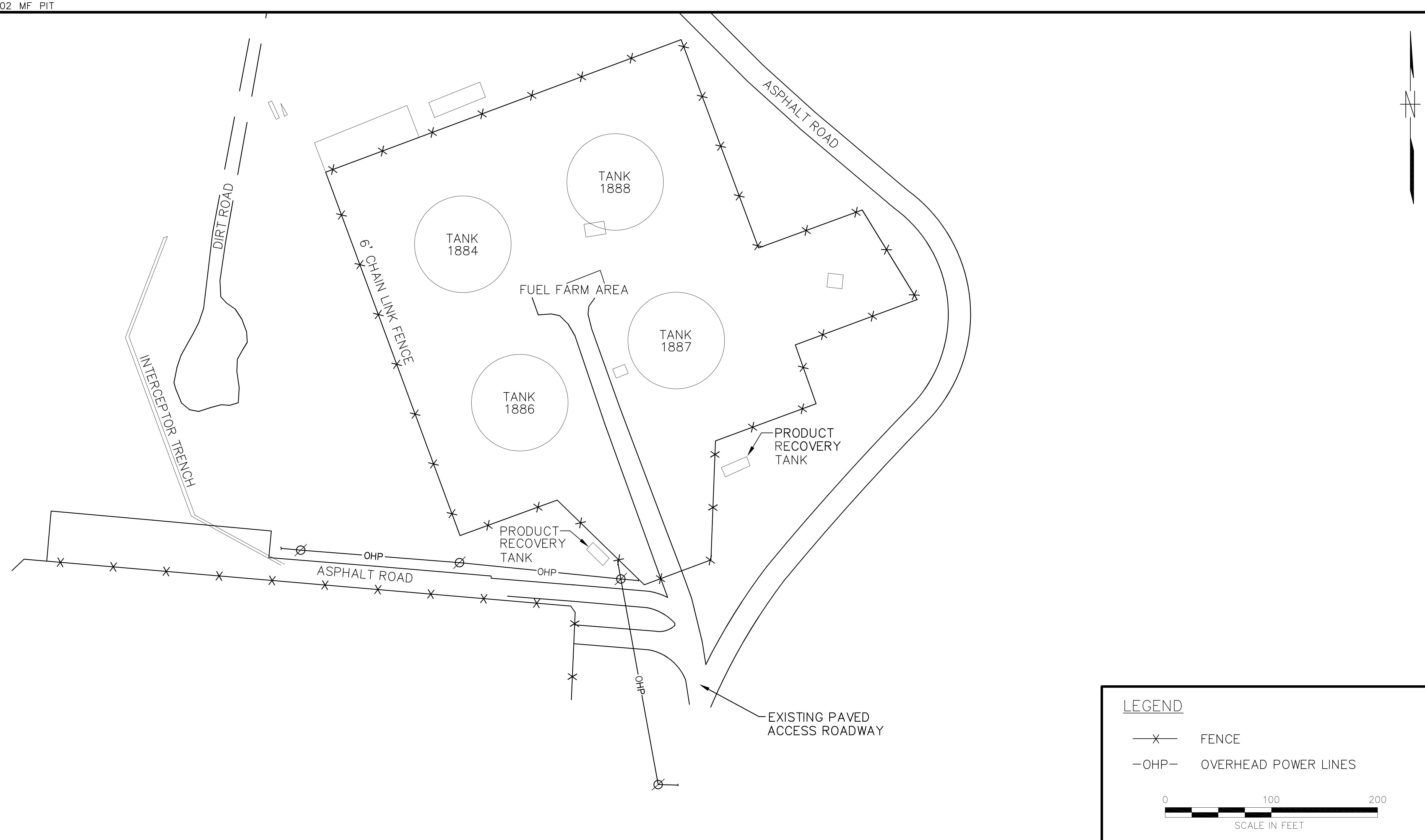

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY: MF DATE: 10/7/02
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COST/SCHED-AREA
SCALE: AS NOTED

SITE PLAN
SHERMAN FIELD FUEL FARM
REMEDIAL ACTION PLAN
NAS PENSACOLA
PENSACOLA, FLORIDA

CONTRACT NO. 2827
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 1-3
REV. 0

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1.3 SITE HISTORY

According to the SAR, an equipment malfunction in 1983 resulted in the release of approximately 48,000 gallons of JP-4 jet fuel. NAS Pensacola personnel installed four recovery ditches initially and recovered approximately 600 to 700 gallons of free product. Shortly thereafter, use of the recovery ditches was discontinued by direction of the NAS Pensacola Fire Marshall. In August 1983, a product/groundwater recovery well system was installed. The recovery system proved ineffective and recovery efforts were discontinued (TtNUS, 2002).

1.4 REPORT ORGANIZATION

This RAP is organized into eight sections. Below is a list of the sections and a brief description of their purpose:

Section 1.0	Introduction	Summarizes the report's purpose, scope, site information, and organization.
Section 2.0	Previous Investigation Findings and Conclusions	Provides information from the approved SAR and summarizes the findings and conclusions.
Section 3.0	RAP Goals	Establishes the soil treatment and free product recovery objectives for the remedial system/plan.
Section 4.0	Contaminant Distribution	Estimates the mass of free product and contaminants in the soil.
Section 5.0	Remedial Alternative Technology Screening	Presents the alternatives for remediation, determines the suitability, and develops budgetary costs for each.
Section 6.0	Remedial System Design	Presents the assumptions made and provides the conceptual design of the preferred remedial alternatives.
Section 7.0	O&M and Monitoring	Establishes start-up and O&M procedures and provides a monitoring plan for the remediation system and sampling frequencies to evaluate the system's effectiveness.
Section 8.0	Remedial Action Plan Summary	Provides the FDEP summary checklist.
	References	Lists references used.

2.0 PREVIOUS INVESTIGATION FINDINGS AND CONCLUSIONS

The following is a summary of the data and information presented in the SAR (TtNUS, 2002).

2.1 LITHOLOGIC FINDINGS

The USTs were installed upon a flat cut base and then covered and the material forming the mound at the FFF is fill.

The typical lithology at the site is yellowish brown to light brown to white, silty-fine to medium-grained sand at normal land surface and below the tank mound. This lithology was encountered across the site from ground surface to depths of approximately 38 ft below land surface (bls), where at location NASP-FF-MW-5I (in mound) an approximately 1-ft thick peat layer was encountered. Peat layers were also encountered in the boring for deep monitoring well NASP-FF-MW-13D at depths of approximately 38 ft bls and 65 ft bls. Other than the peat layers, lithologies that would indicate potential confining layers were not encountered during the site assessment (TtNUS, 2002). Boring logs are contained within the SAR.

Regional lithology information is provided in the SAR (TtNUS, 2002). A copy of the hydrogeologic cross section from the SAR and the cross section location map are included in Appendix A.

2.2 GROUNDWATER AND AQUIFER CHARACTERISTICS

The depth to groundwater ranged from 7.5 to 28.3 ft bls in shallow wells at the site. This was caused by the difference in elevation of wells installed in the mound covering the tanks and those installed off the mound. Water table elevation ranged from 18 to 22 ft above mean sea level (msl). Groundwater flow in the shallow surficial aquifer was reported in the SAR to flow in a radial pattern near the tank mound and is generally to the south-southeast, toward Big Lagoon, Sherman Cove, and Pensacola Bay (TtNUS, 2002). The groundwater elevation map for November 5, 2000 from the SAR is included in Appendix A. Groundwater level measurement results are presented in Table 3-1 from the SAR that is attached in Appendix B.

The following aquifer parameters were provided in the SAR (TtNUS, 2002):

- Hydraulic conductivity K = 141.20 ft per day or 4.981 x 10^{-2} centimeters per second (cm/sec)
- Hydraulic gradient i = 0.00526 ft per foot
- Seepage Velocity Vs = 905.2 ft per year
- Effective Porosity n_e = 0.30 (unitless)

2.3 CONTAMINATED SOIL ASSESSMENT

The vertical and horizontal extent of petroleum impacted soil in the vadose zone was assessed through soil vapor analysis performed during the soil boring investigation described in the SAR (TtNUS, 2002).

During the SAR field activities performed in July 2000, the extent of soil contamination was determined by the installation of soil borings and Organic Vapor Analyzer (OVA)-Flame Ionization Detector (FID) screening of soil samples. Forty-one soil borings (SB-1 through SB-41) were installed by direct push technology (DPT) to the water table that was encountered at approximately 10.5 to 27 ft bls. Results of the initial soil screening indicated that 26 of the 41 soil borings exhibited FID readings greater than 50 parts per million (ppm). SAR Table 4-1, which summarizes the soil screening results, is included in Appendix B. The soil sampling and DPT borehole locations map from the SAR is included in Appendix A.

In addition, figures from the SAR presenting the 50-ppm isoconcentration lines for soil gas at 4 to 8 ft bls and above the water table are included in Appendix A. Based on the JP-4 released at the site, 50-ppm soil gas is the criteria for "excessively contaminated" soil as defined in Chapter 62-770, FAC.

Twelve confirmatory soil samples were collected for off-site laboratory analysis during the SAR field activities. Six of the samples [SB-11, SB-12 (at 8 ft and 24 ft), SB-13, SB-16, and SB-28] exhibited results that exceeded FDEP Leachability (LE) and/or Direct Exposure (DE) limits. Table 4-2 from the SAR (Appendix B) summarizes the analytical results from the confirmatory soil sample analysis and indicates FDEP Soil Cleanup Target Level (SCTL) exceedances.

The results of the soil assessment indicate that there are petroleum-impacted soils at the site exceeding FDEP SCTLs. Based on soil screening data, the contaminants appear to be located throughout the unsaturated soil as depicted on Figure 4-1 and Figure 4-2 of the SAR (included in Appendix A).

2.4 CONTAMINATED GROUNDWATER ASSESSMENT

The FDEP-approved SAR for the FFF recommended that groundwater sampling of natural attenuation parameters should be conducted after free product recovery and soil remediation have been completed. Therefore, groundwater remediation will not be addressed in this RAP. Groundwater remediation will be addressed after the free product removal and soil remediation has been completed. Included below is a brief summary of groundwater contamination findings from the SAR (TtNUS, 2002).

During November 2000, groundwater samples were collected from 22 shallow monitoring wells, 2 intermediate monitoring wells, and 1 deep monitoring well installed at the site. Twenty-five groundwater samples were collected and analyzed for Volatile Organic Compounds (VOCs), Polynuclear Aromatic Hydrocarbons (PAHs), 1,2-dibromoethane (EDB), Total Recoverable Petroleum Hydrocarbons (TRPH), and lead at an off-site laboratory. During the second sampling event in October and November 2001, groundwater samples were collected from 17 shallow monitoring wells, 3 intermediate monitoring wells, and 1 deep monitoring well. The samples were analyzed for VOCs, PAHs, EDB, TRPH, and lead at an off-site laboratory. The monitoring well location map from the SAR is included in Appendix A. Tables 4-3, 4-4, and 4-5 depicting the laboratory analytical results for both sampling events can be found in Appendix B.

Benzene, ethylbenzene, and total xylene were reported at concentrations exceeding FDEP Groundwater Cleanup Target Levels (GCTLs) in groundwater samples collected from the monitoring wells. The PAH compounds 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene were reported at concentrations exceeding GCTLs in groundwater samples collected from the monitoring wells. TRPH was also reported at concentrations exceeding GCTLs in groundwater samples collected from the monitoring wells.

Benzene detections exceeding the GCTL of 1 micrograms per liter (µg/L) were reported in eight of the November 2000 groundwater samples. The GCTLs for ethylbenzene and total xylene, 30 and 20 µg/L respectively, were exceeded in eight monitoring wells in November 2000. In the samples collected in October and November 2001, benzene was detected above the GCTL in four samples ranging from 5.7 to 670 µg/L and the GCTLs for ethylbenzene and total xylene were exceeded in six monitoring wells.

The PAH analytical results from November 2000 indicate that 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene were detected at concentrations exceeding the GCTLs of 20 µg/L in eight of the groundwater samples at concentrations ranging from 21 to 200 µg/L. Except for monitoring well MW5-S, exceedances for these compounds also occurred in the samples from wells with reported benzene, toluene, ethylbenzene, and xylene (BTEX) exceedances. Exceedances of the TRPH GCTL of 5,000 µg/L also occurred in samples from wells where exceedances of BTEX were reported. The TRPH exceedances ranged from 5,600 to 28,000 µg/L. The October/November 2001 analytical results also indicate the above PAH compounds exceeding the GCTLs in six wells ranging from 20.5 to 190 µg/L and TRPH exceedances in four wells ranging from 5,000 to 10,700 µg/L.

The November 2000 sampling data contained one exceedance of the methylene chloride GCTL of 5 µg/L in MW16-S at an estimated concentration of 13 µg/L and one exceedance of the chloroform GCTL of 5.7 µg/L in MW14-S at a concentration of 6.6 µg/L. Neither constituent exceeded the GCTLs in the samples collected in October/November 2001. The November 2000 data had detections for lead in five wells, and the October/November 2001 data had detections in six wells, none of which exceeded the GCTL of 15 µg/L. Methyl Tertiary Butyl Ether (MTBE) was detected in November 2000 in the deep monitoring well NASP-FF-MW-13D at an estimated concentration of 5.1 µg/L, and in October 2001 at 4.6 µg/L, both of which are below the GCTL of 50 µg/L. There were no detections of EDB during either sampling event (TtNUS, 2002).

2.5 FREE PRODUCT

Free product thickness measurements were recorded from site monitoring wells during three of the four gauging events, on July 19, 2000, September 6 to 26, 2000, November 5, 2000, and January 11, 2002. The initial measurement period in July 2000 and the latest event in January 2002 included all existing monitoring wells installed during previous investigations. The two events in September and November 2000 included only the monitoring wells installed as part of this SAR investigation. Free product measurements ranged from a visible sheen to 1.64 ft in thickness. Nine of the monitoring wells at the site contained measurable thickness of free product and two of the wells contained a visible sheen. Free product thickness measurements from the combined July and September 2000 measurement events are presented in Appendix A (SAR Figure 3-2).

2.6 SITE ASSESSMENT REPORT CONCLUSIONS AND RECOMMENDATIONS

The conclusions based on the data collected during the site assessment performed by TtNUS at the FFF, UST Site 000024, are summarized as follows:

- Excessively contaminated soil at the site exceeded DE and/or LE SCTLs (Chapter 62-777, FAC). Soil contamination at the site is generally limited to the immediate vicinity of the former fuel tanks.

- Free-product accumulations within existing site monitoring wells ranged from a sheen to over 1.6 ft in thickness.

- Concentrations of dissolved petroleum contaminants of concern (COCs) in site groundwater exceeded GCTLs (Chapter 62-777, FAC).

Based upon the hydrogeological and chemical data presented in the SAR and the requirements of Chapter 62-770, FAC, TtNUS recommended that a RAP be completed and active remediation of the free-product and soils be addressed. Following active remediation of the soil and free product, the dissolved concentration of contaminants in the groundwater should be evaluated and a remedy for any groundwater contamination be selected and implemented, as applicable.

3.0 REMEDIAL ACTION PLAN GOALS

The objective of this RAP is to present relevant and cost-effective technologies to

- Remove the free product and remediate petroleum-impacted soil.

- Protect human health and the environment by reducing the concentrations of soil contamination and the amount of free-phase hydrocarbons at the site.

The goals and expected accomplishments of the RAP include:

- Identify a method to remediate or remove petroleum-impacted soil and remove free product.

- Select a remedial alternative that will result in a reduction of the leaching of hydrocarbon constituents to the groundwater matrix.

- Be protective of nearby water bodies.

The target cleanup concentrations for the soil at the subject site are based on analytes detected in the soil in exceedance of Chapter 62-777, FAC. The following subsections list the target levels for the site-specific COCs.

3.1 SOIL TARGET LEVELS

Based on the selected SCTLs listed in Table II of Chapter 62-777, FAC, Table 3-1 presents the soil remediation goals for the site-specific COCs.

3.2 FREE PRODUCT TARGET LEVELS

Chapter 62-770, FAC, defines free product as petroleum or petroleum product in excess of 0.01 ft in thickness, measured at its thickest point, floating on surface water or groundwater. As a result of this definition, the remedial action goal for free product removal at the FFF will be to remove free product in excess of 0.01 ft.

Table 3-1
Chemicals of Concern and Associated Selected Soil Cleanup Target Levels

Remedial Action Plan
Sherman Field Former Fuel Farm, UST Site 000024
Naval Air Station Pensacola
Pensacola, Florida

Site-Specific COCs	Concentrations from Table II*
Benzene	0.007 mg/kg
Ethylbenzene	0.6 mg/kg
Total Xylenes	0.2 mg/kg
1-Methylnaphthalene	2.2 mg/kg
2-Methylnaphthalene	6.1 mg/kg
TRPHs	340 mg/kg

Notes:
* Concentration is the lower of the residential direct exposure SCTL or leachability SCTL based on groundwater criteria Table II, Chapter 62-777, FAC.
mg/kg = milligrams per kilogram

4.0 CONTAMINANT DISTRIBUTION

4.1 ESTIMATED MASS OF CONTAMINANTS IN SOIL

Net soil vapor readings in excess of 50 ppm were used to define “excessively contaminated soil” in accordance with Rule 62-770.200(2), FAC. For the site, the area of impacted soil was calculated by creating a 50-ppm line on a Computer Aided Design (CAD) program. CAD features an option that will calculate the area of an entity. This feature was used to find the area within the 50-ppm isocontour presented in SAR Figure 4-2. The approximate area was found to be the following:

Approximate Area = 108,000 square ft (ft^2)

For estimating purposes in this RAP, the volume of the contaminated soil was calculated by multiplying the above area by the estimated thickness (23 ft) of the soil contamination. A thickness of 23 ft was chosen a conservative estimate and represents the depth from the top of the mound to the water table (27 ft) minus the upper four feet where no contamination was reported. In addition, the volume of the four 588,000 gallon tanks was subtracted from initial volume. The estimated volume of contaminated soil is as follows:

Volume = 1,854,163 cubic ft (ft^3) = 68,673 cubic yards (yd^3)

The mass of contaminants in unsaturated soil was calculated using the average TPRH concentration to estimate total hydrocarbon mass. The mass of contamination is as follows:

Mass of contamination = 96,429 pounds (lbs)

Appendix C presents volume and mass calculations.

4.2 ESTIMATED MASS OF FREE PRODUCT

A determination of free product contaminant mass was completed for the site. The area of free product was calculated using the CAD method discussed above. Encompassing all wells that have been measured to contain free product during past events created the free product area. The determination was completed using the formula:

Total free product mass = $A * T * n * C_f * D_{fp}$

where:

T = Average observed thickness = 0.52 ft

A = Total area of plume = 135,000 ft^2 (from CAD)

n = Porosity = 0.30

C_f = Correction factor for soil type (0.50 for sand)

D_{fp} = Density of free product (49.12 lb/ft^3)

The area of the plume from the January 2002 event was used to calculate an average free product thickness of 0.52 ft. The free product mass calculation was performed in the SAR (TtNUS, 2002) and it was recalculated using the free product area obtained from CAD as discussed in Section 4.1. Based on the above assumptions and the data provided in the SAR, the free product contaminant mass is estimated at 517,234 lbs.

5.0 REMEDIAL ALTERNATIVE TECHNOLOGY SCREENING

TtNUS conducted a screening of available technologies to determine suitable remedial alternatives for the subject site. Potential remedial technologies and process options for the soil and free product remediation have been identified and evaluated based on their ability to meet some or all of the following clean-up objectives: effectiveness, applicability based on site conditions, feasibility of implementation, reliability, anticipated duration, and cost.

5.1 EVALUATION TREATMENT ALTERNATIVES

Based on the calculations included in Appendix C, approximately 96,355 yd^3 of soil is impacted at the site. TtNUS has investigated alternatives for the reduction of hydrocarbons in the soils and recovery of free product at the site. The following actions have been identified for the potential remediation of impacted soil and free product recovery in this RAP:

- Excavation and off-site disposal with dewatering
- Excavation and on-site treatment with dewatering
- Water Table Depression and Soil Vapor Extraction (SVE)
- Bioslurping

The following sections briefly discuss each of these remedial actions with respect to their suitability for implementation at this site.

5.1.1 Excavation and Off-site Disposal with Dewatering

This alternative consists of the physical removal and off-site disposal of impacted soil. To complete the excavation of impacted soil, removal of soil from the surface to the depth of 1 ft below the water table over an area of approximately 108,000 ft^2 would be required. In this scenario the soil would be excavated to approximately 1 ft below the water table, which would require dewatering with collection, treatment, and disposal of groundwater and free product. During the excavation of the tank mound, it would be necessary to remove the four abandoned fuel tanks and all associated piping from the excavation area. In addition, the inert fill material will need to be disposed of properly.

The stockpiled soil and other debris generated during excavation will be characterized, loaded, and transported off site to a permitted facility for treatment and/or disposal. It is assumed that since the soil is petroleum impacted, the soil can be disposed of in a Subtitle D landfill that accepts non-hazardous solid bulk waste, as opposed to a hazardous waste landfill regulated by Resource Conservation and Recovery

Act land disposal restrictions (Subtitle C). The Broadhurst Environmental Landfill located in Jessup, Georgia is a nearby Subtitle D Landfill, which will accept petroleum-impacted soil. Water collected during dewatering would need to be contained, sampled, and disposed in accordance with regulatory guidelines.

Soil sampling and analysis will be performed to confirm that the excavation activities have removed the soil contamination. When the excavation activities are complete, the excavation will be back-filled with clean backfill material. The site will be backfilled to the grade of the area surrounding the tank mound. Based on the SAR cross-section map (Figure 3-1), the area surrounding the mound has an average depth to water of 10 ft bls. Hence, it will be necessary to backfill an estimated 44,000 yd^3 of clean soil at the site.

It is expected that removal of 108,000 yd^3 of soil and restoration to grade by two backhoes would take approximately three to six months.

5.1.1.1 Dewatering During Soil Excavation

Free product may be recovered prior to and during excavation activities by dewatering, using trash pumps or conventional vacuum trucks. During excavation activities, free product and groundwater present in the excavation are removed by one of the above-mentioned methods. The removed product and water from dewatering activities will be treated at or disposed of at an off-site facility.

Free product dewatering is expected during soil excavation activities, and therefore the duration of the excavation phase of the project would determine the time limit for free product removal. Preliminary calculations indicate an estimated remedial time period of 3 to 6 months for excavation and disposal.

5.1.1.2 Alternative Summary

The primary advantage of the excavation and disposal alternative is the complete removal or treatment of contaminants from the site over a short period of time. Impacted soils can be physically removed from the site in a matter of months, as opposed to the years that are required using in-situ treatment alternatives. This eliminates the potential for dispersion of hydrocarbon constituents to unaffected soil or groundwater during the remedial process and reduces potential adverse human health risks. The primary disadvantages of this excavation alternative is the high cost relative to in-situ treatment systems and the difficulty associated with the removal of the abandoned fuel tanks.

The estimated costs for three months of soil excavation, transportation, off-site disposal, dewatering, and site restoration is presented in Table 5-1 and Appendix D, Table D1.

Table 5-1
Cost Comparison for Combined Soil and
Free Product Remedial Alternatives

Remedial Action Plan
Sherman Field Former Fuel Farm, UST Site 000024
Naval Air Station Pensacola
Pensacola, Florida

COMBINED ALTERNATIVE	TOTAL PRESENT COST
Water Table Depression and SVE	$2,352,000
Bioslurping	$965,000
Soil Excavation and Off-site Disposal with Dewatering	$8,050,000
Soil Excavation and On-site Treatment with Dewatering	$3,328,000

Note: See Appendix D for detailed cost estimates for the remediation alternatives.

5.1.2 Excavation and On-site Treatment with Dewatering

This alternative consists of the physical removal and on-site treatment of impacted soil. To complete the excavation of impacted soil, removal of soil from the surface to the depth of 1 ft below the water table over an area of approximately 108,000 ft^2 would be required. In this scenario the soil would be excavated to approximately 1 ft below the water table, which would require dewatering with collection, treatment, and disposal of groundwater and free product. During the excavation of the tank mound it would be necessary to remove the four abandoned fuel tanks and all associated piping from the excavation area. In addition, the inert fill material will need to be disposed of properly or treated in the low termperature thermal desorbtion (LTTD) unit.

The stockpiled soil can be treated at the site either by biopiles, land farming, or by a mobile LTTD unit. Biopiles and land farming are used to reduce concentrations of petroleum constituents in excavated soils through the use of biodegradation by aeration. While tilling and plowing aerate land farms, biopiles are aerated most often by forcing air to move through slotted piping placed throughout the pile. Biopiles and land farms have been proven effective in reducing concentrations of nearly all of the petroleum product constituents. While the lighter petroleum products are removed by volatilization, the heavier petroleum products do not evaporate and breakdown as a result of biodegradation. However, higher molecular weight petroleum constituents, such as heating and lubricating oils and to a lesser extent in diesel fuel and kerosene, require a longer period of time to degrade [United States Environmental Protection Agency (USEPA), 1995]. JP-4 is similar in nature to kerosene and as such is expected to require an extended treatment time using this technology. Because of the long time period to degrade the large volume of contaminant present by land farming or biopiles, these two options are ruled out, and it is recommended that LTTD be used for the selected remedial option for on-site treatment.

LTTD, also known as low-temperature thermal volatilization, thermal stripping, and soil roasting, is an ex-situ remedial technology that uses heat to physically separate petroleum hydrocarbons from excavated soils. Thermal desorbers are designed to heat soils to temperatures sufficient to cause constituents to volatilize and desorb (physically separate) from the soil. The vaporized hydrocarbons are generally treated in a secondary treatment unit (e.g., an afterburner, catalytic oxidation chamber, condenser, or carbon adsorption unit) prior to discharge to the atmosphere. Treated soil is typically re-deposited on site or used as cover in landfills. Thermal desorption systems fall into two general classes: off-site stationary facilities or on-site mobile units. Contaminated soils are excavated and either transported to stationary facilities or treated on-site by mobile units. LTTD has proven effective in reducing concentrations of petroleum products including gasoline, jet fuels, kerosene, diesel fuel, heating oils, and lubricating oils. LTTD is applicable to constituents that are volatile at temperatures as great as 1,200 degrees Fahrenheit ($^{\circ}$F) (USEPA, 1995). For large sites, mobile LTTD units are more cost effective as transportation costs are a smaller fraction of the overall treatment cost. For costing purposes, a mobile LTTD unit was chosen.

Soil sampling and analysis will be performed to confirm that the excavation activities have removed the soil contamination. When the excavation activities are completed, the excavation will be back-filled with the treated soil.

It is expected that removal of 108,000 yd^3 of soil and restoration by two backhoes would take approximately three to six months.

5.1.2.1 Dewatering During Soil Excavation

Free product may be recovered prior to and during excavation activities by dewatering, using trash pumps or conventional vacuum trucks. During excavation activities, free product and groundwater present in the excavation are removed by one of the above-mentioned methods. The removed product and water from dewatering activities will be treated at or disposed of at an off-site facility.

Free product dewatering is expected during soil excavation activities, and therefore the duration of the excavation phase of the project would determine the time limit for free product removal. Preliminary calculations indicate an estimated remedial time period of 3 to 6 months for excavation and on-site treatment.

5.1.2.2 Alternative Summary

The primary advantage of this excavation alternative is the complete treatment of contaminants from the site over a short period of time. Impacted soils can be physically removed from the site in a matter of months, as opposed to the years that are required using in-situ treatment alternatives. This eliminates the potential for dispersion of hydrocarbon constituents to unaffected soil or groundwater during the remedial process and reduces potential adverse human health risks. If on-site treatment is performed, the treated soil can be placed back into the excavation, and soil disposal and clean backfill costs are not incurred. The primary disadvantages of this excavation alternative is the high cost relative to in-situ treatment systems and the difficulty associated with the removal of the abandoned fuel tanks.

The estimated costs for three months of soil excavation, transportation, on-site treatment by LTTD, dewatering, and site restoration is presented in Table 5-1 and Appendix D, Table D2. It should be noted that the costs calculated for this LTTD alternative include the cost for a typical small LTTD.

5.1.3 Water Table Depression and SVE

5.1.3.1 Water Table Depression

This method of free product recovery creates a depression in the water table so that free product is directed toward pumping wells within the plume area. Both free product and groundwater are extracted during recovery operations as the pump removes free product and water from the subsurface. The design of this system is constrained by the need to minimize drawdown of the water table because minimizing drawdown will reduce both the volume of co-produced water as well as the smearing of free product along the drawdown surface.

Product recovery systems using water table depression are most applicable when hydraulic control of the hydrocarbon plume is necessary. These systems can operate in a wide range of permeability values and geologic media. Typically, free product recovery with water table depression is used in long-term operations of greater than one year (USEPA, 1996). The primary constraints on the design of this system include the need to minimize pumping rates and drawdown but still provide hydraulic control of the free product.

To accomplish free product removal with groundwater depression, specialized pumps would be installed in water table depression wells. Based on calculations, included in Appendix E, it would be necessary to install 21 groundwater recovery wells at the site. The wells would be installed in a straight line perpendicular to groundwater flow. The wells would be spaced approximately 24 ft apart. The free product and groundwater would be removed from these wells and separated. The free product would be stored in drums or a tank on site, and the groundwater treated and discharged to the FOTW.

Free product recovery using groundwater depression can generate large quantities of co-produced groundwater. Two options for the disposal of recovered groundwater include FOTW discharge or treatment and recharge to the water-bearing geologic formation. Because of the cost of treating contaminated groundwater and permitting, discharging it to the FOTW is preferred (provided the facility will accept discharges). Some pretreatment, such as phase separation, would be required before discharging to the sanitary sewer.

Operational time to remediation using groundwater depression was estimated at 20 years. Experience with free product recovery systems indicates that adsorbed petroleum hydrocarbons within saturated zone soils continually leach into groundwater prolonging remedial time periods. The time associated with this leaching process cannot be predicted accurately as differences in lithology and constituent concentration create difficulties in determining an accurate remedial time estimate. Hence, an operational time of 20 years was used for cost purposes only, due to the uncertainties associated with free product removal. Actual removal times may vary significantly.

5.1.3.2 SVE

SVE involves the introduction of a pressure gradient across the soil matrix to extract hydrocarbon vapors and enhance volatilization of adsorbed hydrocarbons. A typical SVE system consists of vapor extraction wells, a vacuum blower, associated piping and safety controls. During SVE operation, a vacuum is applied to extraction wells situated within the vadose zone. As air is forced through the soil pores, soil gas is typically displaced and is drawn to the extraction wells and subsequently above ground via piping for treatment. Extracted vapors are typically treated with an air-phase treatment unit (e.g., activated carbon) prior to discharge to the atmosphere. As the process continues, adsorbed- and dissolved-phase hydrocarbons remaining in the vadose zone are gradually stripped from the soil matrix. In addition, volatilization of contaminants on the surface of the water table is enhanced. The SVE system can be designed and constructed using explosion-proof equipment.

The SVE system promotes oxygen recharge, which also stimulates existing biological activity in the soil and enhanced aerobic biodegradation. The indigenous soil microbes, present at virtually all hydrocarbon release sites, tend to multiply rapidly in the presence of oxygen, which increases hydrocarbon digestion, and results in an accelerated remediation process. (USEPA, 1996)

If a cleanup level of lower than 0.1 mg/kg is required for any individual constituent or a reduction in TRPH greater than 95 percent is required to reach the cleanup level for TRPH, either a pilot study should be conducted to demonstrate the ability of SVE to achieve these reductions at the site or another technology should be considered (USEPA, 1995). Therefore, TtNUS recommends a pilot study if the SVE alternative is chosen.

In order to perform the conceptual design of the SVE system “Hyperventilate” was used. By entering site conditions and variables the program can be used to optimize the design and determine estimated remediation time. In the program remediation time is a variable entered by the user. The user must analyze the results such as system flow rates and recovery rates to determine the optimal remediation time. Based on the results, it is estimated that soil remediation may be achieved in approximately 15 years (calculations are presented in Appendix E).

5.1.3.3 Alternative Summary

The main advantage associated with water table depression should be the ability of the system to control plume migration. However, there is no evidence to suggest the free product plume at UST Site 000024 is migrating at rate that necessitates hydraulic control. Hence there are no advantages to water table depression over the alternatives. A disadvantage of this system is the potential to smear contaminant through the soil when the water table is lowered. Furthermore, the amount of water recovered by the system would create a large groundwater treatment cost relative to other technologies. An advantage of SVE is that it has proven effective at achieving cleanup target levels. However, the combination of the water table depression and SVE systems creates a need to install and maintain two separate systems, which would not be cost effective. Also, the system has the longest estimated remediation time of the selected alternatives.

The estimated costs for free product recovery with water table depression for 20 years of operation are presented in Appendix D, Table D3. An estimated cost of SVE implementation with 15 years of O&M is presented Appendix D Table D4. The estimated cost of the combined alternatives is presented in Table 5-1.

5.1.4 <u>Bioslurping (Dual-phase Extraction)</u>

Bioslurping, also known as VEE is an in-situ technology that uses pumps to remove combinations of contaminated groundwater, separate-phase petroleum products, and hydrocarbon vapor from the subsurface. Bioslurping systems can be effective in removing free-phase product from the subsurface and reducing concentrations of petroleum hydrocarbons in both the saturated and unsaturated zones of the subsurface. Bioslurping systems are designed to maximize the extraction of free product while minimizing the collection of groundwater. The technology also stimulates biodegradation of petroleum constituents in the unsaturated zone by increasing the supply of oxygen (USEPA, 1995).

Bioslurping is a single-pump system that relies on high-velocity airflow to lift suspended liquid droplets upward by frictional drag through an extraction tube to land surface. The vacuum applied to the subsurface with DPE systems creates vapor-phase pressure gradients toward the vacuum well. These vapor-phase pressure gradients are also transmitted directly to the subsurface liquids present, and those liquids existing in a continuous phase will flow toward the vacuum well in response to the imposed pressure gradients. The higher the applied vacuum, the larger the hydraulic gradients that can be achieved in both vapor and liquid phases and thus the greater the vapor and liquid recovery rates.

The effectiveness of bioslurping within the zone of dewatering that commonly develops should be greater than that of air sparging due to the more uniform air flow developed using bioslurping (USEPA, 1995).

Bioslurping can enhance biodegradation by substantially increasing the supply of oxygen to the vadose zone.

The bioslurping system consists of a draw tube with its opening positioned at the oil-water interface within the bioslurping well. Typical bioslurping wells are screened from the top of the impacted soil zone to approximately 2 ft into the groundwater table. A vacuum is initially applied to the draw tube to begin removal of free product and some groundwater. The draw tube and the well casing are manifolded to the same vacuum source. High vacuum is applied to the draw tube in order to lift the free product and/or water. A vacuum applied to the inside of the well also results in a positive uplift on the water table thereby increasing the hydraulic gradients of the fluids within the well. The vacuum influence of the well increases the airflow into the well providing oxygen flow through the vadose and capillary fringe and stimulating biodegradation.

Assuming site conditions similar to Building 325 at CSSPC, 46 bioslurping wells would be required to remediate the soil and free product plumes. However, a pilot study is recommend to better design the system. The bioslurping wells are manifolded to a central compound with a vacuum pump(s), total fluids collection tanks, vapor treatment, and an oil-water separator. The permeability of soil at the FFF should provide conditions conducive for airflow through the vadose and unsaturated zones, but also would increase the amount of extracted water that would be necessary to treat. Therefore, it is recommended to reduce costs the extracted groundwater be discharged to the FOTW after the groundwater has been partially treated thorough the oil-water separator. It may also be necessary to install an air stripping unit to treat the recovered groundwater before discharge. Recovered free product will be containerized in 55-gallon drums and disposed of by an authorized vendor.

Based on results from a similar system at CSSPC, the time to cleanup has been estimated to be 15 years. The system at CSSPC was effective in an area with similar lithology, but lower contaminant levels. Remediation time at CSSPC was less than five years, the amount of free product and soil contamination was lower. Based on this information a safety factor of three was used to determine the estimated remediation time at the FFF. A pilot study is recommended to obtain a more accurate estimated time to cleanup and evaluate the systems actual potential for cleanup.

5.1.4.1 Alternative Summary

The advantages of a bioslurping system are as follows: a single system for both free product recovery and soil remediation is more cost effective than two separate systems, the in-situ technology is more cost effective than a large-scale excavation project, and bioslurping has been proven effective at a similar site (CSSPC). The disadvantages of bioslurping include the amount of O&M required to maintain the optimization of free product recovery and the length of remediation time.

An estimated cost of bioslurping implementation with a pilot study and 15 years of O&M is presented in Table 5-1 and Appendix D, Table D5.

5.2 COST COMPARISON AND RATIONALE FOR SELECTION

A table comparing the estimated cost of remediation of soil and free product at the subject site using the combinations of the evaluated alternatives is provided in Table 5-1. Based on a review of the advantages, disadvantages, and costs, TtNUS recommends bioslurping.

The soil and free product remedial alternative, bioslurping, is recommended over other alternatives as it is a single system, has proven effective in similar situations, and is cost-effective. Excavation and dewatering appears cost prohibitive. The combination of a SVE and groundwater depression would result in a need to install two separate sets of new wells at the site and the installation and O&M of two systems. In addition, this technology could generate millions of gallons contaminated groundwater that would require treatment. Based on this information bioslurping was chosen as the remedial alternative.

In order to effectively design and implement the bioslurping system, it will be necessary to conduct a pilot study. This study will assist in determining the optimum number of VEE wells to be installed. Information collected during the pilot study would also be used to more accurately design the bioslurping system, the oil/water separator, and determine if an air stripper is necessary. In addition, the pilot study will be used to determine a more accurate cleanup time.

6.0 REMEDIAL SYSTEM DESIGN

The preferred remedial alternative presented in this RAP was selected as an effective method for treatment of hydrocarbons within the vadose zone and recovery of free product. The potential remedial technologies and process options for free product recovery and soil remediation were identified and screened, and the results were presented in Section 5.0. The selected alternative is bioslurping, which addresses soil contamination and free product recovery.

6.1 PILOT STUDY

Prior to system installation, a pilot study is recommended to optimize system design and efficiency. Mobile dual-phase extraction systems (MDES), also known as aggressive fluid vapor recovery systems, are useful for bioslurping pilot studies. The MDES vehicles are specially designed vacuum trucks, which perform DPE/bioslurping. Some specialty vendors of MDES provide site-specific data on vapor, free product, and groundwater extraction rates along with pressure transducers and water level indicators in surrounding monitoring wells. The water levels, pressure changes, and extraction rates provided during an MDES event can help determine radius of influence (ROI), effectiveness, and site specific criteria to be used in the final design of the soil and free product treatment systems. During the pilot study, information should also be gathered for vapor recovery without free product recovery. This information will be used in the design of the vapor recovery wells that will be nested with the deep bioslurping interface wells, which is discussed in detail in Section 6.2. An MDES event typically costs between $3,000 to $5,000.

A pilot study should be used to calculate an actual ROI for free product recovery and vapor extraction. Hence, a more accurate number of wells may be determined. If an accurate ROI of free product recovery is not obtained and the wells are too close, the system may create excessive drawdown. Drawdown must be controlled to limit the free product from creating a smear zone. Transversely, if the ROI is too large the system will be ineffective in certain areas. In addition, optimization of well placement may decrease the total cost of the system.

In addition to determining the site specific ROI, the pilot study will more accurately determine potential air emissions from the vapor extraction portion of the system. A standard calculation was used to estimate the average daily emission rate at 92.2 lbs per day (lbs/day) of hydrocarbons, which is greater than the 13.7 lbs/day allowable by Chapter 62-770, FAC. A more accurate number will be determined by the pilot study to determine the size of the vapor treatment system. In addition, a pilot study would be used to determine an accurate groundwater recovery rate.

6.2 BIOSLURPING SYSTEM CONCEPTUAL DESIGN

Major components of the bioslurping system design for this site include the following:

- VEE wells
- Piping network
- Skid system
- Vapor treatment
- Groundwater treatment

6.2.1 <u>VEE Wells</u>

For preliminary (conceptual) design and costing purposes, the ROI is based on the hydraulic conductivity values estimated through slug tests conducted during the SAR (TtNUS, 2002), and intrinsic permeability associated with the system design for a similar system at Building 325 CSSPC [ABB Environmental Services (ABB-ES), 1996]. The hydraulic conductivity at UST Site 000024 was calculated at 4.981 x 10^{-2} cm/sec. According to Applied Geology (Fetter, 1980), the hydraulic conductivity of 10^{-3} to 10^{-1} is associated with well-sorted sands and an associated intrinsic permeability (darcys) of 1 to 10 darcys. At Building 325, the intrinsic permeability was also in the range of 1 to 10 darcys and the ROI was found to be 35 ft. Therefore, to complete the conceptual design without a pilot study, a vacuum ROI was estimated at 35 ft. A more accurate ROI may be obtained through the pilot study.

An estimate of vacuum drawdown, vapor flow rate, and the number of VEE wells required were made based on the site-specific data presented above. Based on a comparison to similar conditions at CSSPC, it is estimated that UST Site 000024 requires 46 VEE wells, with a total flow rate of 920 standard cubic feet per minute (SCFM) based on 20 SCFM per well. These VEE wells are also designed to extract free product and some groundwater. The proposed well placements are illustrated on Figure 6-1.

The VEE wells will be installed to a depth of approximately 30 ft bls on the mound and 10 ft bls outside the mound. The wells will be installed via a hollow stem auger drill rig. The well casing will be constructed of 4-inch diameter schedule 80 polyvinyl chloride (PVC) pipe with, 4-inch diameter schedule 80, 0.020-inch slot PVC screen. The wells will be screened according to total depth and soil contamination. Use of a large screened interval in a single bioslurping well would affect the efficiency of the system. As a result, in areas where a screen length over 12 ft is necessary, a well nest will be installed. The well nest will include an interface bioslurping well screened from 2 ft below the water table to approximately 3 ft above the water table and a vapor recovery well installed adjacent to it. The vapor recovery well will be similar to the interface bioslurping wells except that it will not contain a free product

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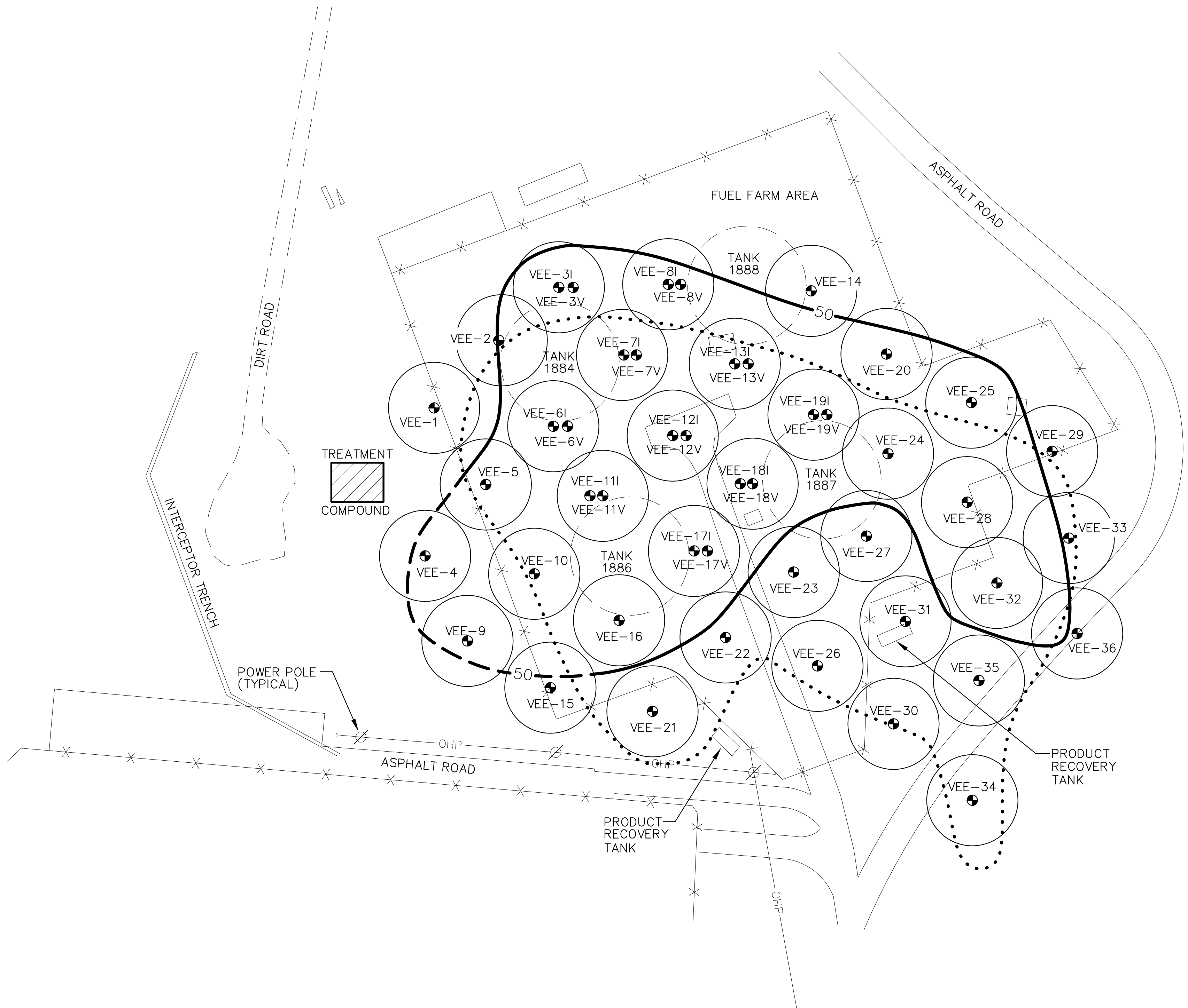

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NOTES:

1. THE INTERFACE WELL IS SHOWN IN THE CENTER ON THE NESTED INTERFACE AND VAPOR WELLS.

RECOVERY ZONES

ZONE	WELLS	TOTAL
1	VEE-1 THRU VEE-8	12
2	VEE-9 THRU VEE-14	9
3	VEE-15 THRU VEE-20	9
4	VEE-21 THRU VEE-29	9
5	VEE-30 THRU VEE-36	7

LEGEND:

WELL RADIUS OF INFLUENCE
VEE = VAPOR ENHANCED EXTRACTION
WELL ID NUMBER
VEE-18I
VEE-18V
"I" = INTERFACE WELL (IN CENTER OF RADIUS OF INFLUENCE)
"V" = VAPOR WELL (OFFSET TO CENTER OF RADIUS OF INFLUENCE)

APPROXIMATE AREA OF FREE PRODUCT
APPROXIMATE AREA IN WHICH SOIL VAPOR CONCENTRATIONS EXCEED 50 PPM
FENCE
-OHP- OVERHEAD POWER LINES

0 80 160
SCALE IN FEET

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 10/11/02
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

DEPARTMENT OF THE NAVY · SOUTHERN DIV FACILITIES ENGINEERING COMD

PROPOSED BIOSLURPING WELL LOCATIONS
SHERMAN FIELD FUEL FARM
REMEDIAL ACTION PLAN
NAS PENSACOLA
PENSACOLA, FLORIDA

CONTRACT NO. 2827
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 6-1 REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

recovery tube. The vapor recovery wells will be manifolded to the same system as the conventional VEE wells, but will only be used for vapor recovery. This will ensure that both free product and soil vapors are extracted efficiently. Construction details for the VEE wells are detailed on Table 6-1. VEE interface wells are depicted on Figure 6-2 and VEE vapor recovery wells are depicted on Figure 6-3.

The VEE wells will be used to remove soil vapors by connecting it to a liquid ring pump system via 1-inch PVC piping. Free product will be extracted from the well using 1-inch clear, flexible PVC tubing which will also be connected to the liquid ring pump. The drop tube will be inserted into the well through a three-way junction fitted to the top of the well casing. The tube will be placed at the oil-water interface.

6.2.2 Piping Network

In each zone (Figure 6-1) the vapor extraction piping for each well will be manifolded together. In addition, the fluid recovery piping from each well will be manifolded together. The separate vapor and fluid piping from each zone will be run to the system compound and be manifolded before it enters its associated skid system.

6.2.3 Skid System

Each bioslurping system is a skid mounted system with an oil-sealed liquid ring vacuum pump, close coupled to a explosion proof motor, and an oil reservoir tank with built-in baffles and coalescing filters for maximum air/oil separation and minimum oil emission. A vertical 120-gallon knockout tank and transfer pump is also connected to the bioslurping system to remove moisture from the vapor stream. All components of the bioslurping system are piped and mounted on a steel baseplate. Each liquid ring vacuum pump system is supplied with a 4-inch header for connection to the knockout package.

The VEE wells are designed to extract free product, soil vapor, and some groundwater. Hence, the vacuum pump selected for this system should operate under dry (100 percent soil vapor), wet (100 percent fluids), and mixed flow situations. The vacuum pump(s) should also be capable of generating enough vacuum to extract soil vapor, free product, and groundwater from the VEE well and carry the total flow into the holding tank. Based on these requirements, it is recommended that five liquid ring pumps be used. Five liquid ring pumps similar those used at Building 325, CSSPC are recommended (Atlantic Fluidics Model A300 liquid ring pumps or equivalent). This liquid ring pump has a 20-horsepower motor and operates on 230 volt, 3-phase, alternating current, electrical power. This system is capable of extracting soil vapor, free product, and groundwater simultaneously. Design specifications and the quote are included in Appendix F. The selected pumps should be reevaluated after the pilot study is complete.

Table 6-1
Construction Details of Proposed VEE Wells

Remedial Action Plan
Sherman Field Former Fuel Farm, UST Site 000024
Naval Air Station Pensacola
Pensacola, Florida

VEE Well ID	Dual Phase or Vapor Recovery	Estimated Water Table (ft bls)	Screen Interval (ft bls)	Total Depth (ft)
VEE-1	Dual	7	5-10	10
VEE-2	Dual	27	20-30	30
VEE-3V	Vapor	27	5-25	25
VEE-3I	Dual	27	25-30	30
VEE-4	Vapor	7	5-10	10
VEE-5	Dual	7	5-10	10
VEE-6V	Vapor	27	5-25	25
VEE-6I	Dual	27	25-30	30
VEE-7V	Vapor	27	5-25	25
VEE-7I	Dual	27	25-30	30
VEE-8V	Vapor	27	5-25	25
VEE-8I	Dual	27	25-30	30
VEE-9	Dual	7	5-10	10
VEE-10	Dual	7	5-10	10
VEE-11V	Vapor	27	5-25	25
VEE-11I	Dual	27	25-30	30
VEE-12V	Vapor	27	5-25	25
VEE-12I	Dual	27	25-30	30
VEE-13V	Vapor	27	5-25	25
VEE-13I	Dual	27	25-30	30
VEE-14	Dual	27	20-30	30
VEE-15	Dual	7	5-10	10
VEE-16	Dual	27	20-30	30
VEE-17V	Vapor	27	5-25	25
VEE-17I	Dual	27	25-30	30
VEE-18V	Vapor	27	5-25	25
VEE-18I	Dual	27	25-30	30
VEE-19V	Vapor	27	5-25	25
VEE-19I	Dual	27	25-30	30
VEE-20	Dual	27	20-30	30
VEE-21	Dual	7	5-10	10
VEE-22	Dual	27	20-30	30
VEE-23	Dual	27	20-30	30
VEE-24	Dual	27	20-30	30
VEE-25	Dual	7	5-10	10
VEE-26	Dual	7	5-10	10
VEE-27	Dual	27	20-30	30
VEE-28	Dual	7	5-10	10
VEE-29	Dual	7	5-10	10
VEE-30	Dual	7	5-10	10
VEE-31	Dual	7	5-10	10

Table 6-1
Construction Details of Proposed VEE Wells

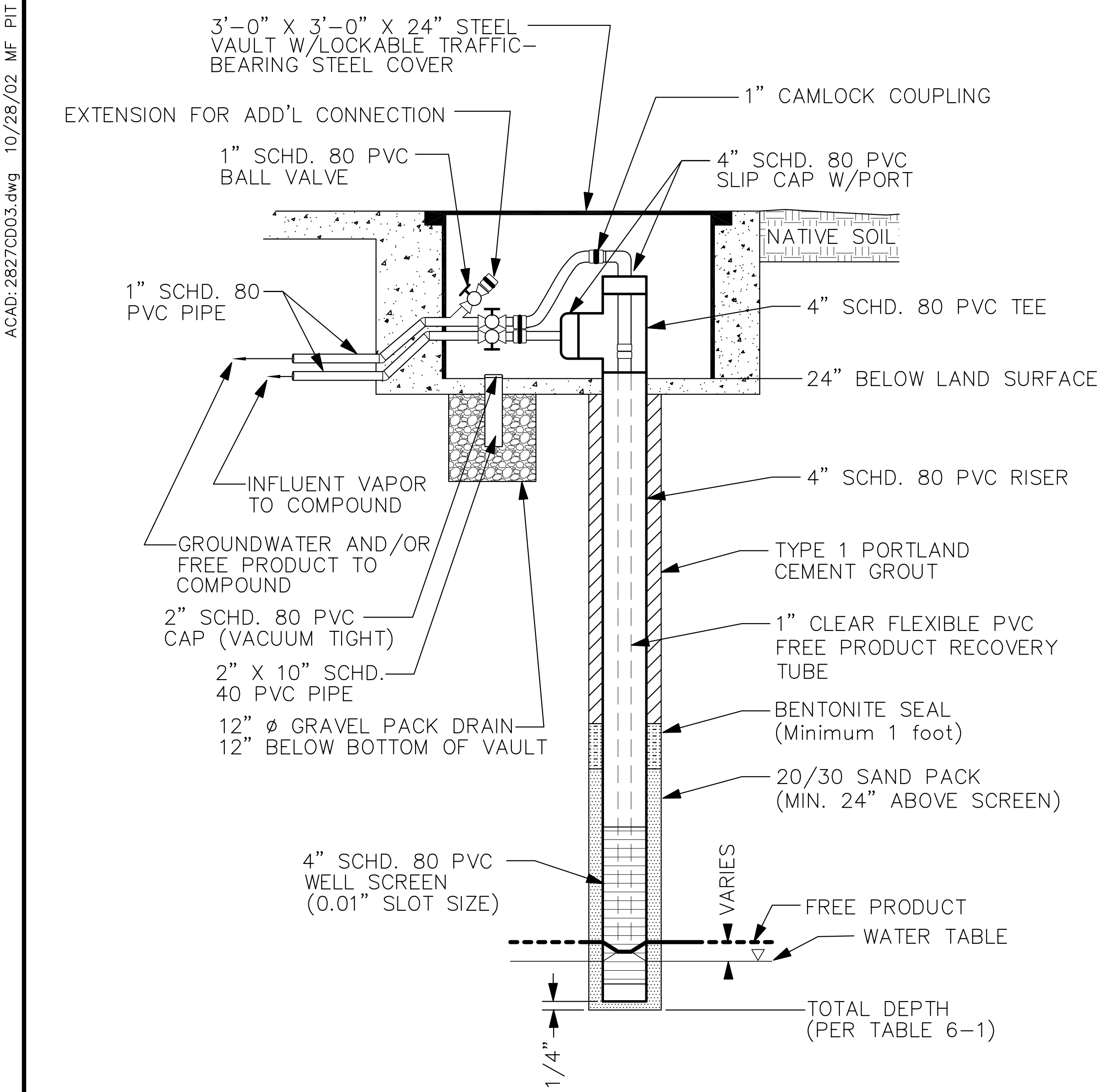
Remedial Action Plan
Sherman Field Former Fuel Farm, UST Site 000024
Naval Air Station Pensacola
Pensacola, Florida

VEE Well ID	Dual Phase or Vapor Recovery	Estimated Water Table (ft bls)	Screen Interval (ft bls)	Total Depth (ft)
VEE-32	Dual	7	5-10	10
VEE-33	Dual	7	5-10	10
VEE-34	Dual	7	5-10	10
VEE-35	Dual	7	5-10	10
VEE-36	Dual	7	5-10	10

Notes:
ft = feet   bls = below land surface
ID = indentification

Dual phase wells will be installed to three feet below the water table at the time of installation and shall not be screened more than 12 ft into the vadose zone.

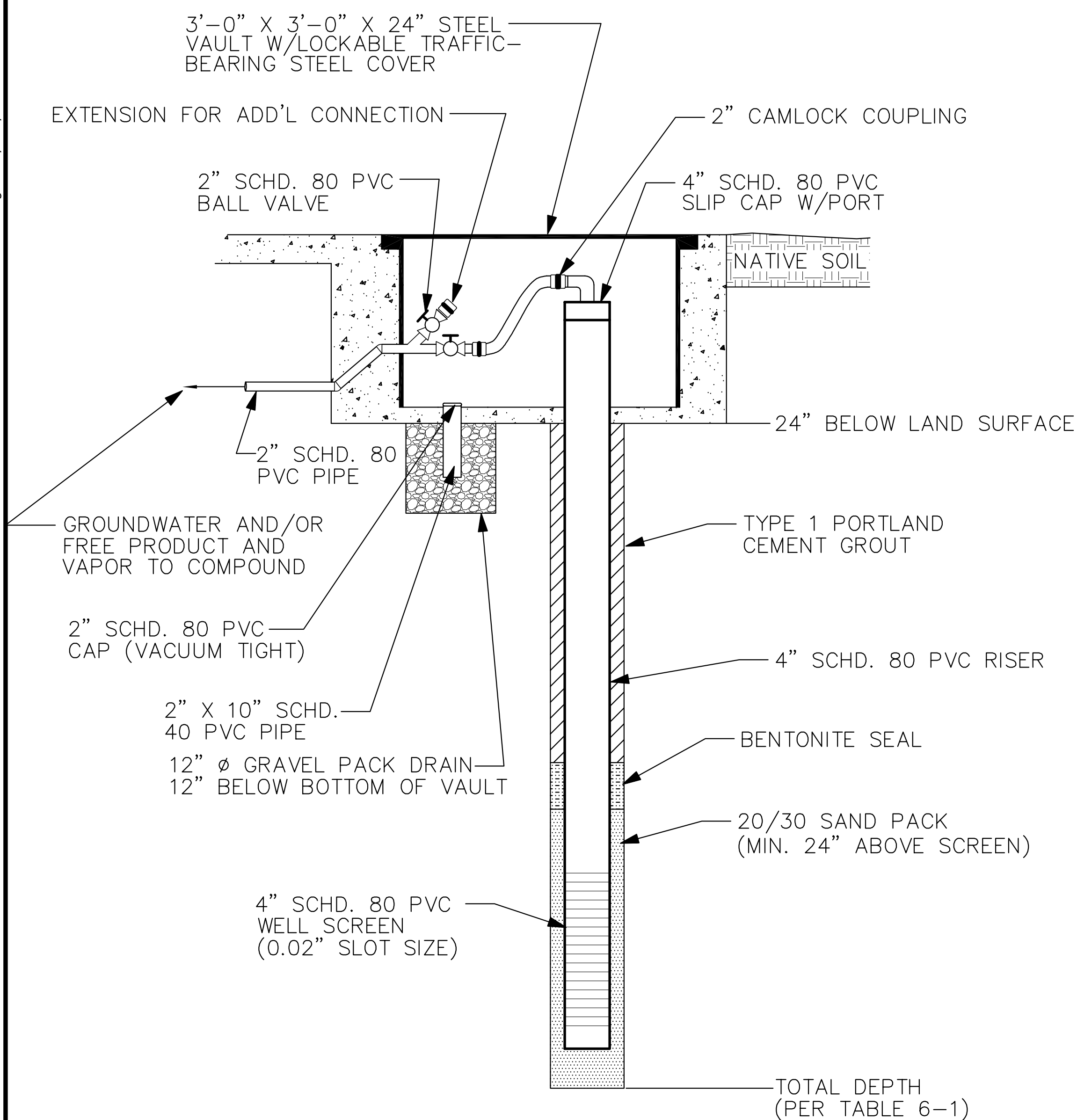
Vapor phase wells will be installed to the depth of the top of the screen of the adjacent dual phase well and will be screened from 5 ft bls to depth.



DRAWN BY MF DATE 10/15/02	VEE INTERFACE WELL CONSTRUCTION DETAILS REMEDIAL ACTION PLAN NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NO. 2827
CHECKED BY DATE		APPROVED BY DATE
COST/SCHED-AREA		APPROVED BY DATE
SCALE NONE		DRAWING NO. FIGURE 6-2 REV. 0

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98

ACAD: 2827CD05.dwg 10/28/02 MF PIT



DRAWN BY MF / DATE 10/18/02		VAPOR WELL CONSTRUCTION DETAILS REMEDIAL ACTION PLAN NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NO. 2827
CHECKED BY / DATE			APPROVED BY / DATE
COST/SCHED–AREA			APPROVED BY / DATE
SCALE NONE			DRAWING NO. FIGURE 6–3 / REV. 0

FORM CADD NO. SDIV_AV.DWG – REV 0 – 1/20/98

The liquid ring pump systems will be skid mounted and equipped with pressure and vacuum gauges, adjustable pressure relief valves, a flow meter, and a thermometer. The vacuum pumps will be explosion proof and will be operated by a control panel located on the skid.

The control panel will cause a shutdown of the pumps if any of the following occur:

- The liquid level in the seal reservoir of the liquid ring pump is at or below a low-level sensor.
- The thermometer on the pump reads temperatures at or higher than those set by the pump manufacturer.
- The liquid level in the oil-water separator is at or above a high level sensor.
- The liquid level in the free product recovery tank is at or above a high level sensor.
- The air stripper's high level switch is triggered.
- In case of a shut off, the system will be serviced and the pumps manually restarted.

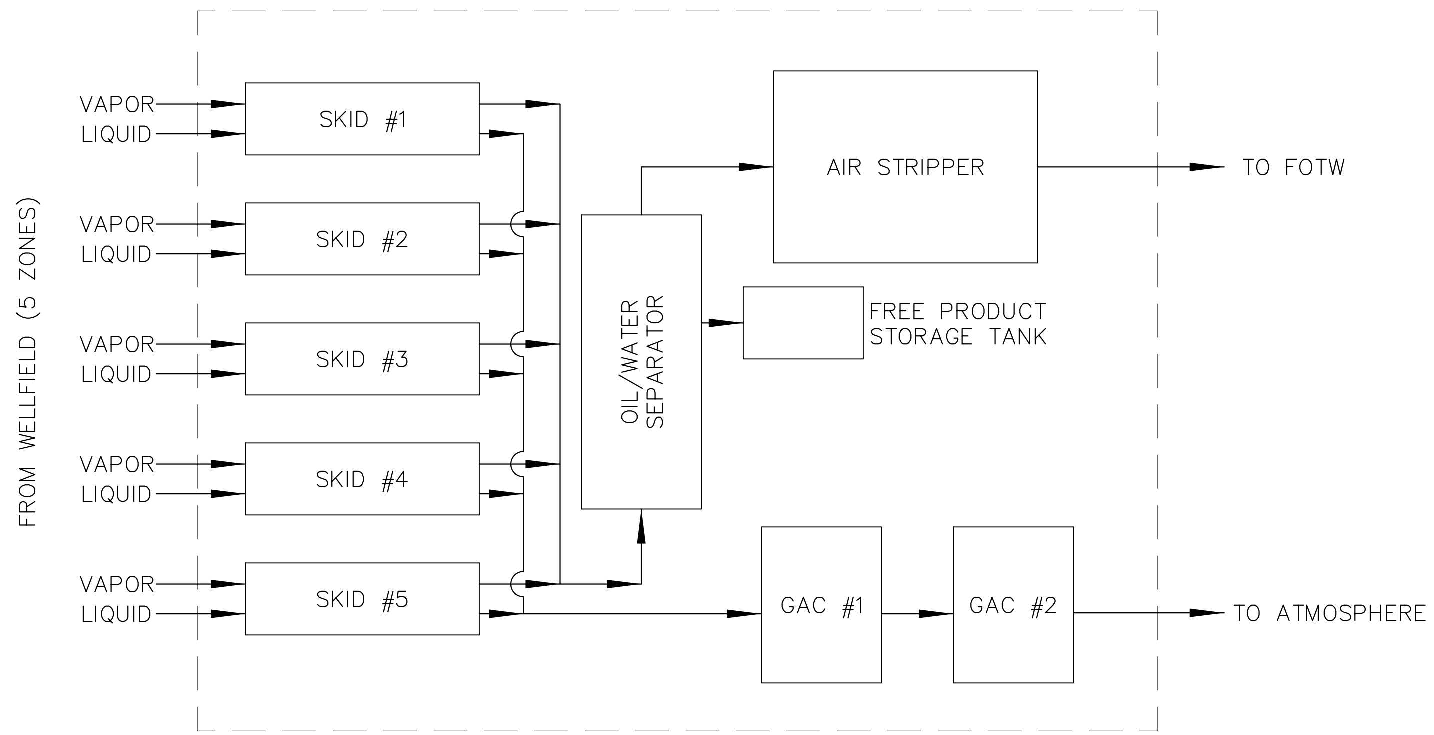
Figure 6-4 includes the treatment compound detail. Figure 6-5 includes the piping and instrumentation diagram for the VEE system. Each VEE well will have two independent supply lines (liquid and vapor) that are manifolded at the compound. Appropriate sampling ports, flow control valves, and flow meters will be installed on each vacuum supply line to facilitate selective operation of the VEE wells. A totalizer flow meter and totalizer sampling port will be installed after the manifold to monitor the overall efficiency of the soil vapor extraction and free product recovery process.

The vacuum source attached to the drop tube will be designed to provide a third source of vacuum to facilitate supply of a vacuum to any of the monitoring wells for free product recovery (see Figure 6-2). Installing these features on the well head will facilitate using any of the existing monitoring wells as a free product recovery well, thus improving the overall efficiency of the VEE system.

The piping from each VEE well will be designed to carry soil vapor, free product, and groundwater. The piping from the VEE wells to the manifold will be of 1-inch diameter Schedule 80 PVC. The main supply line (manifold) connecting the VEE pipes to the liquid ring pump will be of 4-inch diameter Schedule 80 PVC.

Fluids recovered from the VEE wells will be discharged to the oil-water separation system. The entire system and treatment compound will be located within a 6-foot tall chain link fence with a minimum 10-ft long lockable gate for access.

ACAD: 2827CD06.dwg 11/05/02 MF PIT



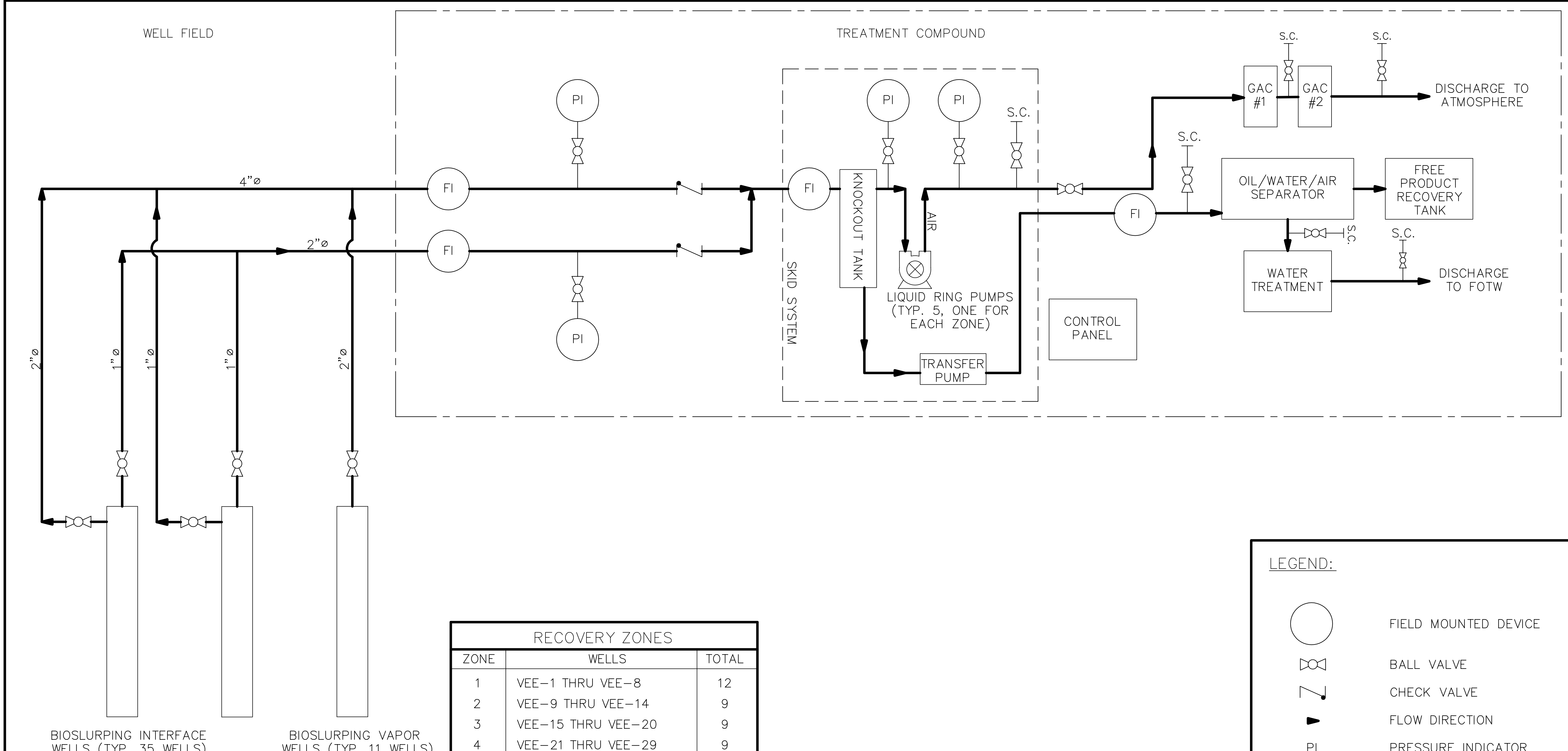
NOTES:

1. EQUIPMENT PAD SIZE IS APPROXIMATELY 40'–0" X 30'–0".
2. EQUIPMENT SIZES ARE APPROXIMATE.

DRAWN BY MF DATE 11/05/02		TREATMENT COMPOUND DETAIL REMEDIAL ACTION PLAN NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NO. 2827
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED–AREA			APPROVED BY DATE
SCALE NOT TO SCALE			DRAWING NO. FIGURE 6–4 REV. 0

FORM CADD NO. SDIV_AH.DWG – REV 0 – 1/20/98

ACAD: 2827PF01.dwg 10/28/02 MF PIT



RECOVERY ZONES

ZONE	WELLS	TOTAL
1	VEE-1 THRU VEE-8	12
2	VEE-9 THRU VEE-14	9
3	VEE-15 THRU VEE-20	9
4	VEE-21 THRU VEE-29	9
5	VEE-30 THRU VEE-36	7

LEGEND:

○	FIELD MOUNTED DEVICE
⋈	BALL VALVE
	CHECK VALVE
►	FLOW DIRECTION
PI	PRESSURE INDICATOR
FI	FLOW INDICATOR
S.C.	SAMPLE CONNECTION

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 10/17/02

CHECKED BY DATE

COST/SCHED-AREA

SCALE AS NOTED

VEE WELL PIPING AND INSTRUMENTATION DIAGRAM
REMEDIAL ACTION PLAN
NAS PENSACOLA
PENSACOLA, FLORIDA

CONTRACT NO. 2827

APPROVED BY DATE

APPROVED BY DATE

DRAWING NO. FIGURE 6-5 REV. 0

FORM CADD NO. SDIV_BH.DWG – REV 0 – 1/20/98

6.2.4 Vapor Treatment System

Soil vapor recovered by the system may also need to be treated. If the system extracts more than 13.7 lbs/day of hydrocarbon vapors, it must be treated per Chapter 62-770, FAC. The exhaust vapor will be treated using granular activated carbon (GAC) filters. Soil vapors are discharged from the liquid ring pump to an unrestricted exhaust tower, also known as a centrifugal scrubber, which is included with the bioslurping system skid. Vapors at the effluent port of the centrifugal scrubber will be treated before atmospheric discharge using two 2,000-lb GAC vessels that will remove the volatile organic hydrocarbon compounds. During start-up and after the first 30 days of operation, the amount of hydrocarbon exhaust will be measured. If the emissions are below action levels, the use of the GAC filters can be discontinued.

6.2.5 Groundwater Treatment System

The oil-water separator will have a liquid high level sensor to prevent overfill. The selection of the oil-water separator should be performed after the pilot study to assure adequate sizing. However, for costing purposes a 200 gallon per minute (gpm) oil-water separator was chosen. Free product will be collected in a holding tank and disposed of by an authorized vendor. The water generated in the oil-water separator will be discharged to an air stripper or directly to the FOTW.

Conversations with the personnel at the NAS Pensacola FOTW gave no guarantee that recovered groundwater from the remediation system could be accepted by the FOTW. Actual contaminant constituent concentrations will have to be presented to the FOTW and the NAS Pensacola Environmental Department to determine if effluent will be accepted untreated. As a result, the costing for the conceptual design includes a 99 percent efficient air stripper to treat the groundwater effluent. We assume an air stripper will adequately treat recovered groundwater to meet the FOTW standards.

During the final design of the system TtNUS recommends reevaluating the need for a water treatment system. Elimination of the air stripper would decrease the total cost of the remediation system.

6.3 ELECTRICAL AND CONTROLS

6.3.1 Control Panel

Based on the current operations at the site, it is assumed that electrical power is available to the area, and a power drop will be installed to provide electrical power to the bioslurping system. This may require a power pole installed adjacent to the system, pending a recommendation by the Navy on utility connection. There will be a power drop provided for the bioslurping system with a 240-volt, two-pole, 100-amp breaker in a weatherproof box. A telephone service connection box is also recommended although not required.

There will be a single field-mounted control panel for the bioslurping system. There will be a single "ON" switch with additional subsystem control switches and individual Hand-On-Auto (HOA) switches for individual motors. When in “ON” position, all devices which are equipped with HOA switches will operate when their switch is in the “HAND” position and will be enabled when their switch is in the “AUTO” position.

The control panel supplied with the bioslurping system will be designed and fabricated to receive three-phase, 240-voltage alternating current (VAC) as well as 120 VAC and 240 VAC single-phase power from a breaker panel. Individual power sources (circuit breakers) for each load will be provided in the power panel, to be wired directly to the individual motor starters. The control panel will be designed to properly operate all system electrical equipment including separation and treatment equipment. The control panel will contain all relays, motor starters, terminal blocks, transformers, and other components necessary for operation of the electrical equipment. The panel will be pre-wired and fabricated in accordance with the National Electric Code and will utilize readily available electrical components.

The control panel will contain motor starters with thermal overload and overcurrent protection, automatic reset, HOA switches, and on/off control logic for the liquid ring pump. The panel will also contain all relays, terminal blocks, and other components necessary for automatic operation of the bioslurping system. Alarm circuits will be equipped with indicator lights at the control panel to serve as “first out annunciators” when alarm conditions occur.

The electrical control panel will be located outside, therefore a National Electrical Manufacturers Association (NEMA) 4 external flange mounted enclosure surrounding a NEMA 1 enclosure that is complete with externally-mounted pump hour meters, HOA pump switches, reset button, and high liquid level indicator lights will be required. The NEMA 4 enclosure will have a locking cover for controlled access.

6.3.2 Bioslurping System Controls/Operation

The control panel will control the on/off operation of the liquid ring pump, air/water separator pump and associated control valves, high pressure and high temperature cut-out switches on pumps, and liquid level (high-high level) shut off switches installed in the air-water separator and the holding tank.

The bioslurping main control and operation components are listed below:

- Pump motor starters with thermal overload, overcurrent protection, and loss of three-phase protection, automatic reset, external hour meter, and HOA switches.

- One air-water separator/condensate pump motor starter with thermal overload, overcurrent protection, HOA switch, and on/off control logic.

- Moisture separator high-high level sensor and controls will deactivate the liquid ring pump in the event of an abnormally high liquid level condition in the separator.

- Holding tank high-high level sensor and controls will deactivate the liquid ring pump in the event of an abnormally high liquid level condition in the tank.

- Condensate pump will start upon the activation of sensor level high and operate until sensor level low is deactivated.

- A solenoid-operated valve (control valve) will be interlocked with the condensate pump for open/closed operation. This interlock will be by auxiliary contact with the motor starter or across motor winding. This valve will open on air/water separator high level and close when the low-level switch de-actuates.

- High temperature sensor(s) [located on the discharge of the liquid ring pump(s)] and controls will deactivate the pump in the event of an abnormally high temperature condition at the pump.

- High-pressure sensor(s) [located at the discharge of the liquid ring pump(s)] and controls will deactivate the pump in the event a high-pressure condition is detected downstream of the pump.

7.0 O&M AND MONITORING

The following sections establish procedures for the start-up of the system, O&M of the remediation equipment, monitoring of the operating parameters, and final system deactivation.

7.1 BIOSLURPING SYSTEM START-UP

Following the pilot study, final design, installation, final inspection, and acceptance by the Navy, the system will be set for initial start-up. Approximately one week prior to start-up, a full round of water levels, free product measurements, and dissolved oxygen measurements will be collected. Also, prior to start-up, the VEE wells in the area will be surveyed in reference to location and elevation to establish a baseline top of casing elevation for each well.

7.2 DOCUMENTATION

A bioslurping operation manual and maintenance plan will be provided at the time of system installation and start-up. The plan will provide all necessary information for the proper O&M of the system and maintenance of the product monitoring and recovery plan. The plan will include at a minimum the following:

- System start-up instructions.
- System shutdown instructions.
- Electrical controls and wiring diagram.
- System “as-built” drawings.
- Equipment manufacturers’ product operation manuals for each piece of equipment.
- Equipment warranty and guarantee information.
- Equipment service and repair vendor information.
- System troubleshooting guide.
- Equipment and system maintenance schedule and checklist.
- Material safety data sheets for materials used or being stored.
- Monitoring schedule, including sample frequency, sampling locations, required analyses, parameters for field measurements, vapor monitoring requirements, and vacuum measurement requirements.
- Instructions for maintaining a site activity log.

The operation manual and maintenance plan will be assembled and bound in a manner suitable for use in the field.

7.3 MONITORING FREE PRODUCT RECOVERY

Free product thickness and depth to groundwater will be measured in the monitoring wells on a weekly basis for the first three months and monthly for the remainder of the remediation time in order to establish the presence and extent of free product at the site. Free product and groundwater recovery will be continued until the objectives discussed in Section 3.2 have been met.

7.4 MONITORING SOIL REMEDIATION PROGRESS

On a weekly basis for the first three months and a monthly basis for the remainder of the first year of operation, vapor extraction emissions will be monitored for volatile organic hydrocarbons by collecting TO 14 vapor samples. Vapor monitoring will be performed on the soil vapor airstream before treatment, between carbon systems, and following carbon treatment, so that GAC filters can be changed before system breakthrough.

The monitoring results after GAC treatment will be used to verify the system exhaust meets the requirements of Chapter 62-770, FAC. Samples will be collected in a tedlar bag and analyzed by USEPA Method TO 14 to determine total VOC concentrations in the discharge. Once emissions before treatment have fallen below regulatory limits the use of the GAC filters will be discontinued.

The pretreatment monitoring data will be used to determine if the objectives of the RAP and standards of the design criteria are being met. The remedial system will be evaluated to determine if the cleanup goals cannot be met in the time frame as specified in the RAP.

7.5 SYSTEM O&M

The proposed remedial system will require regularly scheduled maintenance. Site visits for system inspection and maintenance will be performed by a trained and qualified technician and will be performed in conjunction with system monitoring to reduce costs.

Although an O&M manual should be provided with all installed equipment, the following O&M items are scheduled to be performed weekly for the first month and monthly thereafter:

- Ensure that drop tubes in all wells are located at the oil-water interface.

- Maintain good housekeeping measures for the entire remediation system compound, picking up trash and cutting weeds as necessary.

- Complete regular maintenance of equipment and repair any malfunctions, in accordance with the equipment manufacturers instructions and manuals.

- Restart system if a shutdown has occurred.

- Measure water levels and free product thickness in monitoring wells.

- Complete scheduled air emissions sampling or groundwater monitoring as required.

- Log all inspection activities and repairs performed.

7.6 STATUS REPORTS

During the implementation and operation of the remedial system described in this RAP, annual status reports will be prepared and submitted to Navy. The reports will summarize all remedial activities and will contain at a minimum the following information:

- Startup date.
- Recent free-phase hydrocarbon plume and groundwater contour maps.
- A graph of cumulative mass of soil contamination degraded versus operation time.
- A graph of free product removal versus operation time.
- Summary of system operational data.
- Conclusions as to the effectiveness of the active remedial system, and recommendations on future monitoring and operations of the system.

7.7 GROUNDWATER MONITORING

Although this remedial system does not address dissolved-phase groundwater contamination treatment, groundwater monitoring is recommended to track dissolved plume migration, and to collect data to serve as a basis for the future selection of a remedial alternative for groundwater. It is recommended that groundwater monitoring be conducted on a semi-annual basis during system operations. It is recommended that the following monitoring wells be sampled: MW-1S, 2S, 3S, 5S, 6, 8S, 10R (upgradient), 12, 14S, 16S, 17S (downgradient), and 22S (See SAR Figure 2-2 in Appendix A). The monitoring wells should be sampled for the Gasoline Analytical Group (GAG) and Kerosene Analytical Group (KAG) as specified in Chapter 62-770, FAC. If measurable free product is present in any of the selected monitoring wells they shall not be sampled. The groundwater analytical results should be included in the status reports.

7.8 SYSTEM DEACTIVATION

The following criteria must be met for the active remediation to be deemed complete and prior to deactivation of the bioslurping system:

- Soil effluent vapor samples contain no detectable constituents.
- Free product thickness less than 0.01 or extent practicable.
- The five systems could be shut down in stages if the associated zone is deemed to have met the above criteria.

After the site meets the above criteria, the system will be deactivated. The following steps will be followed during system deactivation:

- Deactivate the liquid ring pumps and allow them to cool down.
- De-energize the control panel via the service disconnect.
- The entire system will remain on site until after the post-closure monitoring verifies that the site has been properly remediated, at which point it will be removed from the site as directed by the Navy.

Following system deactivation, a full round of sampling for COCs and groundwater natural attenuation parameters will be conducted to evaluate the need for a groundwater remedial action. A second RAP for the site might be needed to address dissolved phase groundwater contamination if it exists. If no contaminated groundwater exists, then a Post Active Remediation Monitoring Plan must be developed for the site and approved by the FDEP. The contents of this plan are included in Chapter 62-770.750, FAC.

8.0 REMEDIAL ACTION PLAN SUMMARY

The RAP Summary checklist is included in Appendix G.

REFERENCES

ABB-ES (ABB Environmental Services, Inc.), 1996. *Remedial Action Plan Facility 325*, Coastal System Station Panama City, Panama City.

FDEP (Florida Department of Environmental Protection), 1997. Florida Administrative Code, Petroleum Contamination Site Cleanup Site Criteria, Chapter 62-770. September.

Fetter, C.W., Jr., 1980. *Applied Hydrogeology*, University of Wisconsin – Oshkosh, Charles E. Merrill Publishing, 1980.

Johnson, Paul C. and Amy J. Stabenau. *Hyperventilate* SVE design Program, Shell Development. "A Practical Approach to the Design, Operation, and Monitoring of In-Situ Soil Venting Systems". Version 2.0.

TtNUS (Tetra Tech NUS, Inc.), 2002. *Site Assessment Report for Sherman Field Former Fuel Farm, UST Site 000024*, Naval Air Station Pensacola, Pensacola, Florida.

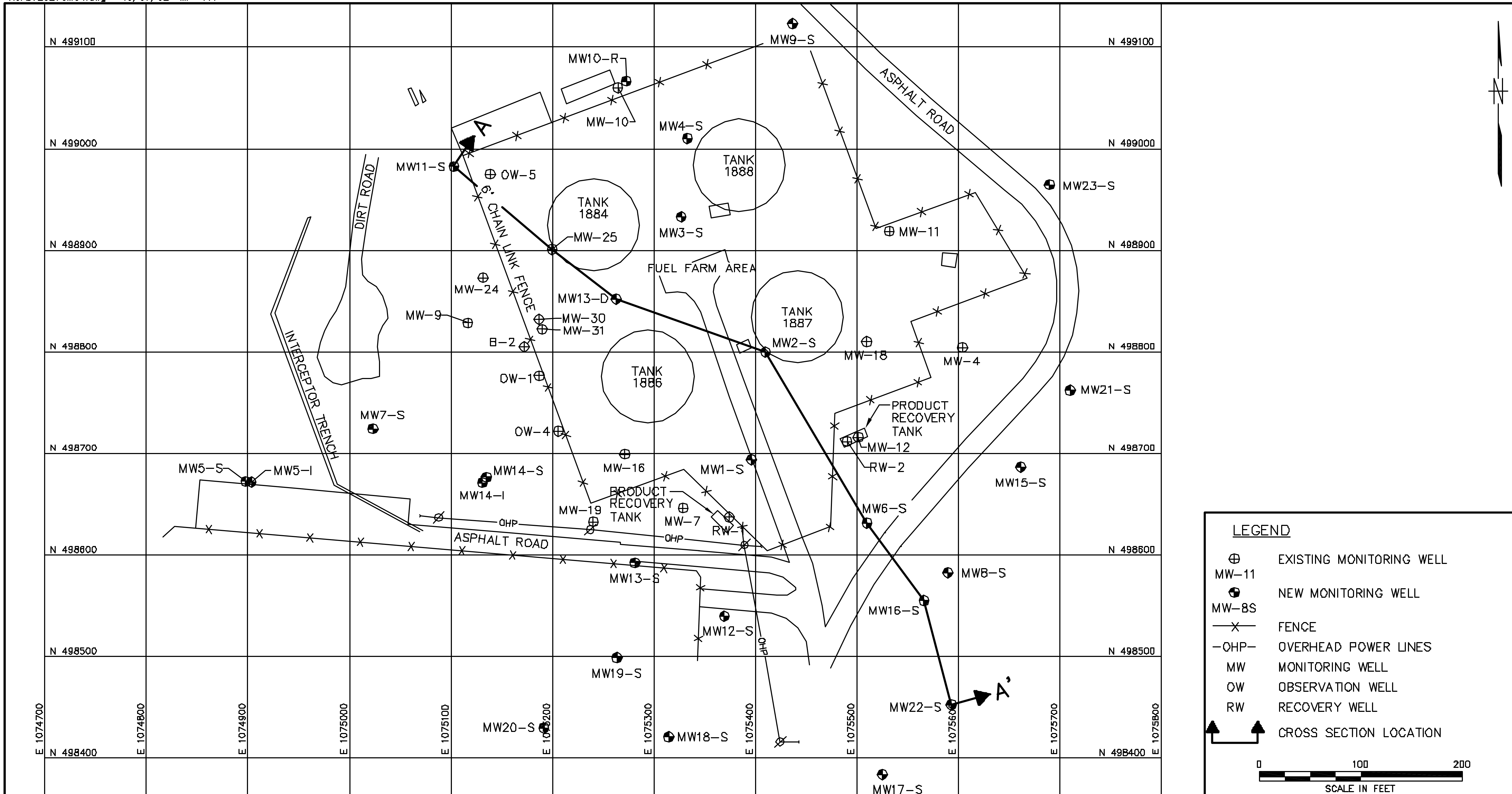
USEPA, 1995. *How to Evaluate Alternative Cleanup Technologies For Underground Storage Tank Sites, A Guide For Corrective Action Plan Reviewers*, USEPA 510-B-95-007. May.

USEPA, 1996. *How to Effectively Recover Free Product at Leaking Underground Storage Tank Sites,* USEPA 510-R-96-001. September.

APPENDIX A

SAR FIGURES

ACAD: 2827CM04.dwg 10/07/02 MF PIT



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

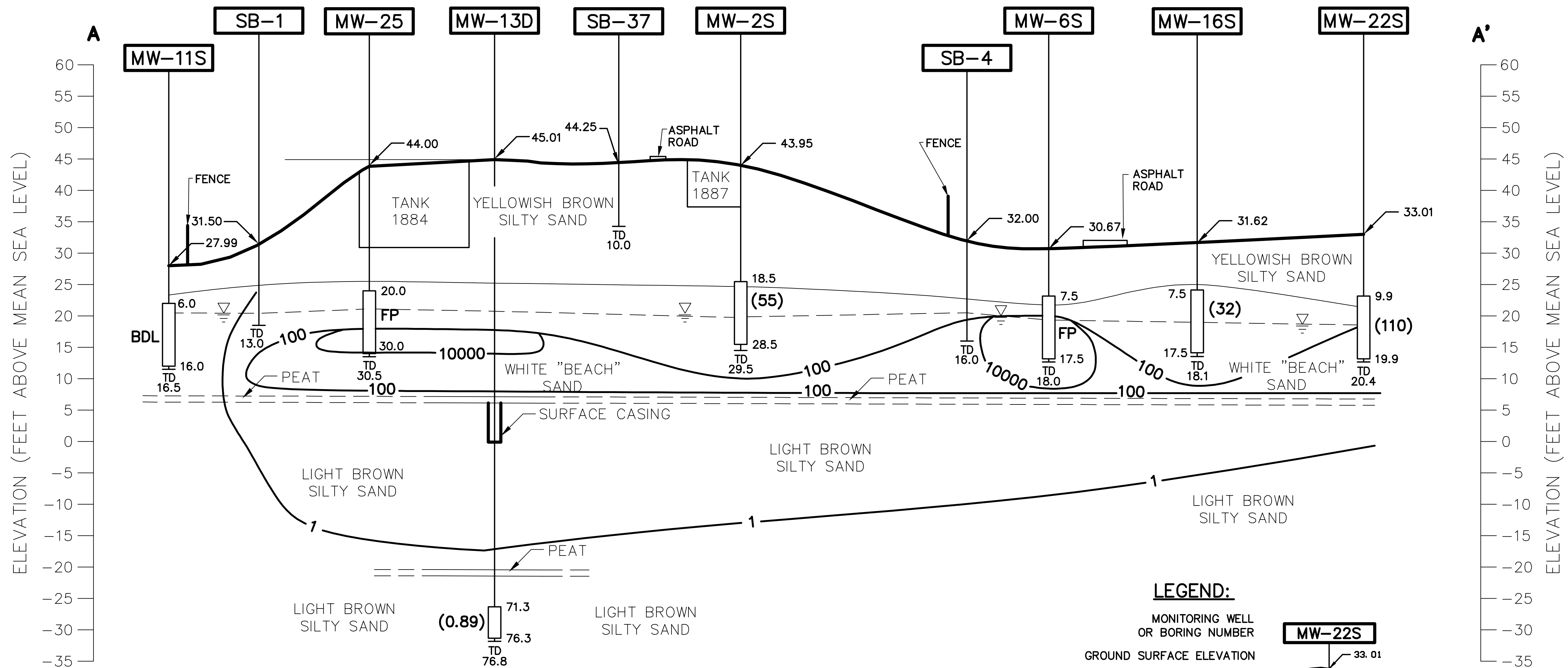
DRAWN BY: MF DATE: 10/7/02
CHECKED BY DATE
COST/SCHED-AREA
SCALE: AS NOTED

MONITORING WELL AND CROSS SECTION LOCATION MAP
SHERMAN FIELD FUEL FARM
NAS PENSACOLA
PENSACOLA, FLORIDA

CONTRACT NO. 2827
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-2 REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

ACAD: 0516GX01.dwg 02/08/01 HJP



0 80 160
HORIZONTAL SCALE IN FEET

0 20 40
VERTICAL SCALE IN FEET

LEGEND:

MONITORING WELL OR BORING NUMBER — MW-22S
GROUND SURFACE ELEVATION — 33.01
GROUND SURFACE
GROUNDWATER ELEVATION 11/05/00 DATA
TOP OF MONITORED INTERVAL (FT BGS) — 9.9
LITHOLOGIC CONTACT (DASHED WHERE INFERRED)
BOTTOM OF MONITORED INTERVAL (FT BGS) — 19.9
TOTAL DEPTH OF WELL OR BORING (FT BGS) — TD 20.4

FP = FREE PRODUCT
BDL= BELOW DETECTION LIMIT FOR BENZENE
(110) = BENZENE CONCENTRATION IN ppb
ppb = PARTS PER BILLION
—1— BENZENE ISOCONCENTRATION

NOTE:

ISOCONCENTRATION LEVELS EXPRESSED IN PPB

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 1/26/01
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

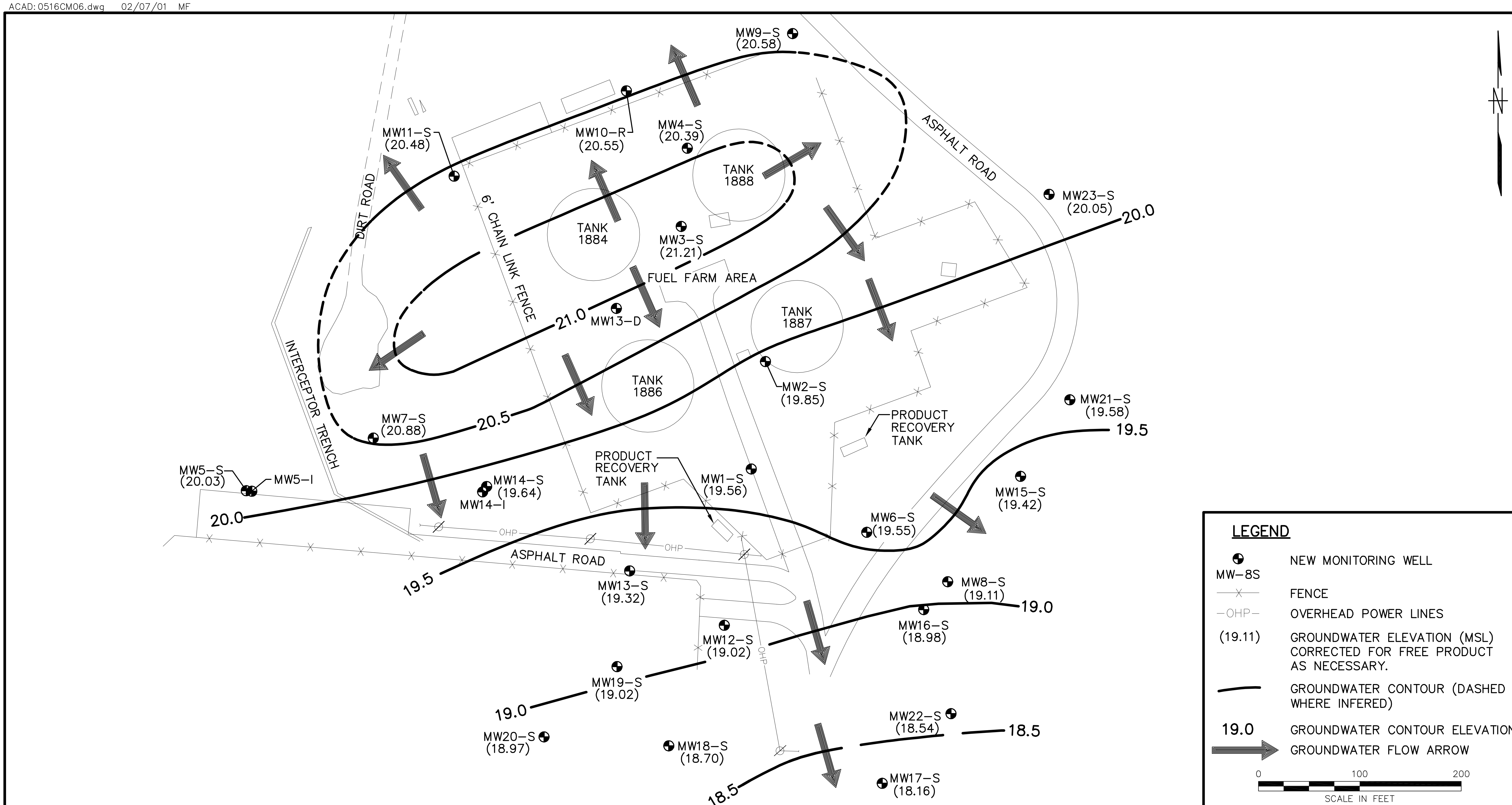
DEPARTMENT OF THE NAVY — SOUTHERN DIV FACILITIES ENGINEERING COMD

HYDROGEOLOGIC CROSS SECTION
SHERMAN FIELD FUEL FARM
NAS PENSACOLA
PENSACOLA, FLORIDA

CONTRACT NO. 0516
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 3-1 REV. 0

FORM CADD NO. SOUTH-BH.DGN - REV 0 - 9/9/98

ACAD: 0516CM06.dwg 02/07/01 MF



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY: MF DATE: 1/9/01

CHECKED BY DATE

COST/SCHED–AREA

SCALE: AS NOTED

GROUNDWATER ELEVATION MAP
(NOVEMBER 5, 2000)
SHERMAN FIELD FUEL FARM
NAS PENSACOLA
PENSACOLA, FLORIDA

CONTRACT NO. 0516

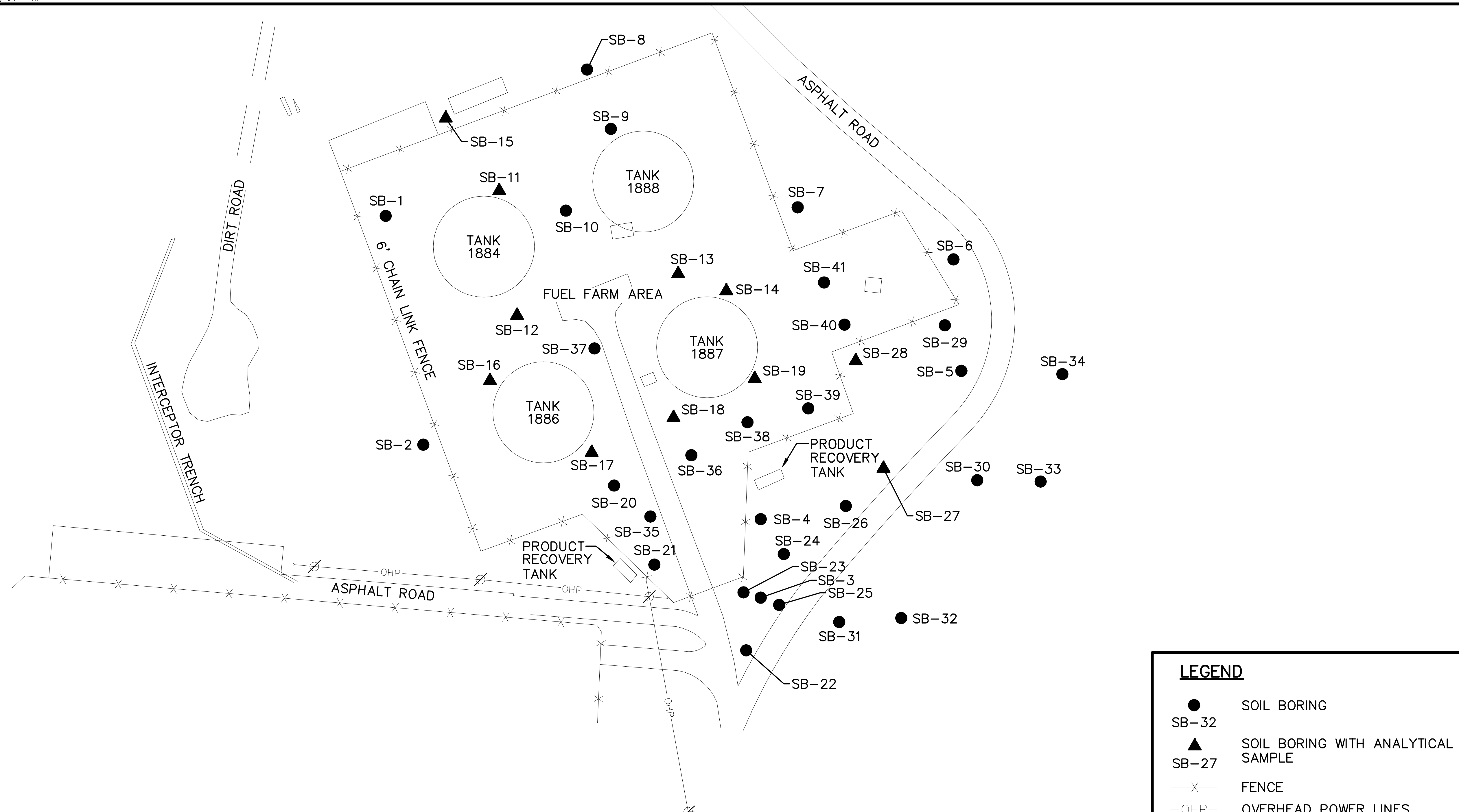
APPROVED BY DATE

APPROVED BY DATE

DRAWING NO. FIGURE 3–3 REV. 0

FORM CADD NO. SDIV_BH.DWG – REV 0 – 1/20/98

ACAD: 0516CM05.dwg 02/07/01 MF



LEGEND

Symbol	Description
● SB-32	SOIL BORING
▲ SB-27	SOIL BORING WITH ANALYTICAL SAMPLE
—x—	FENCE
—OHP—	OVERHEAD POWER LINES

0 100 200
SCALE IN FEET

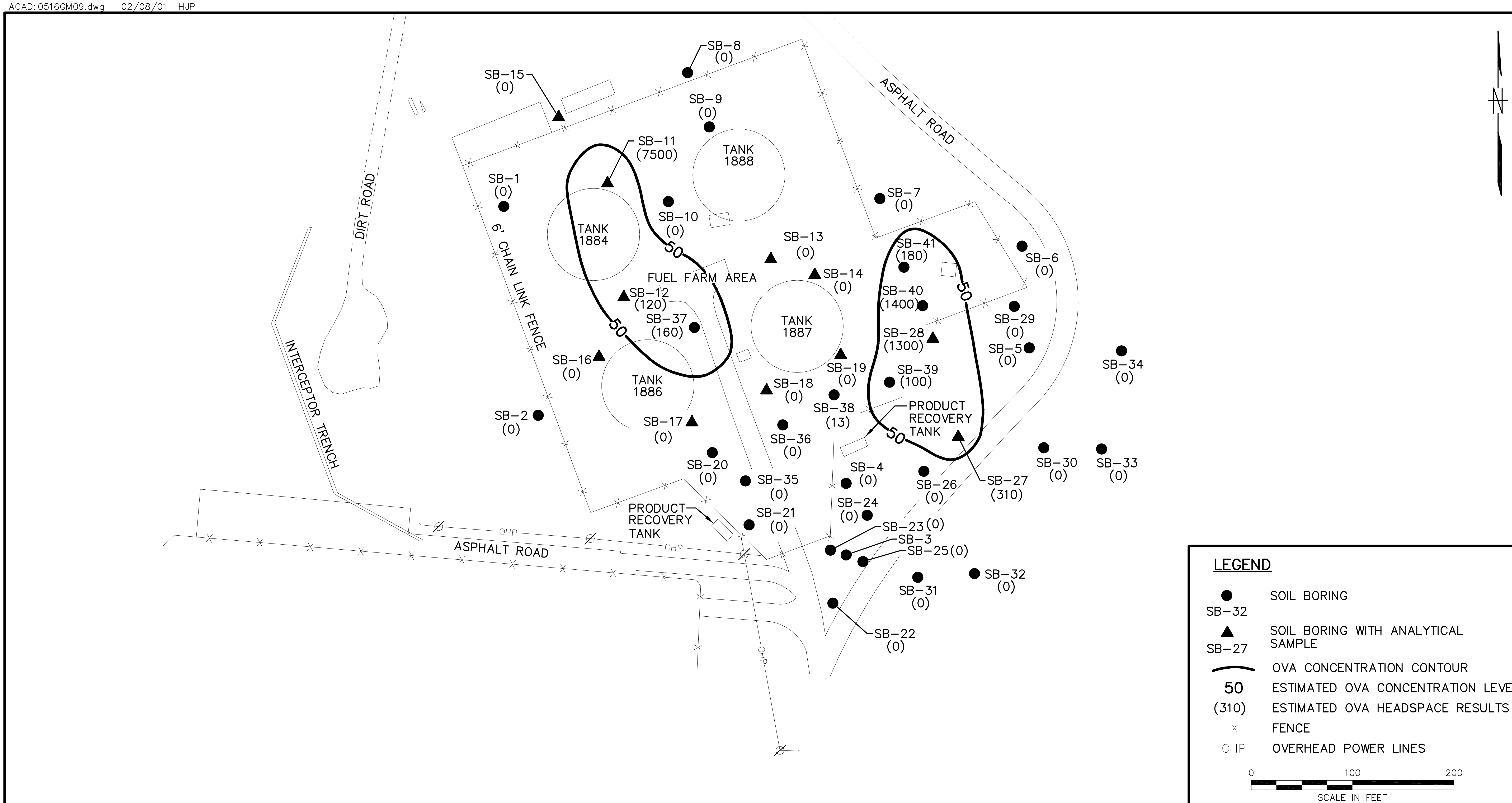
NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY: MF DATE: 1/9/01
CHECKED BY DATE
COST/SCHED-AREA
SCALE: AS NOTED

SOIL SAMPLING AND DPT BOREHOLE LOCATIONS
SHERMAN FIELD FUEL FARM
NAS PENSACOLA
PENSACOLA, FLORIDA

CONTRACT NO. 0516
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-1
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98



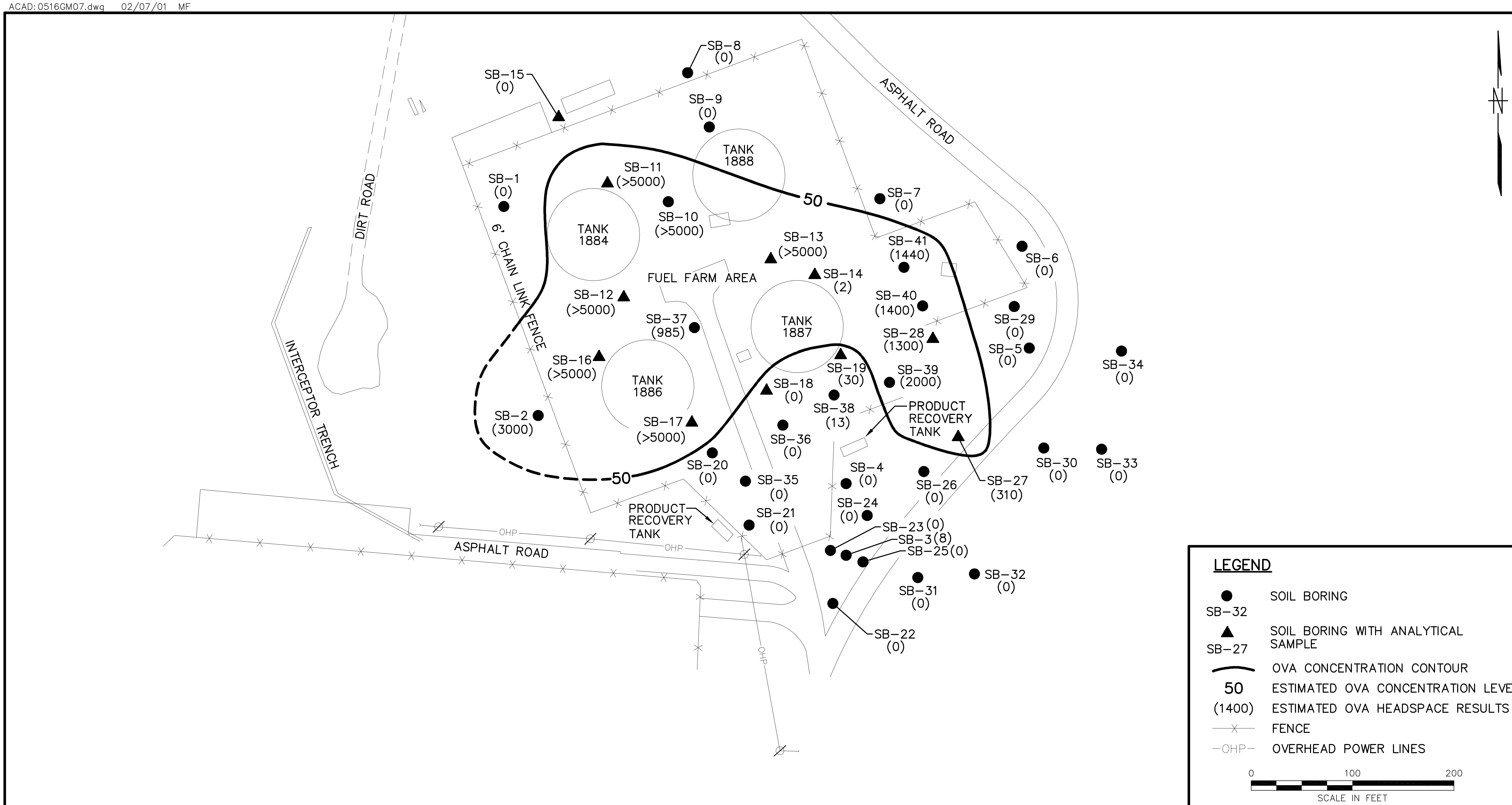
NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY: HJP DATE: 2/8/01
CHECKED BY DATE
COST/SCHED-AREA
SCALE: AS NOTED

SOIL HEADSPACE SCREENING RESULTS 4-8 FT
SHERMAN FIELD FUEL FARM
NAS PENSACOLA
PENSACOLA, FLORIDA

CONTRACT NO. 0516
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 4-1
REV. 0

ACAD: 0516GM07.dwg 02/07/01 MF



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 2/7/01

CHECKED BY DATE

COST/SCHED-AREA

SCALE AS NOTED

SOIL HEADSPACE SCREENING RESULTS FOR SAMPLE IMMEDIATELY ABOVE WATERTABLE
SHERMAN FIELD FUEL FARM
NAS PENSACOLA
PENSACOLA, FLORIDA

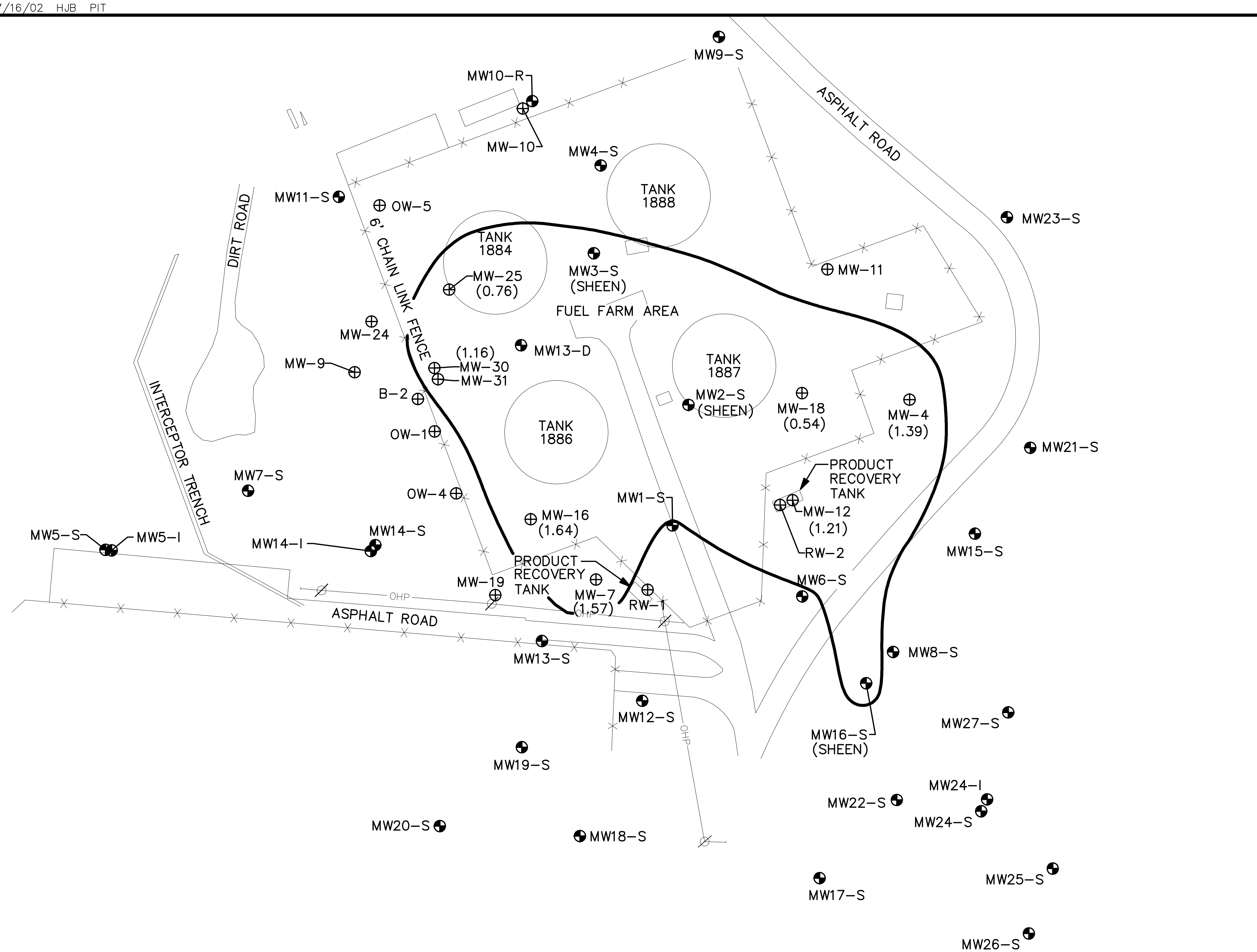
CONTRACT NO. 0516

APPROVED BY DATE

APPROVED BY DATE

DRAWING NO. FIGURE 4-2 REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98



LEGEND:

⊕ MW–11	EXISTING MONITORING WELL
MW–8S	NEW MONITORING WELL
—x—	FENCE
—OHP—	OVERHEAD POWER LINES
MW	MONITORING WELL
OW	OBSERVATION WELL
RW	RECOVERY WELL
———	FREE PRODUCT
(1.21)	APPROXIMATE FREE PRODUCT THICKNESS

NOTE:

MEASURMENT RECORDED JULY 19, 2000 AND SEPTEMBER 2000

0 100 200
SCALE IN FEET

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY: MF DATE: 7/15/02
CHECKED BY DATE
COST/SCHED–AREA
SCALE: AS NOTED

FREE PRODUCT THICKNESS
JULY/SEPTEMBER 2000
SHERMAN FIELD FUEL FARM
NAS PENSACOLA
PENSACOLA, FLORIDA

CONTRACT NO. 0516
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 3–2
REV. 0

APPENDIX B

SAR TABLES

TABLE 2-1

MONITORING WELL CONSTRUCTION DETAILS
UST SITE 000024 ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Well No.	Date Installed	Drilling Method	Top of Casing Elevation(1)	A/G Riser Length, If Applicable	Total Well Depth (Feet)	Screened Interval (FBLS)	Well Diameter (Inches)	Litholog Screened Ir
MW1-S	9/9/2000	HSA	40.01	NA	24.65	14.5 - 24.5	2	yellowish to white "beach"
MW2-S	9/9/2000	HSA	43.95	NA	29.45	18.5 - 28.5	2	yellowish to white "beach"
MW3-S	9/9/2000	HSA	45.65	NA	29.45	19.0 - 29.0	2	yellowish to white "beach"
MW4-S	9/10/2000	HSA	44.88	NA	29.70	19.0 - 29.0	2	yellowish to white "beach"
MW5-S	9/8/2000	HSA	31.86	NA	18.60	7.5 - 17.5	2	white "beach" silty fi
MW6-S	9/10/2000	HSA	30.67	NA	18.00	7.5 - 17.5	2	white "beach" silty fi
MW7-S	9/8/2000	HSA	28.83	NA	16.70	6.2 - 16.2	2	white "beach" silty fi
MW8-S	9/9/2000	HSA	31.47	NA	18.27	7.5 - 17.5	2	white "beach" silty fi
MW9-S	9/6/2000	HSA	29.24	NA	16.65	6.0 - 16.0	2	white "beach" silty fi
MW10-R	9/6/2000	HSA	29.85	NA	18.50	8.0 - 18.0	2	white "beach" silty fi
MW11-S	9/6/2000	HSA	27.99	NA	16.50	6.0 - 16.0	2	white "beach" silty fi
MW12-S	9/9/2000	HSA	33.47	NA	19.70	9.2 - 19.2	2	white "beach" silty fi
MW13-S	9/9/2000	HSA	36.24	NA	18.80	8.3 - 18.3	2	white "beach" silty fi
MW14-S	9/8/2000	HSA	31.47	NA	18.25	7.5 - 17.5	2	white "beach" silty fi
MW15-S	9/9/2000	HSA	30.62	NA	18.20	7.5 - 17.5	2	white "beach" silty fi
MW16-S	9/9/2000	HSA	31.62	NA	18.10	7.5 - 17.5	2	white "beach" silty fi
MW17-S	9/9/2000	HSA	34.28	NA	19.40	8.9 - 18.9	2	white "beach" silty fi
MW18-S	9/11/2000	HSA	32.29	NA	19.55	9.0 - 19.0	2	white "beach" silty fi
MW19-S	9/11/2000	HSA	35.87	NA	19.20	9.0 - 19.0	2	white "beach" silty fi
MW20-S	9/11/2000	HSA	36.13	NA	19.40	9.0 - 19.0	2	white "beach" silty fi
MW21-S	9/9/2000	HSA	28.83	NA	18.15	7.5 - 17.5	2	white "beach" silty fi
MW22-S	9/13/2000	HSA	33.01	NA	20.35	9.85 - 19.85	2	white "beach" silty fi
MW23-S	9/14/2000	HSA	29.59	NA	15.30	4.5 - 14.5	2	white "beach" silty fi
MW5-I	9/11/2000	HSA	31.65	NA	39.30	34.0 - 39.0	2	white "beach" fine-med Sa

TABLE 2-1

MONITORING WELL CONSTRUCTION DETAILS
UST SITE 000024 ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Well No.	Date Installed	Drilling Method	Top of Casing Elevation[1]	A/G Riser Length, If Applicable	Total Well Depth (Feet)	Screened Interval (FBLS)	Well Diameter (Inches)	Litholog Screened Ir
MW14-I	9/11/2000	HSA	32.27	NA	40.00	34.0 - 39.0	2	white "beach" fine-med Sa
MW13-D	9/13/2000	MR	45.01	NA	76.83	71.33 - 76.33	2	brown silty Sand, dark gr
MW24-S	10/26/2001	DPT	34.72	3.55	23.02	13.02-23.02	0.75	No samples cc
MW24-I	10/26/2001	DPT	34.65	3.50	43.16	38.16-43.16	0.75	No samples cc
MW25-S	10/26/2001	DPT	34.04	4.17	23.66	13.66-23.66	0.75	No samples cc
MW26-S	10/26/2001	DPT	31.14	3.97	23.49	13.49-23.49	0.75	No samples cc
MW27-S	10/26/2001	DPT	33.55	3.64	23.30	13.30-23.30	0.75	No samples cc

NOTES:

(1)	Top of casing elevations referenced to Mean Sea Level, North American Vertical Datum of 1988 (NAVD 88)
A/G	Above ground
FBLS	Feet below land surface
S Suffix	suffix indicates shallow depth monitoring well
HSA	Hollow stem auger
NA	Not applicable
R Suffix	suffix indicates replacement monitoring well
I Suffix	suffix indicates intermediate depth monitoring well
D Suffix	Indicates deep monitoring well
MR	Mud rotary
DPT	Direct push technology

TABLE 3-1

GROUNDWATER ELEVATION SUMMARY
UST SITE 000024 ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

November 5, 2000

Well ID	TOC Elevation (ft)	Depth of Well (ft)	Screened Interval (ft)	Depth to Water Level (ft)	Depth to Free Product (ft)	Free Product Thickness (ft)	Adj. Water Level Elevation (ft)
MW1-S	40.01	24.65	14.5 - 24.5	20.45			19.56
MW2-S	43.95	29.45	18.5 - 28.5	24.10	Sheen		19.85
MW3-S	45.65	29.45	19.0 - 29.0	24.44	Sheen		21.21
MW4-S	44.88	29.70	19.0 - 29.0	24.49			20.39
MW5-S	31.86	18.60	7.5 - 17.5	11.83			20.03
MW6-S	30.67	18.00	7.5 - 17.5	11.33	11.30	0.03	19.55
MW7-S	28.83	16.70	6.2 - 16.2	7.95			20.88
MW8-S	31.47	18.27	7.5 - 17.5	12.36			19.11
MW9-S	29.24	16.65	6.0 - 16.0	8.66			20.58
MW10-R	29.85	18.50	8.0 - 18.0	9.30			20.55
MW11-S	27.99	16.50	6.0 - 16.0	7.51			20.48
MW12-S	33.47	19.70	9.2 - 19.2	14.45			19.02
MW13-S	36.24	18.80	8.3 - 18.3	16.92			19.32
MW14-S	31.47	18.25	7.5 - 17.5	11.83			19.64
MW15-S	30.62	18.20	7.5 - 17.5	11.2			19.42
MW16-S	31.62	18.10	7.5 - 17.5	12.64			18.98
MW17-S	34.28	19.40	8.9 - 18.9	16.12			18.16
MW18-S	32.29	19.55	9.0 - 19.0	13.59			18.70
MW19-S	35.87	19.20	9.0 - 19.0	16.85			19.02
MW20-S	36.13	19.40	9.0 - 19.0	17.16			18.97
MW21-S	28.83	18.15	7.5 - 17.5	9.25			19.58
MW22-S	33.01	20.35	9.85 - 19.85	14.47			18.54
MW23-S	29.59	15.30	4.5 - 14.5	9.54			20.05
MW5-I	31.65	39.30	34.0 - 39.0	12.14			19.51
MW14-I	32.27	40.00	34.0 - 39.0	12.65			19.62
MW13-D	45.01	76.83	71.33 - 76.33	28.21			16.80
NOTES:	TOC (Top Of Casing) elevations surveyed 11/7-9/00 using North American Vertical Datum of 1988 (NAVD 88) datum.						
	Assumes Specfic Gravity of 0.7 for free product.						

TABLE 3-1

GROUNDWATER ELEVATION SUMMARY
UST SITE 000024 ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

September 6 to September 26, 2000 Data - Prior to Development

Well ID	TOC Elevation (ft)	Depth of Well (ft)	Screened Interval (ft)	Depth to Water Level (ft)	Depth to Free Product (ft)	Free Product Thickness (ft)	Adj. Water Level Elevation (ft)
MW1-S	40.01	24.65	14.5 - 24.5	20.28*			NA
MW2-S	43.95	29.45	18.5 - 28.5	24.02	Sheen		19.93
MW3-S	45.65	29.45	19.0 - 29.0	25.29*	Sheen		NA
MW4-S	44.88	29.70	19.0 - 29.0	24.14*			NA
MW5-S	31.86	18.60	7.5 - 17.5	11.53*			NA
MW6-S	30.67	18.00	7.5 - 17.5	12.61*	Sheen		NA
MW7-S	28.83	16.70	6.2 - 16.2	9.50*			NA
MW8-S	31.47	18.27	7.5 - 17.5	13.77*			NA
MW9-S	29.24	16.65	6.0 - 16.0	10.31*			NA
MW10-R	29.85	18.50	8.0 - 18.0	11.08*			NA
MW11-S	27.99	16.50	6.0 - 16.0	8.60*			NA
MW12-S	33.47	19.70	9.2 - 19.2	13.47			20.00
MW13-S	36.24	18.80	8.3 - 18.3	17.61*			NA
MW14-S	31.47	18.25	7.5 - 17.5	13.38*			NA
MW15-S	30.62	18.20	7.5 - 17.5	12.47*			NA
MW16-S	31.62	18.10	7.5 - 17.5	13.95*			NA
MW17-S	34.28	19.40	8.9 - 18.9	16.38*			NA
MW18-S	32.29	19.55	9.0 - 19.0	16.85			15.44
MW19-S	35.87	19.20	9.0 - 19.0	16.19			19.68
MW20-S	36.13	19.40	9.0 - 19.0	12.65			23.48
MW21-S	28.83	18.15	7.5 - 17.5	10.59*			NA
MW22-S	33.01	20.35	9.85 - 19.85	13.62*			NA
MW23-S	29.59	15.30	4.5 - 14.5	8.46			21.13
MW5-I	31.65	39.30	34.0 - 39.0	11.02			20.63
MW14-I	32.27	40.00	34.0 - 39.0	11.7			20.57
MW13-D	45.01	76.83	71.33 - 76.33	18.31			26.70
NOTES:	TOC (Top Of Casing) elevations surveyed 11/7-9/00 using North American Vertical Datum of 1988 (NAVD 88) datum.						
	* = Measurment prior to casing cut to final TOC elevation.						
	NA = Data not available						

TABLE 3-1

GROUNDWATER ELEVATION SUMMARY
UST SITE 000024 ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

January 11, 2002 Data

Well ID	TOC Elevation (ft)	Depth of Well (ft)	Screened Interval (ft)	Depth to Water Level (ft)	Depth to Free Product (ft)	Free Product Thickness (ft)	Adj. Water Level Elevation (ft)
MW1-S	40.01	24.65	14.5 - 24.5	22.05	sheen		17.96
MW2-S	43.95	29.45	18.5 - 28.5	25.18			18.77
MW3-S	45.65	29.45	19.0 - 29.0	28.30	26.94	1.36	18.30
MW4-S	44.88	29.70	19.0 - 29.0	26.37			18.51
MW5-S	31.86	18.60	7.5 - 17.5	13.39			18.47
MW6-S	30.67	18.00	7.5 - 17.5	13.85	12.65	1.20	17.66
MW7-S	28.83	16.70	6.2 - 16.2	10.48			18.35
MW8-S	31.47	18.27	7.5 - 17.5	13.82			17.65
MW9-S	29.24	16.65	6.0 - 16.0	10.55			18.69
MW10-R	29.85	18.50	8.0 - 18.0	NM			NM
MW11-S	27.99	16.50	6.0 - 16.0	9.29			18.70
MW12-S	33.47	19.70	9.2 - 19.2	15.90			17.57
MW13-S	36.24	18.80	8.3 - 18.3	18.20			18.04
MW14-S	31.47	18.25	7.5 - 17.5	13.38			18.09
MW15-S	30.62	18.20	7.5 - 17.5	12.81			17.81
MW16-S	31.62	18.10	7.5 - 17.5	14.15			17.47
MW17-S	34.28	19.40	8.9 - 18.9	17.00			17.28
MW18-S	32.29	19.55	9.0 - 19.0	14.93			17.36
MW19-S	35.87	19.20	9.0 - 19.0	18.30			17.57
MW20-S	36.13	19.40	9.0 - 19.0	18.58			17.55
MW21-S	28.83	18.15	7.5 - 17.5	10.92			17.91
MW22-S	33.01	20.35	9.85 - 19.85	15.78			17.23
MW23-S	29.59	15.30	4.5 - 14.5	11.36			18.23
MW5-I	31.65	39.30	34.0 - 39.0	13.60			18.05
MW14-I	32.27	40.00	34.0 - 39.0	14.18			18.09
MW13-D	45.01	76.83	71.33 - 76.33	28.50			16.51
MW24-S	34.72	23.02	13.02-23.02	17.75			16.97
MW24-I	34.65	43.16	38.16-43.16	17.95			16.70
MW25-S	34.04	23.66	13.66-23.66	17.14			16.90
MW26-S	31.14	23.49	13.49-23.49	16.82			14.32
MW27-S	33.55	23.30	13.30-23.30	16.52			17.03
MW-4	31.21	NA	NA	12.58	12.56	0.02	18.64
MW-7	33.99	NA	NA	15.54			18.45
MW-9	30.03	NA	NA	11.16			18.87
MW-11	31.10	NA	NA	dry			dry
MW-12	32.37	NA	NA	14.47	13.54	0.93	18.55
MW-16	37.43	NA	NA	18.94	18.84	0.10	18.56
MW-18	43.77	NA	NA	25.35	25.05	0.30	18.63
MW-19	35.38	NA	NA	16.92			18.46
MW-24	30.75	NA	NA	11.74	sheen		19.01
MW-25	31.21	NA	NA	26.19	26.00	0.19	5.15
MW-30	33.88	NA	NA	15.28	15.14	0.14	18.70
MW-31	32.69	NA	NA	15.03			17.66
OW-4	30.05	10.40	NA	Dry			dry
NOTES:			NM = Not Measured		NA = Data not available		
TOC (Top Of Casing) elevations surveyed 11/7-9/00 using North American Vertical Datum of 1988 (NAVD 88) datum.							

TABLE 3-2

POTABLE WELL INVENTORY DATA
UST 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

WELL ID/LOCAL NAME	LOCATION	TOTAL DEPTH (ft) bls	SCREENED INTERVAL (ft) bls	DIAMETER CASING/SCREEN (inches)
302116087170201/No. 1	Sec. 1, T3S, R30W Duncan and Taylor Roads	174	105-160	24/12
302124087163601/No. 2	Sec. 1, T3S, R30W Murray and Farrar Roads	178	110-160	24/12
NOTE: bls = below land surface				

TABLE 4-1

SOIL OVA SCREENING RESULTS FROM DPT INVESTIGATION
UST SITE - UST000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

SAMPLE				OVA SCREENING RESULTS			
LOCATION NO.	DATE COLLECTED	DEPTH TO WATER (ft)	SAMPLE INTERVAL (fbls)	TOTAL READING (ppm)	CARBON FILTERED (ppm)	NET READING (ppm)	COMMENTS
SB-1	7/19/2000		4-8	0	0	0	All soil borings hand-augered the first four
	7/19/2000	11	8-12	0	0	0	feet for potential utilities.
SB-2	7/19/2000		4-8	0	0	0	
	7/19/2000		9-11	3000	0	3000	
	7/19/2000	12	11-13	5000	0	5000	
SB-3	7/19/2000		0-4	0	0	0	
	7/19/2000		4-8	0	0	0	
	7/19/2000		8-12	8	0	8	
	7/19/2000	13	12-14	>5000	0	>5000	
	7/19/2000		14-16	3500	0	3500	
SB-4	7/19/2000		0-4	0	0	0	
	7/19/2000		4-8	0	0	0	
	7/19/2000	11.5	8-12	25	0	25	
	7/19/2000		12-16	25	0	25	
SB-5	7/19/2000		0-4	0	0	0	
	7/19/2000		6-10	0	0	0	
	7/19/2000	12	10-14	0	0	0	
SB-6	7/20/2000		0-4	0	0	0	
	7/20/2000		6-10	0	0	0	
	7/20/2000	12	10-14	0	0	0	
SB-7	7/20/2000		0-4	0	0	0	
	7/20/2000		6-10	0	0	0	
	7/20/2000	12	10-14	0	0	0	
SB-8	7/20/2000		0-4	0	0	0	
	7/20/2000		6-10	0	0	0	
	7/20/2000	12	10-14	0	0	0	
SB-9	7/20/2000		0-4	0	0	0	
	7/20/2000		4-8	0	0	0	
	7/20/2000		8-12	0	0	0	
	7/20/2000		12-16	0	0	0	
	7/20/2000		16-20	0	0	0	
	7/20/2000		20-24	0	0	0	
	7/20/2000	26	24-28	0	0	0	
SB-10	7/20/2000		0-4	0	0	0	
	7/20/2000		4-8	0	0	0	
	7/20/2000		8-12	0	0	0	
	7/20/2000		12-16	35	0	35	
	7/20/2000		16-20	350	0	350	
	7/20/2000		20-24	>5000	0	>5000	
	7/20/2000	26	24-27	>5000	0	>5000	

TABLE 4-1

SOIL OVA SCREENING RESULTS FROM DPT INVESTIGATION
UST SITE - UST000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

SAMPLE				OVA SCREENING RESULTS			
LOCATION NO.	DATE COLLECTED	DEPTH TO WATER (ft)	SAMPLE INTERVAL (fbls)	TOTAL READING (ppm)	CARBON FILTERED (ppm)	NET READING (ppm)	COMMENTS
SB-11	7/21/2000		0-4	0	0	0	
	7/21/2000		4-8	>5000	250	>5000	Analytical Sample
	7/21/2000		8-12	4800	4800	0	Sewerage odor
	7/21/2000		12-16	4500	4400	100	
	7/21/2000		18-22	>5000	220	>5000	Refusal-Offset
	7/21/2000	25	22-26	>5000	0.1	>5000	
SB-12	7/21/2000		0-4	0	0	0	
	7/21/2000		4-8	240	120	120	Analytical Sample
	7/21/2000		8-12	30	0	30	
	7/21/2000		12-16	120	0	120	
	7/21/2000		16-20	600	15	585	
	7/21/2000		20-24	>5000	50	>5000	Analytical Sample
	7/21/2000	26.5	24-28	>5000	80	>5000	
SB-13	7/22/2000		0-4	0	0	0	
	7/22/2000		4-8	0	0	0	
	7/22/2000		8-12	0	0	0	
	7/22/2000		12-16	1100	600	500	Analytical Sample
	7/22/2000		14-18	900	210	690	Difficult Penetration
	7/22/2000		17-21	240	120	120	
	7/22/2000		21-24	>5000	5	>5000	
	7/22/2000	26.5	24-27.5	>5000	50	>5000	
SB-14	7/22/2000		0-4	0	0	0	
	7/22/2000		4-8	0	0	0	
	7/22/2000		8-12	0	0	0	
	7/22/2000		12-16	0	0	0	
	7/22/2000		16-20	0	15	0	
	7/22/2000		20-24	2	0	2	
	7/22/2000	27	24-28	35	0	35	Analytical Sample + TOC
SB-15	7/22/2000		0-4	0	0	0	
	7/22/2000		5-9	0	0	0	
	7/22/2000	11.5	9-13	0	0	0	Analytical Sample + TOC
SB-16	7/23/2000		0-4	0	0	0	
	7/23/2000		4-8	0	0	0	
	7/23/2000		8-12	0	0	0	
	7/23/2000		12-16	50	10	40	
	7/23/2000		16-20	>5000	0	>5000	
	7/23/2000		20-24	>5000	0	>5000	Analytical Sample 22-26
	7/23/2000	26	24-28	>5000	0	>5000	

TABLE 4-1

SOIL OVA SCREENING RESULTS FROM DPT INVESTIGATION
UST SITE - UST000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

SAMPLE				OVA SCREENING RESULTS			
LOCATION NO.	DATE COLLECTED	DEPTH TO WATER (ft)	SAMPLE INTERVAL (fbls)	TOTAL READING (ppm)	CARBON FILTERED (ppm)	NET READING (ppm)	COMMENTS
SB-17	7/23/2000		0-4	0	0	0	
	7/23/2000		4-8	0	0	0	
	7/23/2000		8-12	1000	130	870	Analytical Sample 10-12
	7/23/2000		12-16	1000	125	875	
	7/23/2000		16-20	>5000	28	>5000	
	7/23/2000		20-24	>5000	40	>5000	
	7/23/2000	26	24-27	>5000	40	>5000	
SB-18	7/23/2000		0-4	0	0	0	
	7/23/2000		4-8	0	0	0	
	7/23/2000		8-12	0	0	0	
	7/23/2000		12-16	8	8	0	
	7/23/2000		16-20	13	0	13	
	7/23/2000		20-24	12	2	10	
	7/23/2000	26	24-28	1200	7	1193	Analytical Sample 24-27
SB-19	7/24/2000		0-4	0	0	0	
	7/24/2000		4-8	0	0	0	
	7/24/2000		8-12	0	0	0	
	7/24/2000		12-16	0	0	0	
	7/24/2000		16-20	0	0	0	
	7/24/2000		20-24	36	0	36	Analytical Sample
	7/24/2000	26	24-28	15	5	10	
SB-20	7/24/2000		0-4	0	0	0	
	7/24/2000		4-8	0	0	0	
	7/24/2000		8-12	0	0	0	
	7/24/2000	15.5	12-16	3500	0	3500	
SB-21	7/24/2000		0-4	0	0	0	
	7/24/2000		4-8	0	0	0	
	7/24/2000		8-12	0	0	0	
	7/24/2000	15.5	12-16	0	0	0	
SB-22	7/24/2000		0-4	0	0	0	
	7/24/2000		4-8	0	0	0	
	7/24/2000		8-12	0	0	0	
	7/24/2000	15	12-16	0	0	0	
SB-23	7/24/2000		0-4	0	0	0	
	7/24/2000		4-8	0	0	0	
	7/24/2000		8-12	0	0	0	
	7/24/2000	15	12-16	0	0	0	
SB-24	7/24/2000		0-4	0	0	0	
	7/24/2000		4-8	0	0	0	
	7/24/2000	11.5	8-12	>5000	0	>5000	
	7/24/2000		12-16	>5000	0	>5000	

TABLE 4-1

SOIL OVA SCREENING RESULTS FROM DPT INVESTIGATION
UST SITE - UST000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

SAMPLE				OVA SCREENING RESULTS			
LOCATION NO.	DATE COLLECTED	DEPTH TO WATER (ft)	SAMPLE INTERVAL (fbls)	TOTAL READING (ppm)	CARBON FILTERED (ppm)	NET READING (ppm)	COMMENTS
SB-25	7/24/2000		0-4	0	0	0	
	7/24/2000		4-8	20	0	20	
	7/24/2000		8-12	0	0	0	
	7/24/2000	15	12-16	>5000	0	>5000	
SB-26	7/25/2000		0-4	0	0	0	
	7/25/2000		4-8	0	0	0	
	7/25/2000	11.5	8-12	100	0	100	
SB-27	7/25/2000		0-4	0	0	0	
	7/25/2000		4-8	310	0	310	Analytical Sample
	7/25/2000	11.5	8-12	>5000	10	>5000	
SB-28	7/25/2000		0-4	0	0	0	
	7/25/2000		4-8	1300	0	1300	Analytical Sample 7-11
	7/25/2000	11.0	8-12	>5000	5	>5000	
SB-29	7/25/2000		0-4	0	0	0	
	7/25/2000		4-8	0	0	0	
	7/25/2000	11.5	8-12	12	6	6	
SB-30	7/25/2000		0-4	0	0	0	
	7/25/2000		4-8	0	0	0	
	7/25/2000	11.0	8-12	>5000	0	>5000	
SB-31	7/25/2000		0-4	0	0	0	
	7/25/2000		4-8	0	0	0	
	7/25/2000	12	8-12	4200	0	4200	
SB-32	7/25/2000		0-4	0	0	0	
	7/25/2000		4-8	0	0	0	
	7/25/2000	12	8-12	3000	0	3000	
SB-33	7/25/2000		0-4	0	0	0	
	7/25/2000		4-8	0	0	0	
	7/25/2000	11.5	8-12	0	0	0	
SB-34	7/26/2000		0-4	0	0	0	
	7/26/2000		4-8	0	0	0	
	7/26/2000	10.5	8-12	0	0	0	
SB-35	7/26/2000		0-4	0	0	0	
	7/26/2000		4-8	0	0	0	
	7/26/2000		8-12	0	0	0	
	7/26/2000		12-16	0	0	0	
	7/26/2000	19	16-20	12	0	12	
SB-36	7/26/2000		0-4	0	0	0	
	7/26/2000		4-8	0	0	0	
	7/26/2000		8-12	0	0	0	
	7/26/2000	13	12-13	0	0	0	

TABLE 4-1

SOIL OVA SCREENING RESULTS FROM DPT INVESTIGATION
UST SITE - UST000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

SAMPLE				OVA SCREENING RESULTS			
LOCATION NO.	DATE COLLECTED	DEPTH TO WATER (ft)	SAMPLE INTERVAL (fbls)	TOTAL READING (ppm)	CARBON FILTERED (ppm)	NET READING (ppm)	COMMENTS
SB-37	7/26/2000		0-4	0	0	0	
	7/26/2000		4-8	170	10	160	
	7/26/2000		8-12	215	135	80	Groundwater not encountered.
	7/26/2000		12-16	1800	310	1490	Difficulty retrieving sampler
	7/26/2000	NE	16-20	1350	365	985	Terminated above water table
SB-38	7/26/2000		7-8	13	0	13	Hand Auger inside fence.
	7/26/2000	10.5	9-10	4100	0	4100	
SB-39	7/26/2000		0-4	0	0	0	
	7/26/2000		7-8	100	0	100	Hand Auger inside fence.
	7/26/2000		9-10	2000	0	2000	
	7/26/2000	11.5	11-12	>5000	0	>5000	
SB-40	7/26/2000		0-4	0	0	0	
	7/26/2000		7-8	1400	0	1400	Hand Auger inside fence.
	7/26/2000	11.5	10.5-11.5	>5000	0	>5000	
SB-41	7/26/2000		0-4	0	0	0	Hand Auger inside fence.
	7/26/2000		7-8	180	0	180	
	7/26/2000		9-10	4400	0	4400	
	7/26/2000	10.5	10.5-11.5	4400	0	4400	

Notes: fbls = feet below land surface
ppm = parts per million
NS = not sampled
Shade = headspace sample collected at water table.

TABLE 4-2

ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Sample No.		NASPFFSB-11	NASPFFSB-12	NASPFFSB-12	NASPFFSB-13	NASPFFSB-14
Sample Location		SB-11	SB-12	SB-12	SB-13	SB-14
Collect Date		8/3/2000	8/2/2000	8/2/2000	8/3/2000	8/3/2000
Sample Depth (bls)		4-8'	6-8'	20-24'	14-16'	24-27'
	DE1[1]/DE2[2]/LE[3] (mg/kg)					
Volatile[4] (mg/kg)						
Benzene	1.1/1.6/0.**007**	--	**0.0106**	**0.0115**	0.0018[J]	--
Ethylbenzene	1100/8400/**0.6**	**5.05**	0.0087	0.0146	0.0177	--
Total Xylenes	5900/40000/**0.2**	**12.3**	--	0.0119[J]	0.0144[J]	--
Polycyclic Aromatic Hydrocarbons[5] (mg/kg)						
1-Methylnaphthalene	68/470/**2.2**	**8.65**	**--**	**--**	**--**	**--**
2-Methylnaphthalene	80/560/**6.1**	**9.28**	**--**	**--**	**--**	**--**
Naphthalene	40/270/**1.7**	**2.85**	**--**	**--**	**--**	**--**
Total Petroleum Hydrocarbons[6] (mg/kg)	**340**/2500/**340**	**2,530**	9.79	10.4	14.7	--

[1] DE1= Direct Exposure limit for residential area from Chapter 62-777, F.A.C.
[2] DE2= Direct Exposure limit for industrial area from Chapter 62-777, F.A.C.
[3] LE= Leachability for groundwater limit from Chapter 62-777, F.A.C.
[4] SW-846 8260B, [5] SW-846 8310, [6] FL-PRO
[J] Indicates the presence of a chemical at an estimated concentration.
Bold indicates an exceedance of regulatory limits.

Table 4-2

ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Sample No.		NASPFFDUP-1	NASPFFSB-15	NASPFFSB-16	NASPFFSB-17	NASPFFSB-18
Sample Location		SB-14	SB-15	SB-16	SB-17	SB-18
Collect Date		8/3/2000	8/3/2000	8/3/2000	8/2/2000	8/2/2000
Sample Depth (bls)			8-12'	22-26'	10-12'	24-27'
	DE1[1]/DE2[2]/LE[3] (mg/kg)					
Volatile[4] (mg/kg)						
Benzene	1.1/1.6/**0.007**	--	--	**0.113[J]**	--	--
Ethylbenzene	1100/8400/**0.6**	--	--	**6.7**	--	--
Total Xylenes	5900/40000/**0.2**	--	--	**13.3**	**--**	**--**
Polycyclic Aromatic Hydrocarbons[5] (mg/kg)						
1-Methylnaphthalene	68/470/**2.2**	--	**--**	**2.32**	--	--
2-Methylnaphthalene	80/560/6.1	--	**--**	2.7	--	--
Naphthalene	40/270/1.7	--	**--**	0.566	--	--
Total Petroleum Hydrocarbons[6] (mg/kg)	**340**/2500/**340**	--	**--**	**810**	**--**	**--**

[1] DE1= Direct Exposure limit for residential area from Chapter 62-777, F.A.C.
[2] DE2= Direct Exposure limit for industrial area from Chapter 62-777, F.A.C.
[3] LE= Leachability for groundwater limit from Chapter 62-777, F.A.C.
[4] SW-846 8260B, [5] SW-846 8310, [6] FL-PRO
[J] Indicates the presence of a chemical at an estimated concentration.
Bold indicates an exceedance of regulatory limits.

Table 4-2

ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Sample No.		NASPFFSB-19	NASPFFSB-27	NASPFFSB-28
Sample Location		SB-19	SB-27	SB-28
Collect Date		8/2/2000	8/2/2000	8/2/2000
Sample Depth (bls)		20-24'	6-8'	7-11'
	DE1[1]/DE2[2]/LE[3] (mg/kg)			
Volatile[4] (mg/kg)				
Benzene	1.1/1.6/0.007	--	--	--
Ethylbenzene	1100/8400/0.6	--	--	**3.41**
Total Xylenes	5900/40000/0.2	--	--	**30.5**
Polycyclic Aromatic Hydrocarbons[5] (mg/kg)				
1-Methylnaphthalene	68/470/2.2	--	--	**3.27**
2-Methylnaphthalene	80/560/6.1	--	--	4.05
Naphthalene	40/270/1.7	--	--	1.38
Total Petroleum Hydrocarbons[6] (mg/kg)	340/2500/340	9.97	--	**2,130**

[1] DE1= Direct Exposure limit for residential area from Chapter 62-777, F.A.C.
[2] DE2= Direct Exposure limit for industrial area from Chapter 62-777, F.A.C.
[3] LE= Leachability for groundwater limit from Chapter 62-777, F.A.C.
[4] SW-846 8260B, [5] SW-846 8310, [6] FL-PRO
[J] Indicates the presence of a chemical at an estimated concentration.
Bold indicates an exceedance of regulatory limits.

TABLE 4-3

ANALYTICAL RESULTS FOR INORGANIC ANALYTES IN SUBSURFACE SOIL SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Sample No.		NASPFFSB-12	NASPFFSB-14	NASPFFSB-15	NASPFFSB-16
Sample Location		Soil boring 12	Soil boring 14	Soil boring 15	Soil boring 16
Collect Date		8/2/2000	8/3/2000	8/3/2000	8/3/2000
Sample Depth (bls)		20-24'	24-27'	8-12'	22-26'
	DE1[1]/DE2[2]/LE[3] (mg/kg)				
Metals[4] (mg/kg)					
Barium		5.7	NA	NA	--
Chromium		4.3	NA	NA	--
Lead		1.1	NA	NA	--
Mercury		0.05	NA	NA	0.01
Selenium		0.29	NA	NA	--
Silver		0.15	NA	NA	--
Miscellaneous (mg/kg)					
Total Organic Carbon		NA	--	--	NA
Total Organic Halides		NA	--	--	NA

[1] DE1= Direct Exposure limit for residential area from Chapter 62-777, F.A.C.
[2] DE2= Direct Exposure limit for industrial area from Chapter 62-777, F.A.C.
[3] LE= Leachability for groundwater limit from Chapter 62-777, F.A.C.

[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 4-4

SUMMARY ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Sample No.		NASPFF MW1-S	NASPFF MW2-S	NASPFF MW3-S	NASPFF MW4-S	NASPFF MW5-I
Sample Location		MW1-S	MW2-S	MW3-S	MW4-S	MW5-I
Collect Date		11/7/2000	11/7/2000	11/9/2000	11/9/2000	11/7/2000
	Groundwater Clean-up Criteria [1] (ug/L)					
Volatile [2] (ug/L)						
1,1-Dichloroethane	70	--	--	--	--	--
1,2-Dichloroethane	3	17[J]	--	--	--	--
1,2-Dichloropropane	5	--	3.6[J]	--	--	--
Benzene	1	**530**	**55**	**280**	--	--
Chloroform	5.7	--	--	--	0.63[J]	--
Chloromethane	2.7	--	--	--	--	--
Ethylbenzene	30	**1,300**	**1,100**	**1,700**	1.2	--
Methyl tert-Butyl Ether	50	--	--	--	--	--
Methylene Chloride	5	--	--	--	--	--
Toluene	40	--	10	16[J]	--	--
Xylenes, total	20	**430**	**3,100**	**4,100**	0.88[J]	--
Polycyclic Aromatic Hydrocarbons [3] (ug/L)						
1-Methylnaphthalene	20	**54**	**50**	**64**	--	--
2-Methylnaphthalene	20	**68**	**63**	**79**	--	--
Acenaphthene	20	0.8[J]	2.2	0.59[J]	--	--
Anthracene	2,100	--	--	--	--	--
Benzo(g,h,i)perylene	210	--	--	--	--	--
Dibenzo(a,h)anthracene	0.2	--	--	--	--	--
Fluoranthene	280	--	--	--	--	--
Fluorene	280	1.1	2	1.4	--	--
Indeno(1,2,3-c,d)pyrene	0.2	--	--	--	--	--
Naphthalene	20	**130**	**110**	**200**	--	--
Phenanthrene	210	0.78[J]	2	--	--	--
Pyrene	210	--	--	--	--	--
Total Petroleum Hydrocarbons [4] (ug/L)	5,000	**5,600[J]**	**7,900[J]**	**28,000**	--	--
Dissolved Gases [5] (ug/L)						
Methane	NA	6,300	2,500	2,100	210	NA
Oxygen*	NA	290	710	<200	2,600	270
Metals [6] (ug/L)						
Lead	15	--	--	--	--	--
Ferrous Iron*	NA	6,100	5,600	6200	800	NA
Inorganic Parameters [7] (ug/L)						
Nitrate	10,000	90	10	--	860	NA
Nitrite	1,000	--	--	80	20	NA
Sulfate	250,000	--	1,000	--	5,000	NA

[1] Groundwater Clean-up Criteria as provided in Chapter 62-777,F.A.C.
[2] SW-846 8021B and EPA 504.1, [3] SW-846 8310, [4] FDEP FL-PRO, [5] RSK-175M, [6] SW-846 6010B, [7] EPA 300/376.1
[J] indicates the presence of a chemical at an estimated concentration.

* = Field Measurement -- = not detected NA = not applicable
Bold indicates an exceedance of limits.

TABLE 4-4

SUMMARY ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Sample No.		NASPFF MW5-S	NASPFF MW7-S	NASPFF MW8-S	NASPFF MW9-S	NASPFF MW10-R
Sample Location		MW5-S	MW7-S	MW8-S	MW9-S	MW10-R
Collect Date		11/6/2000	11/6/2000	11/6/2000	11/15/2000	11/6/2000
	Groundwater Clean-up Criteria [1] (ug/L)					
Volatile [2] (ug/L)						
1,1-Dichloroethane	70	--	--	--	--	--
1,2-Dichloroethane	3	--	--	--	--	--
1,2-Dichloropropane	5	--	--	--	--	--
Benzene	1	--	--	**39**	--	--
Chloroform	5.7	2.9	1.8	--	0.81[J]	0.65[J]
Chloromethane	2.7	--	--	--	0.56[J]	--
Ethylbenzene	30	--	--	**100**	--	--
Methyl tert-Butyl Ether	50	--	--	--	--	--
Methylene Chloride	5	--	--	--	0.58[J]	--
Toluene	40	--	--	--	--	--
Xylenes, total	20	0.78[J]	--	**520**	--	--
Polycyclic Aromatic Hydrocarbons [3] (ug/L)						
1-Methylnaphthalene	20	**30[J]**	--	16	--	--
2-Methylnaphthalene	20	**48[J]**	--	**21**	--	--
Acenaphthene	20	--	--	--	--	--
Anthracene	2,100	--	--	--	--	--
Benzo(g,h,i)perylene	210	--	--	--	--	--
Dibenzo(a,h)anthracene	0.2	--	--	--	--	--
Fluoranthene	280	--	--	--	--	--
Fluorene	280	--	--	--	--	--
Indeno(1,2,3-c,d)pyrene	0.2	--	--	--	--	--
Naphthalene	20	**110[J]**	--	**30**	--	--
Phenanthrene	210	--	--	--	--	--
Pyrene	210	--	--	--	--	--
Total Petroleum Hydrocarbons [4] (ug/L)	5,000	--	--	4,600	--	--
Dissolved Gases [5] (ug/L)						
Methane	NA	NA	NA	NA	--	NA
Oxygen*	NA	3,800	2,450	300	3,700	3,220
Metals [6] (ug/L)						
Lead	15	--	--	--	--	7.2[J]
Ferrous Iron*	NA	NA	NA	NA	<200	NA
Inorganic Parameters [7] (ug/L)						
Nitrate	10,000	NA	NA	NA	330	NA
Nitrite	1,000	NA	NA	NA	--	NA
Sulfate	250,000	NA	NA	NA	7,000	NA

[1] Groundwater Clean-up Criteria as provided in Chapter 62-777,F.A.C.
[2] SW-846 8021B and EPA 504.1, [3] SW-846 8310, [4] FDEP FL-PRO, [5] RSK-175M, [6] SW-846 6010B, [7] EPA 300/376.1
[J] indicates the presence of a chemical at an estimated concentration.

* = Field Measurement -- = not detected NA = not applicable
Bold indicates an exceedance of limits.

TABLE 4-4

SUMMARY ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA
PAGE 3 OF 6

Sample No.		NASPFF MW11-S	NASPFF MW12-S	NASPFFDUP-3	NASPFF MW13-D	NASPFF MW13-S
Sample Location		MW11-S	MW12-S	Duplicate of MW12-S	MW13-D	MW13-S
Collect Date		11/15/2000	11/16/2000	11/16/2000	11/9/2000	11/7/2000
	Groundwater Clean-up Criteria [1] (ug/L)					
Volatile [2] (ug/L)						
1,1-Dichloroethane	70	--		--	2	--
1,2-Dichloroethane	3	--		--	--	--
1,2-Dichloropropane	5	--		--	--	--
Benzene	1	--	**590**	**560**	0.89[J]	--
Chloroform	5.7	--		--	--	2.2
Chloromethane	2.7	--		--	--	--
Ethylbenzene	30	--	**550**	**550**	--	--
Methyl tert-Butyl Ether	50	--		--	5.1[J]	--
Methylene Chloride	5	0.81[J]		--	--	--
Toluene	40	--	11	11	--	--
Xylenes, total	20	--	**320**	**320**	--	--
Polycyclic Aromatic Hydrocarbons [3] (ug/L)						
1-Methylnaphthalene	20	--	**52**	**53**	--	--
2-Methylnaphthalene	20	--	**65**	**67**	--	--
Acenaphthene	20	--	1.4	1.2	--	--
Anthracene	2,100	--	0.64[J]	0.59[J]		
Benzo(g,h,i)perylene	210	--	--	--	--	--
Dibenzo(a,h)anthracene	0.2	--	--	--	--	--
Fluoranthene	280	--	1.7	1.7		
Fluorene	280	--	1.5	1.3	--	--
Indeno(1,2,3-c,d)pyrene	0.2	--	--	--	--	--
Naphthalene	20	--	**130**	**130**	--	--
Phenanthrene	210	--	2.6	2.5	--	--
Pyrene	210	--	0.97[J]	0.94[J]	--	--
Total Petroleum Hydrocarbons [4] (ug/L)	5,000	--	4,000	3,800	--	--
Dissolved Gases [5] (ug/L)						
Methane	NA	41	4,400	4,800	NA	NA
Oxygen*	NA	3,200	<200	NA	1,030	1,180
Metals [6] (ug/L)						
Lead	15	--	--	--	--	--
Ferrous Iron*	NA	2,800	6,200	NA	NA	NA
Inorganic Parameters [7] (ug/L)						
Nitrate	10,000	220	450	430	NA	NA
Nitrite	1,000	--	20[J]	10[J]	NA	NA
Sulfate	250,000	8,000	6,000	6,000	NA	NA

D=Duplicate Samples
[1] Groundwater Clean-up Criteria as provided in Chapter 62-777,F.A.C.
[2] SW-846 8021B and EPA 504.1, [3] SW-846 8310, [4] FDEP FL-PRO, [5] RSK-175M, [6] SW-846 6010B, [7] EPA 300/376.1
[J] indicates the presence of a chemical at an estimated concentration.
* = Field Measurement -- = not detected NA = not applicable
Bold indicates an exceedance of limits.

Sample Location

TABLE 4-4

SUMMARY ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Sample No.		NASPFF MW14-I	NASPFF MW14-S	NASPFF MW15-S	NASPFF DUP-2	NASPFF MW16-S
Sample Location		MW14-I	MW14-S	MW15-S	Duplicate of MW15-S	MW16-S
Collect Date		11/16/2000	11/16/2000	11/7/2000	11/7/2000	11/8/2000
	Groundwater Clean-up Criteria [1] (ug/L)					
Volatile [2] (ug/L)						
1,1-Dichloroethane	70	--	--	--	--	--
1,2-Dichloroethane	3	--	--	--	--	--
1,2-Dichloropropane	5	--	--	--	--	--
Benzene	1	--	--	--	--	**32**
Chloroform	5.7	0.78[J]	6.6	--	--	--
Chloromethane	2.7	--	--	--	--	--
Ethylbenzene	30	--	--	--	--	**330**
Methyl tert-Butyl Ether	50	--	--	--	--	--
Methylene Chloride	5	--	--	--	--	13[J]
Toluene	40	--	--	--	--	17
Xylenes, total	20	--	--	--	--	**2,300**
Polycyclic Aromatic Hydrocarbons [3] (ug/L)						
1-Methylnaphthalene	20	--	--	--	--	**29**
2-Methylnaphthalene	20	--	--	--	--	**37**
Acenaphthene	20	--	--	--	--	0.44[J]
Anthracene	2,100	--	--	--	--	--
Benzo(g,h,i)perylene	210	--	--	--	--	0.44[J]
Dibenzo(a,h)anthracene	0.2	--	--	--	--	**0.27[J]**
Fluoranthene	280	--	--	--	--	--
Fluorene	280	--	--	--	--	0.42[J]
Indeno(1,2,3-c,d)pyrene	0.2	--	--	--	--	**0.28[J]**
Naphthalene	20	--	--	--	--	**75**
Phenanthrene	210	--	--	--	--	--
Pyrene	210	--	--	--	--	--
Total Petroleum Hydrocarbons [4] (ug/L)	5,000	--	--	--	--	**9,600**
Dissolved Gases [5] (ug/L)						
Methane	NA	NA	--	NA	NA	2,900
Oxygen*	NA	1,640	7,000	3,130	NA	<200
Metals [6] (ug/L)						
Lead	15	--	--	--	--	11
Ferrous Iron*	NA	NA	<200	NA	NA	600
Inorganic Parameters [7] (ug/L)						
Nitrate	10,000	NA	380	NA	NA	40
Nitrite	1,000	NA	--	NA	NA	--
Sulfate	250,000	NA	9,000	NA	NA	4,000

[1] Groundwater Clean-up Criteria as provided in Chapter 62-777,F.A.C.
[2] SW-846 8021B and EPA 504.1, [3] SW-846 8310, [4] FDEP FL-PRO, [5] RSK-175M, [6] SW-846 6010B, [7] EPA 300/376.1
[J] indicates the presence of a chemical at an estimated concentration.

* = Field Measurement -- = not detected NA = not applicable
Bold indicates an exceedance of limits.

Sample Depth (bls)

TABLE 4-4

SUMMARY ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Sample No.		NASPFF MW17-S	NASPFF MW18-S	NASPFF MW19-S	NASPFF MW20-S	NASPFF MW21-S
Sample Location		MW17-S	MW18-S	MW19-S	MW20-S	MW21-S
Collect Date		11/6/2000	11/5/2000	11/5/2000	11/5/2000	11/15/2000
	Groundwater Clean-up Criteria [1] (ug/L)					
Volatile [2] (ug/L)						
1,1-Dichloroethane	70	--	--	--	--	--
1,2-Dichloroethane	3	--	--	--	--	--
1,2-Dichloropropane	5	--	--	--	--	--
Benzene	1	--	--	--	--	--
Chloroform	5.7	2.4	--	0.93[J]	--	--
Chloromethane	2.7	--	--	--	--	--
Ethylbenzene	30	--	3.1	--	--	--
Methyl tert-Butyl Ether	50	--	--	--	--	--
Methylene Chloride	5	--	--	--	--	0.68[J]
Toluene	40	--	0.54[J]	--	1.6	--
Xylenes, total	20	1.7[J]	7.7	--	--	--
Polycyclic Aromatic Hydrocarbons [3] (ug/L)						
1-Methylnaphthalene	20	--	4.5	--	--	--
2-Methylnaphthalene	20	--	3.3	--	--	--
Acenaphthene	20	--	--	--	--	--
Anthracene	2,100	--	--	--	--	--
Benzo(g,h,i)perylene	210	--	--	--	--	--
Dibenzo(a,h)anthracene	0.2	--	--	--	--	--
Fluoranthene	280	--	--	--	--	--
Fluorene	280	--	--	--	--	--
Indeno(1,2,3-c,d)pyrene	0.2	--	--	--	--	--
Naphthalene	20	--	5.7	--	--	--
Phenanthrene	210	--	--	--	--	--
Pyrene	210	--	--	--	--	--
Total Petroleum Hydrocarbons [4] (ug/L)	5,000	--	--	--	--	--
Dissolved Gases [5] (ug/L)						
Methane	NA	NA	NA	NA	NA	--
Oxygen*	NA	2,760	4,840	5,440	4,370	4,400
Metals [6] (ug/L)						
Lead	15	4.7[J]	--	--	--	--
Ferrous Iron*	NA	NA	NA	NA	NA	<200
Inorganic Parameters [7] (ug/L)						
Nitrate	10,000	NA	NA	NA	NA	1,880
Nitrite	1,000	NA	NA	NA	NA	--
Sulfate	250,000	NA	NA	NA	NA	11,000

[1] Groundwater Clean-up Criteria as provided in Chapter 62-777,F.A.C.
[2] SW-846 8021B and EPA 504.1, [3] SW-846 8310, [4] FDEP FL-PRO, [5] RSK-175M, [6] SW-846 6010B, [7] EPA 300/376.1
[J] indicates the presence of a chemical at an estimated concentration.

* = Field Measurement -- = not detected NA = not applicable
Bold indicates an exceedance of limits.

Sample Depth (bls)

TABLE 4-4

SUMMARY ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Sample No.		NASPFF MW22-S	NASPFF MW DUP-1	NASPFF MW23-S	NASPFF EQB-1	NASPFF EQB-2
Sample Location		MW22-S	Duplicate of MW22-S	MW23-S	N/A	N/A
Collect Date		11/6/2000	11/6/2000	11/6/2000	11/7/2000	
	Groundwater Clean-up Criteria [1] (ug/L)					
Volatile [2] (ug/L)						
1,1-Dichloroethane	70	--	--	--	--	--
1,2-Dichloroethane	3	3.8	--	--	--	--
1,2-Dichloropropane	5	--	--	--	--	--
Benzene	1	**110**	**120**	--	--	--
Chloroform	5.7	--	--	0.74[J]	--	--
Chloromethane	2.7	0.65[J]	0.64[J]	--	--	--
Ethylbenzene	30	**420**	**450**	--	--	--
Methyl tert-Butyl Ether	50	--	--	--	--	--
Methylene Chloride	5	--	--	--	--	--
Toluene	40	2.8	2.8	--	--	--
Xylenes, total	20	**2,900**	**3,100**	--	--	--
Polycyclic Aromatic Hydrocarbons [3] (ug/L)						
1-Methylnaphthalene	20	--	**37**	--	--	--
2-Methylnaphthalene	20	--	**45**	--	--	--
Acenaphthene	20	--	--	--	--	--
Anthracene	2,100	--	--	--	--	--
Benzo(g,h,i)perylene	210	--	--	--	--	--
Dibenzo(a,h)anthracene	0.2	--	--	--	--	--
Fluoranthene	280	--	--	--	--	--
Fluorene	280	--	--	--	--	--
Indeno(1,2,3-c,d)pyrene	0.2	--	--	--	--	--
Naphthalene	20	--	**120**	--	--	--
Phenanthrene	210	--	--	--	--	--
Pyrene	210	--	--	--	--	--
Total Petroleum Hydrocarbons [4] (ug/L)	5,000	**23,000**	**22,000**	--	--	--
Dissolved Gases [5] (ug/L)						
Methane	NA	NA	NA	NA	NA	NA
Oxygen*	NA	300	NA	5,670	NA	NA
Metals [6] (ug/L)						
Lead	15	6.7[J]	6.4[J]	--	--	--
Ferrous Iron*	NA	NA	NA	NA	NA	NA
Inorganic Parameters [7] (ug/L)						
Nitrate	10,000	NA	NA	NA	NA	NA
Nitrite	1,000	NA	NA	NA	NA	NA
Sulfate	250,000	NA	NA	NA	NA	NA

[1] Groundwater Clean-up Criteria as provided in Chapter 62-777,F.A.C.
[2] SW-846 8021B and EPA 504.1, [3] SW-846 8310, [4] FDEP FL-PRO, [5] RSK-175M, [6] SW-846 6010B, [7] EPA 300/376.1
[J] indicates the presence of a chemical at an estimated concentration.

* = Field Measurement -- = not detected NA = not applicable
Bold indicates an exceedance of limits.

Sample Depth (bls)

TABLE 4-5

SUMMARY ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA
PAGE 1 OF 5

Sample No.		NASPFF MW1-S	NASPFF MW3-S	NASPFF MW4-S	NASPFF MW7-S	NASPFF MW8-S
Sample Location		MW1-S	MW3-S	MW4-S	MW7-S	MW8-S
Collect Date		10/28/2001	11/8/2001	10/28/2001	10/27/2001	10/27/2001
	Groundwater Clean-up Criteria [1] (ug/L)					
Volatile [2] (ug/L)						
1,1-Dichloroethane	70	--	--	--	--	--
1,1-Dichloroethene	7	--	--	--	--	--
1,2-Dichloroethane	3	14	--	--	--	--
1,2-Dichloropropane	5	--	--	--	--	--
Trichoroethene	3	--	--	--	--	--
Benzene	1	**670**	**260[J]**	--	--	**55**
Chloroform	5.7	--	--	1.3	1.8	--
Chloromethane	2.7	--	--	--	--	--
Ethylbenzene	30	**1,300**	**1800[J]**	--	--	**200**
Methyl tert-Butyl Ether	50	--	--	--	--	--
Methylene Chloride	5	--	--	--	--	--
Toluene	40	1.1	10	--	--	**64**
Xylenes, total	20	**92**	**4810[J]**	--	--	**1,051**
Polycyclic Aromatic Hydrocarbons [3] (ug/L)						
1-Methylnaphthalene	20	**59.4**	**66.9**	--	--	**20.5**
2-Methylnaphthalene	20	**93.1**	**95.4**	--	--	**37.7**
Acenaphthene	20	--	--	--	--	--
Anthracene	2,100	--	--	--	--	--
Benzo(g,h,i)perylene	210	--	--	--	--	--
Dibenzo(a,h)anthracene	0.2	--	--	--	--	--
Fluoranthene	280	0.263	--	--	--	--
Fluorene	280	--	--	--	--	--
Indeno(1,2,3-c,d)pyrene	0.2	--	--	--	--	--
Naphthalene	20	**183**	**190**	--	--	**72.9**
Phenanthrene	210	1.08	--	--	--	--
Pyrene	210	0.15	--	--	--	--
Total Petroleum Hydrocarbons [4] (ug/L)	5,000	**9,240**	--	**1,680**	956	**8,020**
Dissolved Gases [5] (ug/L)						
Methane	NA	NA	NA	NA	NA	NA
Oxygen*	NA	NA	NA	NA	NA	NA
Metals [6] (ug/L)						
Lead	15	1.6[J]	--	--	--	2.60[J]
Ferrous Iron*	NA	NA	NA	NA	NA	NA
Inorganic Parameters [7] (ug/L)						
Nitrate	10,000	NA	NA	NA	NA	NA
Nitrite	1,000	NA	NA	NA	NA	NA
Sulfate	250,000	NA	NA	NA	NA	NA

[1] Groundwater Clean-up Criteria as provided in Chapter 62-777,F.A.C.
[2] SW-846 8021B and EPA 504.1, [3] SW-846 8310, [4] FDEP FL-PRO, [5] RSK-175M, [6] SW-846 6010B, [7] EPA 300/376.1
[J] indicates the presence of a chemical at an estimated concentration.
[A] indicates lab blank contamination.
* = Field Measurement -- = not detected NA = not applicable
Bold indicates an exceedance of limits.

TABLE 4-5

SUMMARY ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Sample No.		NASPFF MW11-S	NASPFF MW13-D	NASPFF MW13-S	NASPFF MW14-I	NASPFF MW14-S
Sample Location		MW11-S	MW13-D	MW13-S	MW14-I	MW14-S
Collect Date		10/27/2001	10/24/2001	10/28/2001	11/8/2001	11/8/2001
	Groundwater Clean-up Criteria [1] (ug/L)					
Volatile [2] (ug/L)						
1,1-Dichloroethane	70	--	2	--	--	--
1,1-Dichloroethene	7	--	0.510[J]	--	--	--
1,2-Dichloroethane	3	--	--	--	--	--
1,2-Dichloropropane	5	--	--	--	--	--
Trichoroethene	3	--	--	--	--	--
Benzene	1	--	0.68[J]	**5.7**	--	--
Chloroform	5.7	--	--	--	1.9	5.4
Chloromethane	2.7	--	--	--	--	--
Ethylbenzene	30	--	--	**54**	--	--
Methyl tert-Butyl Ether	50	--	4.60	--	--	--
Methylene Chloride	5	--	--	--	--	--
Toluene	40	--	--	--	--	--
Xylenes, total	20	--	--	**440**	0.89[J]	--
Polycyclic Aromatic Hydrocarbons [3] (ug/L)						
1-Methylnaphthalene	20	--	--	19.7	--	--
2-Methylnaphthalene	20	--	--	**20.8**	--	--
Acenaphthene	20	--	--	--	--	--
Anthracene	2,100	--	--	--	--	--
Benzo(g,h,i)perylene	210	--	--	--	--	--
Dibenzo(a,h)anthracene	0.2	--	--	--	--	--
Fluoranthene	280	--			--	--
Fluorene	280	--	--	--	--	--
Indeno(1,2,3-c,d)pyrene	0.2	--	--	--	--	--
Naphthalene	20	0.189	--	**43.4**	--	--
Phenanthrene	210	--	--	--	--	--
Pyrene	210	--	--	1.08	--	--
Total Petroleum Hydrocarbons [4] (ug/L)	5,000	900	--	**13,600**	--	--
Dissolved Gases [5] (ug/L)						
Methane	NA	NA	NA	NA	NA	NA
Oxygen*	NA	NA	NA	NA	NA	NA
Metals [6] (ug/L)						
Lead	15	1.70[J]	1.5[J]	1.6[J]	--	--
Ferrous Iron*	NA	NA	NA	NA	NA	NA
Inorganic Parameters [7] (ug/L)						
Nitrate	10,000	NA	NA	NA	NA	NA
Nitrite	1,000	NA	NA	NA	NA	NA
Sulfate	250,000	NA	NA	NA	NA	NA

[1] Groundwater Clean-up Criteria as provided in Chapter 62-777,F.A.C.
[2] SW-846 8021B and EPA 504.1, [3] SW-846 8310, [4] FDEP FL-PRO, [5] RSK-175M, [6] SW-846 6010B, [7] EPA 300/376.1
[J] indicates the presence of a chemical at an estimated concentration.
[A] indicates lab blank contamination.
* = Field Measurement -- = not detected NA = not applicable
Bold indicates an exceedance of limits.

TABLE 4-5

SUMMARY ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Sample No.		NASPFF MW14-SD	NASPFF MW17-S	NASPFF MW18-S	NASPFF MW19-S	NASPFF MW21-S
Sample Location		Duplicate of MW14-S	MW17-S	MW18-S	MW19-S	MW21-S
Collect Date		11/8/2001	10/28/2001	11/8/2001	11/8/2001	10/27/2001
	Groundwater Clean-up Criteria [1] (ug/L)					
Volatile [2] (ug/L)						
1,1-Dichloroethane	70	--	--	--	--	--
1,1-Dichloroethene	7	--	--	--	--	--
1,2-Dichloroethane	3	--	--	--	--	--
1,2-Dichloropropane	5	--	--	--	--	--
Trichoroethene	3	--	--	--	1.8	--
Benzene	1	--	--	--	--	--
Chloroform	5.7	5.7	1.3	--	--	--
Chloromethane	2.7	--	--	--	--	--
Ethylbenzene	30	--	--	**72**[J]	3.8	--
Methyl tert-Butyl Ether	50	--	--	--	--	--
Methylene Chloride	5	--	--	--	--	--
Toluene	40	--	--	30	0.61[J]	--
Xylenes, total	20	--	1.3	**235**[J]	**43**	--
Polycyclic Aromatic Hydrocarbons [3] (ug/L)						
1-Methylnaphthalene	20	--	--	14.9	8.83	--
2-Methylnaphthalene	20	--	--	18.5	10.1	--
Acenaphthene	20	--	--	--	--	--
Anthracene	2,100	--	--	--	--	--
Benzo(g,h,i)perylene	210	--	--	--	--	--
Dibenzo(a,h)anthracene	0.2	--	--	--	--	--
Fluoranthene	280	--	--	--	--	--
Fluorene	280	--	--	0.45	0.516	--
Indeno(1,2,3-c,d)pyrene	0.2	--	--	--	9.87	--
Naphthalene	20	--	--	**30.1**	--	--
Phenanthrene	210	--	--	--	--	--
Pyrene	210	--	--	--	--	--
Total Petroleum Hydrocarbons [4] (ug/L)	5,000	--	758	3,750	2,310	943
Dissolved Gases [5] (ug/L)						
Methane	NA	NA	NA	NA	NA	NA
Oxygen*	NA	NA	NA	NA	NA	NA
Metals [6] (ug/L)						
Lead	15	--	--	--	--	--
Ferrous Iron*	NA	NA	NA	NA	NA	NA
Inorganic Parameters [7] (ug/L)						
Nitrate	10,000	NA	NA	NA	NA	NA
Nitrite	1,000	NA	NA	NA	NA	NA
Sulfate	250,000	NA	NA	NA	NA	NA

[1] Groundwater Clean-up Criteria as provided in Chapter 62-777,F.A.C.
[2] SW-846 8021B and EPA 504.1, [3] SW-846 8310, [4] FDEP FL-PRO, [5] RSK-175M, [6] SW-846 6010B, [7] EPA 300/376.1
[J] indicates the presence of a chemical at an estimated concentration.
[A] indicates lab blank contamination.
* = Field Measurement -- = not detected NA = not applicable
Bold indicates an exceedance of limits.

TABLE 4-5

SUMMARY ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Sample No.		NASPFF MW23-S	NASPFF MW23-SD	NASPFF MW24-I	NASPFF MW24-S	NASPFF MW25-S
Sample Location		MW23-S	Duplicate of MW23-S	MW24-I	MW-24-S	MW25-S
Collect Date		10/27/2001	10/27/2001	11/8/2001	11/8/2001	11/8/2001
	Groundwater Clean-up Criteria [1] (ug/L)					
Volatile [2] (ug/L)						
1,1-Dichloroethane	70	--	--	--	--	--
1,1-Dichloroethene	7	--	--	--	--	--
1,2-Dichloroethane	3	--	--	--	--	--
1,2-Dichloropropane	5	--	--	--	--	--
Trichoroethene	3	--	--	--	--	--
Benzene	1	--	--	--	110[J]	--
Chloroform	5.7	1.5	1.5	--	--	0.79[J]
Chloromethane	2.7	--	--	--	--	--
Ethylbenzene	30	--	--	0.96[J]	**290[J]**	--
Methyl tert-Butyl Ether	50	--	--	--	--	--
Methylene Chloride	5	--	--	--	--	--
Toluene	40	--	--	--	1.4	--
Xylenes, total	20	--	--	3	**98**	--
Polycyclic Aromatic Hydrocarbons [3] (ug/L)						
1-Methylnaphthalene	20	--	--	--	**29.8**	--
2-Methylnaphthalene	20	--	--	--	**48.5**	--
Acenaphthene	20	--	--	--	--	--
Anthracene	2,100	--	--	--	--	--
Benzo(g,h,i)perylene	210	--	--	--	--	--
Dibenzo(a,h)anthracene	0.2	--	--	--	--	--
Fluoranthene	280	--	--	--	--	--
Fluorene	280	--	--	--	--	--
Indeno(1,2,3-c,d)pyrene	0.2	--	--	--	--	--
Naphthalene	20	--	--	--	**101**	--
Phenanthrene	210	--	--	--	--	--
Pyrene	210	--	--	--	--	--
Total Petroleum Hydrocarbons [4] (ug/L)	5,000	1,170[J]	2,272[J]	--	**10,700**	--
Dissolved Gases [5] (ug/L)						
Methane	NA	NA	NA	NA	NA	NA
Oxygen*	NA	NA	NA	NA	NA	NA
Metals [6] (ug/L)						
Lead	15	--	--	--	2.6[J]	--
Ferrous Iron*	NA	NA	NA	NA	NA	NA
Inorganic Parameters [7] (ug/L)						
Nitrate	10,000	NA	NA	NA	NA	NA
Nitrite	1,000	NA	NA	NA	NA	NA
Sulfate	250,000	NA	NA	NA	NA	NA

[1] Groundwater Clean-up Criteria as provided in Chapter 62-777,F.A.C.
[2] SW-846 8021B and EPA 504.1, [3] SW-846 8310, [4] FDEP FL-PRO, [5] RSK-175M, [6] SW-846 6010B, [7] EPA 300/376.1
[J] indicates the presence of a chemical at an estimated concentration.
[A] indicates lab blank contamination.
* = Field Measurement -- = not detected NA = not applicable
Bold indicates an exceedance of limits.

TABLE 4-5

SUMMARY ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES
UST SITE 000024 SITE ASSESSMENT REPORT
NAS PENSACOLA
PENSACOLA, FLORIDA

Sample No.		NASPFF MW26-S	NASPFF MW27-S	NASPFF RB-1	NASPFF TB102701	NASPFF RB-2	NASPFF TB110801
Sample Location		MW26-S	MW27-S	N/A	N/A	N/A	N/A
Collect Date		11/8/2001	11/8/2001	10/27/2001	10/27/2001	11/8/2001	11/8/2001
	Groundwater Clean-up Criteria [1] (ug/L)						
Volatile [2] (ug/L)							
1,1-Dichloroethane	70	--	--	--	--	--	--
1,1-Dichloroethene	7	--	--	--	--	--	--
1,2-Dichloroethane	3	--	--	--	--	--	--
1,2-Dichloropropane	5	--	--	--	--	--	--
Trichoroethene	3	--	--	--	--	--	--
Benzene	1	--	--	--	--	--	--
Chloroform	5.7	0.52[J]	--	--	--	--	--
Chloromethane	2.7	--	--	--	--	--	--
Ethylbenzene	30	1.2	--	--	--	--	--
Methyl tert-Butyl Ether	50	--	--	--	--	--	--
Methylene Chloride	5	--	--	0.960[J]	1.3	1.1	3.6
Toluene	40	--	--	--	--	--	--
Xylenes, total	20	1.1	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons [3] (ug/L)							
1-Methylnaphthalene	20	--	--	--	NA	--	NA
2-Methylnaphthalene	20	0.169	--	--	NA	--	NA
Acenaphthene	20	--	--	--	NA	--	NA
Anthracene	2,100	--	--	--	NA	--	NA
Benzo(g,h,i)perylene	210	--	--	--	NA	--	NA
Dibenzo(a,h)anthracene	0.2	--	--	--	NA	--	NA
Fluoranthene	280	--	--	--	NA	--	NA
Fluorene	280	--	--	--	NA	--	NA
Indeno(1,2,3-c,d)pyrene	0.2	--	--	--	NA	--	NA
Naphthalene	20	0.354	--	--	NA	--	NA
Phenanthrene	210	--	--	--	NA	--	NA
Pyrene	210	--	--	--	NA	--	NA
Total Petroleum Hydrocarbons [4] (ug/L)	5,000	992	--	993	NA	--	NA
Dissolved Gases [5] (ug/L)							
Methane	NA	NA	NA	NA	NA	NA	NA
Oxygen*	NA	NA	NA	NA	NA	NA	NA
Metals [6] (ug/L)							
Lead	15	--	--	--	NA	--	NA
Ferrous Iron*	NA	NA	NA	NA	NA	NA	NA
Inorganic Parameters [7] (ug/L)							
Nitrate	10,000	NA	NA	NA	NA	NA	NA
Nitrite	1,000	NA	NA	NA	NA	NA	NA
Sulfate	250,000	NA	NA	NA	NA	NA	NA

[1] Groundwater Clean-up Criteria as provided in Chapter 62-777,F.A.C.
[2] SW-846 8021B and EPA 504.1, [3] SW-846 8310, [4] FDEP FL-PRO, [5] RSK-175M, [6] SW-846 6010B, [7] EPA 300/376.1
[J] indicates the presence of a chemical at an estimated concentration.
[A] indicates lab blank contamination.
* = Field Measurement -- = not detected NA = not applicable
Bold indicates an exceedance of limits.

APPENDIX C

MASS AND VOLUME CALCULATIONS

TABLE C-1
MASS AND VOLUME CALCULATIONS

Remedial Action Plan
Sherman Field Former Fuel Farm, UST Site 000024
Naval Air Station Pensacola
Pensacola, Florida

INPUT:

Estimated Impacted Area on Mound	**83,860**	**ft^2**		
Estimated Average Impacted Thickness	**23**	**ft**		
Estimated Impacted Area off Mound	**23,980**	**ft^2**		
Estimated Average Impacted Thickness	**10**	**ft**		
Estimated Volume of Impacted Area on Mound	**1,928,780**	**ft^3**		
	71,436	**yd^3**		
Estimated Volume of Impacted Area off Mound	**239,800**	**ft^3**		
	8,881	**yd^3**		
Reported Volume of Each Tank	**588,000**	**gal**		
	78,604	**ft^3**		
Estimated Volume of 4 Tanks	**314,417**	**ft^3**		
Estimated Volume of Contaminated Soil	**1,854,163**	**ft^3**		
	68,673	**yd^3**		
Average TRPH Concentration			**501.4**	**mg/kg**
Total Depth of Excavation on Mound	**28**	**ft**		
Total Depth of Excavation off Mound	**11**	**ft**		
Total Volume of Excavation Areas	**2,297,443**	**ft^3**		
	85,090	**yd^3**		
Total Volume of Soil Needed for Backfill	**1,542,112**	**ft^3**		
	57,115	**yd^3**		

CALCULATIONS:

Estimated Mass of Impacted Unsaturated Soil	**95,942**	**ton**	**87,219,842**	**kg**
Estimated Mass of Hydrocarbons in Soil	**96,429**	**lbs**	**43,732**	**kg**
Estimated Mass of Excavated Soil	**119,127**	**ton**		

NOTES

TRPH - Total Recoverable petroleum hydrocarbons
mg/kg - milligram per kilogram
ft = feet
ft^2 = square feet
ft^3 = cubic feet

kg = kilograms
lbs = pounds
gal = gallons
yd^3 = cubic yards

Volume = area x thickness

Assumed density of dry sand is 1.4 tons per cubic yard. ("Pocket Ref", 1994)

Total Volume of Excavation Areas = (Total Depth of Excavation on Mound x Estimated Impacted Area on Mound) + (Total Depth of Excavation off Mound x Estimated Impacted Area off Mound) - Estimated Volume of 4 Tanks x (1 yd^3/27 ft^3))

TABLE C-1
MASS AND VOLUME CALCULATIONS

It is assumed that the site will be backfilled to the grade of the area surrounding the tank mound. The area surrounding the mound has an average depth to water of 10 ft bls. The excavation will be to 1 ft below the water table, resulting in a need to backfill the area 11 ft.

Total Volume Soil Needed for Backfill = (Estimated Impacted Area on Mound + Estimated Impacted Area off Mound) x 11 ft x (1 yd^3/27 ft^3).

Estimated Mass of Impacted Unsaturated Soil = impacted volume (ft^3) x (1 yd^3/27 ft^3) x (1.4 tons/1 yd^3) x (907.2 kg/ton)

Estimated mass of hydrocarbons = hydrocarbon concentration (mg/kg) x mass of impacted soil (kg) x (kg/10^6 mg) x (2.2 lb/kg)

Estimated Volume of Contaminated Soil = Estimated Impacted Volume - Estimated Volume of 4 Tanks

PREPARED BY:____________________ **CHECKED BY:** ____________________
Date

APPENDIX D

REMEDIAL ALTERNATIVE COST ESTIMATES

Table D-1
Excavation and Off-Site Disposal with Dewatering Cost

Remedial Action Plan
Sherman Field Former Fuel Farm, UST Site 000024
Naval Air Station Pensacola
Pensacola, Florida

Estimator: RLM
Checked By:

COST SUMMARY TABLE (costs rounded to nearest $1000)

DIRECT COSTS	
Site Preparation and Mobilization	$45,000
Excavation Workplan and Health & Safety Plan	$6,000
Field Sampling & Oversight	$24,000
Completion Report and Tank Removal Report	$12,000
Excavation Activities	$472,000
Off-site Disposal of Soil	$6,017,000
Tank Removal	$733,000
Site Restoration and Demobilization	$9,000
Costs for Excavation and Off-site Disposal	$7,318,000
Indirect Costs	
Contingency (@20%)	$732,000
Total Costs for Excavation and Off-site Disposal	**$8,050,000**

Table D-1 (Continued)
Excavation and Off-Site Disposal with Dewatering Cost

DIRECT COSTS	Quantity	Unit	Unit Cost	Total Cost
Site Preparation and Mobilization				
Silt fencing/signs/misc. materials	1	ls	$5,000	$5,000
Decontamination pad	1	ls	$1,000	$1,000
Pressure washer (assume base will provide water)	3	mo	$1,050	$3,150
Pick-up trucks (1 foreman, 1 crew, 1 TtNUS)	270	day	$35	$9,450
General site mob/demob (3 people, 1 mob, 1 demob)	6	ea	$90	$538
Foreman (14 weeks * 50 hr/week) Assume 10 hour days	700	hrs	$34	$23,800
Foreman oversight for the entire field event, prep, excavation, demob, etc.				
Laborers (2 for assistance with site prep, 5 days, 10hr/day)	100	hrs	$24	$2,400
Total For Site Preparation and Mobilization				**$45,338**
Site Sampling & Oversight				
Excavation Workplan and Health & Safety Plan				
Staff Engineer	40	hrs	$44	$1,761
Professional Engineer	8	hrs	$78	$626
Sr. Scientist	16	hrs	$58	$924
Word Processor	16	hrs	$38	$603
CADD	32	hrs	$38	$1,206
Copying: 50 pgs x 25 copies	1250	page	$0.10	$125
Binding/shipping, 25 copies	25	ea	$20	$500
Total for Workplan and Health & Safety Plan				**$5,746**
Field Sampling & Oversight				
Staff Geologist	200	hrs	$44	$8,807
ODCs	1	ls	$1,000	$1,000
Excavation extent characterization sampling (assume 40 each)				
RCRA 8 Metals	40	ea	$110	$4,400
VOCs 8260	40	ea	$70	$2,800
PAH 8310	40	ea	$90	$3,600
TRPH FL-PRO	40	ea	$60	$2,400
Sampling equipment	1	ls	$1,000	$1,000
Total for Field Sampling & Oversight				**$24,007**
Completion Report and Tank Removal Report				
Staff Engineer	80	hrs	$44	$3,520
Senior Scientist	16	hrs	$58	$928
Professional Engineer	60	hrs	$78	$4,692
Word Processor	32	hrs	$38	$1,216
CADD	32	hrs	$38	$1,216
Copying: 50 pgs x 25 copies	1250	page	$0.10	$125
Binding/shipping, 25 copies	25	ea	$20	$500
Total for Summary Data Report				**$12,197**

Table D-1 (Continued)
Excavation and Off-Site Disposal with Dewatering Cost

Excavation				
Excavation of Soil:				
(assume two trackhoes 10 hrs/day, 90 days)				
Trackhoe operator labor included in costs				
2.5 yd^3, Track Loader	1800	hrs	$116	$209,034
Dewatering (Assume vacuum truck on site for 30 days, collection, transport, and disposal of contaminated water)	30	day	$3,000	$90,000
Laborers (4 for assistance with excavation activities)	7200	hrs	$24	$172,800
Subtotal for Excavation				**$471,834**
Off-site Disposal of Soil				
Common fill for backfill (load and haul) includes spreading, compaction & testing	57115	yd^3	$8	$477,481
Transportation, and disposal of contaminated soil to a Subtitle D Facility	119127	ton	$47	$5,539,406
Cost derived from quote from Andy Adams of Waste Transportation & Disposal Services (1-800-901-0081) cost quoted was $46.50/ton.				
Subtotal for Off-site Disposal of Soil:				**$6,016,887**
Tank Removal				
Cost to hire Subcontractor to remove four 588,000 gallon fuel tanks	1	ls	$733,333	$733,333
Note: Includes disassembly and removal of tanks and removal and disposal of inert fill material.				
Subtotal for tank removal				**$733,333**
Site Restoration and Demobilization				
Hydroseeding	2	acre	$503	$1,007
Demobilization of Equipment	1	ls	$1,000	$1,000
Drill and install 14 - 2" PVC monitoring wells, each 17 feet deep	238	ft	$28	$6,657
Subtotal Site Restoration and Demob:				**$8,664**

Table D-2
Excavation and On-site Treatment with Dewatering Cost

Remedial Action Plan
Sherman Field Former Fuel Farm, UST Site 000024
Naval Air Station Pensacola
Pensacola, Florida

Estimator: RLM
Checked By:

COST SUMMARY TABLE (costs rounded to nearest $1000)

DIRECT COSTS	
Site Preparation and Mobilization	$45,000
Workplan and Health & Safety Plan	$6,000
Field Sampling & Oversight	$24,000
Summary Data Report	$12,000
Excavation Activities	$472,000
On-site Treatment by LTTD	$1,724,000
Tank Removal	$733,000
Site Restoration and Demobilization	$9,000
Costs for On-site Treatment by LTTD	$3,025,000
(Sum of Direct Costs minus Disposal Cost)	
Indirect Costs	
Contingency (@20%)	$303,000
Total Costs for Excavation and On-site Treatment	**$3,328,000**

Table D-2 (Continued)
Excavation and On-site Treatment with Dewatering Cost

DIRECT COSTS	Quantity	Unit	Unit Cost	Total Cost
Site Preparation and Mobilization				
Silt fencing/signs/misc. materials	1	ls	$5,000	$5,000
Decontamination pad	1	ls	$1,000	$1,000
Pressure washer (assume base will provide water)	3	mo	$1,050	$3,150
Pick-up trucks (1 foreman, 1 crew, 1 TtNUS)	270	day	$35	$9,450
General site mob/demob (3 people, 1 mob, 1 demob)	6	ea	$90	$538
Foreman (14 weeks * 50 hr/week) Assume 10 hour days	700	hrs	$34	$23,800
Foreman oversight for the entire field event, prep, excavation, demob, etc.				
Laborers (2 for assistance with site prep, 5 days, 10hr/day)	100	hrs	$24	$2,400
Total For Site Preparation and Mobilization				**$45,338**
Site Sampling & Oversight				
Excavation Workplan and Health & Safety Plan				
Staff Engineer	40	hrs	$44	$1,761
Professional Engineer	8	hrs	$78	$626
Sr. Scientist	16	hrs	$58	$924
Word Processor	16	hrs	$38	$603
CADD	32	hrs	$38	$1,206
Copying: 50 pgs x 25 copies	1250	page	$0.10	$125
Binding/shipping, 25 copies	25	ea	$20	$500
Total for Workplan and Health & Safety Plan				**$5,746**
Field Sampling & Oversight				
Staff Geologist	200	hrs	$44	$8,807
ODCs	1	ls	$1,000	$1,000
Excavation extent characterization sampling (assume 40 each)				
RCRA 8 Metals	40	ea	$110	$4,400
VOCs 8260	40	ea	$70	$2,800
PAH 8310	40	ea	$90	$3,600
TRPH FL-PRO	40	ea	$60	$2,400
Sampling equipment	1	ls	$1,000	$1,000
Total for Field Sampling & Oversight				**$24,007**
Completion Report and Tank Removal Report				
Staff Engineer	80	hrs	$44	$3,520
Senior Scientist	16	hrs	$58	$928
Professional Engineer	60	hrs	$78	$4,692
Word Processor	32	hrs	$38	$1,216
CADD	32	hrs	$38	$1,216
Copying: 50 pgs x 25 copies	1250	page	$0.10	$125
Binding/shipping, 25 copies	25	ea	$20	$500
Total for Summary Data Report				**$12,197**

Table D-2 (Continued)
Excavation and On-site Treatment with Dewatering Cost

Excavation				
Excavation of Soil:				
(assume two trackhoes 10 hrs/day, 90 days)				
Trackhoe operator labor included in costs				
2.5 yd^3, Track Loader	1800	hrs	$116	$209,034
Dewatering (Assume vacuum truck on site for 30 days, collection, transport, and disposal of contaminated water)	30	day	$3,000	$90,000
Laborers (4 for assistance with excavation activities)	7200	hrs	$24	$172,800
Subtotal for Excavation				**$471,834**
On-site Treatment of Soil by LTTD				
Permitting/Engineering for Site	1	ea	$39,201	$39,201
(permitting site with treatability studies, interface with regulators)				
LTTD, SVOC Contaminated Soil, fixed costs (Mob/demob, Engineering) >50,000 ton	1	ls	$1,623,216	$1,623,216
Front end loader with operator				
(for moving soil)	900	hr	$68	$61,632
Subtotal for soil treatment by LTTD				**$1,724,049**
Tank Removal				
Cost to hire Subcontractor to remove four 588,000 gallon fuel tanks	1	ls	$733,333	$733,333
Note: Includes disassembly and removal of tanks and removal and disposal of inert fill material.				
Subtotal for tank removal				**$733,333**
Site Restoration and Demobilization				
Hydroseeding	2	acre	$503	$1,007
Demobilization of Equipment	1	ls	$1,000	$1,000
Drill and install 14 - 2" PVC monitoring wells, each 17 feet deep	238	ft	$28	$6,657
Subtotal Site Restoration and Demob:				**$8,664**

Table D-3
Groundwater Depression Cost Summary

Remedial Action Plan
Sherman Field Former Fuel Farm, UST Site 000024
Naval Air Station Pensacola
Pensacola, Florida

Estimator: RLM
Checked By:

COST SUMMARY TABLE (costs rounded to nearest $1000)		
DIRECT COSTS		
Site Preparation		$27,000
System		$210,000
TOTAL DIRECT COST		**$210,000**
INDIRECT COSTS		
Engineering and Design (20%)		$42,000
Treatability Study		$10,000
TOTAL INDIRECT COST		**$52,000**
Total Capital Costs (Direct + Indirect)		**$262,000**
OPERATIONS AND MAINTENANCE		
Administrative O&M		
Work Plan (WP) for Monitoring Activities		$7,000
4 Quarterly Site Activities Reports		$22,000
Total Administrative O&M, annual		**$22,000**
Present worth of O&M (7%, 20 yrs)	($233,068)	$233,000
Present worth O&M + SAP		**$240,000**
Treatment System O&M		
System Maintenance		$8,000
Utilities		$16,000
Total Treatment System O&M, Annual		**$24,000**
Present Worth of Treatment System O&M (7%, 20 yrs)	($254,256)	$254,000
Present Worth O&M (Administrative + Treatment System O&M)		**$494,000**
Assumption - System will run for 20 years.		
Total Capital and O&M Cost		$996,000
Contingency (10%)		$100,000
TOTAL COST		**$1,096,000**

Table D-3 (Continued)
Groundwater Depression Cost Summary

DIRECT COSTS	Quantity	Unit	Unit Cost	Total Cost
Site Preparation				
Storage trailer	1	mo	$106	$106
Treatment system concrete pad	1200	ft^2	$3	$3,492
Fencing, 30'x40'	140	ft	$13	$1,799
Gates for access to treatment system area	1	ea	$726	$726
Utility connection for treatment system				
Including electric poles, cable, transformer, phone line for telemetry	1	ls	$15,000	$15,000
Pressure washer and water tank	1	mo	$1,050	$1,050
ODCs(Plastic sheeting, drums, pumps, hoses, supplies,etc.)	1	ls	$2,000	$2,000
Labor				
2 laborers, 4 days, 10 hrs/day	80	hr	$24	$1,920
1 foreman, 4 days, 10 hrs/day	40	hr	$34	$1,360
Total Site Preparation				**$27,454**
Water Table Depression System				
2" Dia. PVC @ 15' Depth, recovery well installed (21 wells)	315	ft	$28	$8,811
Pneumatic Product Recovery Pump	21	ea	$3,807	$79,947.00
200 gpm Oil/Water Separator w/ effluent pump	1	ea	$20,706	$20,706
5,000 Gallon Single-walled Fiberglass Aboveground Tank	1	ea	$17,950	$17,950
200 gpm, low profile air stripper for water	1	ea	$29,359	$29,359
System plumbing (piping, elbows, valves, etc.)	4	ls	$2,000	$8,000
Misc construction materials	1	ls	$5,000	$5,000
Trenching (4' deep x 1' wide x 3000')	12000	cy	$1	$13,320
Site restoration (paving, hydroseeding, etc.)	1	ls	$5,000	$5,000
Sewer Connection Fee	1	ea	$2,270	$2,270
Labor				
1 foreman, 3 weeks, 50 hrs/week	150	hr	$34	$5,100
1 Technician, 3 weeks @ 50 hrs/wk	150	hrs	$38	$5,700
1 Staff Engineer, 3 weeks @ 50 hrs/wk	150	hrs	$44	$6,600
1 Sr. Engineer, 3 days @ 10 hrs/day	30	hrs	$58	$1,740
TOTAL				**$209,503**

OPERATIONS AND MAINTENANCE

Administrative O&M

Work Plan for Monitoring and O&M Activities

Labor	Quantity	Unit	Unit Cost	Total Cost
Staff Engineer	80	hrs	$44	$3,520
Senior Engineer	16	hrs	$58	$928
Word Processor	16	hrs	$38	$608
CADD, 8 hrs/figure, 4 figures	32	hrs	$38	$1,216
Editor	8	hrs	$42	$337
Copying: 50 pgs x 25 copies	1250	page	$0.10	$125
Binding/shipping, 25 copies	25	ea	$20	$500
Total Work Plan				**$7,234**

REPORTING	Quantity	Unit	Unit Cost	Total Cost
Site Activities Report (quarterly)				
Staff Engineer	40	hrs	$44	$1,760
Senior Engineer	16	hrs	$58	$928
Production:				
Word Processor	12	hrs	$38	$456
Technical Expert	6	hrs	$68	$407
Editor	8	hrs	$42	$337
CADD operator, 3 dwgs per report @ 8 hours per dwg	24	hrs	$38	$912
Reproduction: 100 pgs @ 20 copies	2000	pg	$0.10	$200
Shipping/binding: 20 reports	20	ea	$20	$400
Total Report Cost:				**$5,400**

Note: Costs for As Built Drawings are included in the CADD time.

TREATMENT SYSTEM O&M (annual)

System Maintenance				
Labor				
Staff Engineer, 4 hrs per month, system operating data, control	48	hr	$44	$2,112
Technician, 8 hrs per month	96	hr	$38	$3,648
Project Mgr, 2 hrs per month	24	hr	$68	$1,627
Electrician, 4 hours per year	4	hr	$35	$142
Misc. equip/supplies	1	yr	$500	$500
Total System Maintenance (annual):				**$8,029**
Utilities				
Electricity	262800	kWh	$0.06	$15,768
Assume 30 kW*24 hr/day*365 day/yr = 262800 kWh/yr				
Total Utilities				**$15,768**
Total Treatment System O&M (Annual)				**$23,797**

Table D-4
SVE Cost Alternative

Remedial Action Plan
Sherman Field Former Fuel Farm, UST Site 000024
Naval Air Station Pensacola
Pensacola, Florida

Estimator: RLM
Checked By:

COST SUMMARY TABLE (costs rounded to nearest $1000)		
DIRECT COSTS		
Site Preparation		$27,000
Piping and Equipment		$490,000
Total Installation labor		$25,000
TOTAL DIRECT COST		**$542,000**
INDIRECT COSTS		
Engineering and Design (20%)		$108,000
Contingency (20%)		$108,000
TOTAL INDIRECT COST		**$216,000**
Total Capital Costs (Direct + Indirect)		**$758,000**
OPERATIONS AND MAINTENANCE		
Administrative O&M		
Work Plan (WP) for Monitoring Activities		$6,000
Annual Site Activities Reports		$11,000
Total Administrative O&M, annual		**$11,000**
Present worth of O&M (7%, 15 yrs)	($100,187)	$100,000
Present worth O&M + Workplan		**$106,000**
Treatment System O&M		
System Maintenance		$11,000
Utilities		$32,000
Total Treatment System O&M, Annual		**$43,000**
Present Worth of Treatment System O&M (7%, 15 yrs)	($391,640)	$392,000
Present Worth O&M (Administrative + Treatment System O&M)		**$498,000**
Assumption - System will run for 15 years,		
TOTAL COST		**$1,256,000**

Table D-4 (Continued)
SVE Cost Alternative

DIRECT COSTS	Quantity	Unit	Unit Cost	Total Cost
Site Preparation				
Storage trailer	1	mo	$106	$106
Treatment system concrete pad	1200	ft^2	$3	$3,492
Fencing, 30'x40'	140	ft	$13	$1,799
Gates for access to treatment system area	1	ea	$726	$726
Utility connection for treatment system				
Including electric poles, cable, transformer, phone line for telemetry	1	ls	$15,000	$15,000
Pressure washer and water tank	1	mo	$1,050	$1,050
ODCs(Plastic sheeting, drums, pumps, hoses, supplies,etc.)	1	ls	$2,000	$2,000
Labor				
2 laborers, 4 days, 10 hrs/day	80	hr	$23	$1,876
1 foreman, 4 days, 10 hrs/day	40	hr	$34	$1,352
Total Site Preparation				**$27,402**
Note: 55 vertical SVE wells estimated based on an adjusted 30 ft ROI.				
SVE System				
Piping and Equipment				
Carbonair model CE5009 SVE system	2	ls	$12,626	$25,252
2,000 gallon steel abovegrond staorgae tank	2	ea	$2,980	$5,960
750 scfm, 3200 lb fill, 11.5" pressure drop GAC	27	ea	$14,734	$397,818
2" Dia. PVC @ 25' Depth, Vertical pipe vent installed (55 points)	1375	ft	$28	$38,596
System plumbing (piping, elbows, etc.)	1	ls	$10,000	$10,000
Misc construction materials	1	ls	$1,000	$1,000
Trenching (4' deep x 1' wide x 2000')	8000	cy	$1	$8,880
Site restoration (paving, hydroseeding, etc.)	1	ls	$2,000	$2,000
Total Piping and Equipment				**$489,506**
Labor for system connection & Start-up				
3 Laborers, 4 weeks @ 50 hrs/wk	600	hrs	$23	$14,070
1 Staff Engineer, 4 weeks @ 50 hrs/wk	100	hrs	$44	$4,400
1 Sr. Engineer, 20 hours/week for 4 weeks	80	hrs	$58	$4,640
1 Electrician, 1 week @ 50 hrs/wk	50	hrs	$35	$1,773
Total Labor:				**$24,883**
TOTAL DIRECT COSTS				**$541,791**

Table D-4 (Continued)
SVE Cost Alternative

OPERATIONS AND MAINTENANCE

Administrative O&M

Work Plan for Monitoring and O&M Activities

Labor	Quantity	Unit	Unit Cost	Total Cost
Jr.-Level Geologist/Scientist	80	hrs	$29	$2,316
Senior Engineer	16	hrs	$58	$928
Word Processor	16	hrs	$38	$608
CADD, 8 hrs/figure, 4 figures	32	hrs	$38	$1,216
Editor	8	hrs	$42	$337
Copying: 50 pgs x 25 copies	1250	page	$0.10	$125
Binding/shipping, 25 copies	25	ea	$20	$500
Total Work Plan				**$6,030**

REPORTING	Quantity	Unit	Unit Cost	Total Cost
Site Activities/ Completion Report (Annual)				
Staff Engineer	80	hrs	$44	$3,520
Senior Engineer	40	hrs	$58	$2,320
Professional Engineer	20		$78	$1,560
Production:				
Word Processor	24	hrs	$38	$912
Technical Expert	12	hrs	$68	$813
Editor	16	hrs	$42	$675
CADD operator, 3 dwgs per report @ 8 hours per dwg	24	hrs	$38	$912
Reproduction: 100 pgs @ 20 copies	2000	pg	$0.10	$200
Shipping/binding: 20 reports	20	ea	$20	$400
Total Report Cost:				**$11,312**

Note: Costs for As Built Drawings are included in the CADD time.

TREATMENT SYSTEM O&M (annual)

System Maintenance

Labor				
Staff Engineer, 4 hrs per month, system operating data, control	48	hr	$44	$2,112
Technician, 8 hrs per month	96	hr	$38	$3,648
Project Mgr, 2 hrs per month	24	hr	$68	$1,627
Electrician, 4 hours per year	4	hr	$35	$142
Misc. equip/supplies	1	yr	$2,000	$2,000
Air Sampling				
TO 14 Sampling, Tedlar Bag, 3 per quarter	12	each	$100	$1,200
Total System Maintenance (annual):				**$10,729**

Table D-4 (Continued)
SVE Cost Alternative

Utilities				
Electricity	525600	kWh	$0.06	$31,536
Assume 10 kW*24 hr/day*365 day/yr= 525600KWh				
Total Utilities				**$31,536**
Total Treatment System O&M (Annual)				**$42,265**

Table D-5
Bioslurping Cost Alternative

Remedial Action Plan
Sherman Field Former Fuel Farm, UST Site 000024
Naval Air Station Pensacola
Pensacola, Florida

Estimator: RLM
Checked By:

COST SUMMARY TABLE (costs rounded to nearest $1000)		
DIRECT COSTS		
Site Preparation		$27,000
Piping and Equipment		$226,000
Total Installation labor		$31,000
TOTAL DIRECT COST		**$284,000**
INDIRECT COSTS		
Engineering and Design (20%)		$57,000
Treatability Study		$10,000
TOTAL INDIRECT COST		**$67,000**
Total Capital Costs (Direct + Indirect)		**$351,000**
OPERATIONS AND MAINTENANCE		
Administrative O&M		
Work Plan (WP) for Monitoring Activities		$7,000
4 Quarterly Site Activities Reports		$22,000
Total Administrative O&M, annual		**$22,000**
Present worth of O&M (7%, 15 yrs)	($200,374)	$200,000
Present worth O&M + SAP		**$207,000**
Treatment System O&M		
System Maintenance		$13,000
Utilities		$22,000
Total Treatment System O&M, Annual		**$35,000**
Present Worth of Treatment System O&M (7%, 15 yrs)	($318,777)	$319,000
Present Worth O&M (Administrative + Treatment System O&M)		**$526,000**
Assumption - System will run for 15 years.		
Total Capital and O&M Cost		$877,000
Contingency (10%)		$88,000
TOTAL COST		**$965,000**

Table D-5 (Continued)
Bioslurping Cost Alternative

DIRECT COSTS	Quantity	Unit	Unit Cost	Total Cost
Site Preparation				
Storage trailer	1	mo	$106	$106
Treatment system concrete pad	1200	ft^2	$3	$3,492
Fencing, 30'x40'	140	ft	$13	$1,799
Gates for access to treatment system area	1	ea	$726	$726
Utility connection for treatment system				
Including electric poles, cable, transformer, phone line for telemetry	1	ls	$15,000	$15,000
Pressure washer and water tank	1	mo	$1,050	$1,050
ODCs(Plastic sheeting, drums, pumps, hoses, supplies,etc.)	1	ls	$2,000	$2,000
Labor				
2 laborers, 4 days, 10 hrs/day	80	hr	$23	$1,876
1 foreman, 4 days, 10 hrs/day	40	hr	$34	$1,352
Total Site Preparation				**$27,402**
Bioslurping System				
Piping and Equipment				
Skid mounted Liquid Ring Pump System and Controls	5	ea	$19,466	$97,330
Polyethylene Skid Mounted Storage Tank	5	ea	$2,431	$12,155
4" Dia. PVC @ 30' Depth, Vertical pipe installed [1]	540	ft	$28	$15,158
4" Dia. PVC @ 25' Depth, Vertical pipe installed [1]	250	ft	$28	$7,018
4" Dia. PVC @ 10' Depth, Vertical pipe installed [1]	180	ft	$41	$7,461
200 gpm Oil/Water Separator w/ effluent pump	1	ea	$20,706	$20,706
200 gpm, low profile air stripper for water	1	ea	$29,359	$29,359
System plumbing (piping, elbows, valves, etc.)	5	ls	$2,000	$10,000
Misc construction materials	1	ls	$5,000	$5,000
Trenching (4' deep x 1' wide x 3000')	12000	cy	$1	$13,320
Site restoration (paving, hydroseeding, etc.)	1	ls	$5,000	$5,000
Remedial well survey (survey of new well locations)	10	ls	$98	$984
Sewer connection fee	1	ls	$2,270	$2,270
Total Piping and Equipment				**$225,760**

Note: [1] 46 vertical wells estimated based on 35 foot radius of influence, 18 wells to 30', 18 wells to 10', and 10 vapor recovery wells to 25' adjacent to deep bioslurping wells.

	Quantity	Unit	Unit Cost	Total Cost
Labor for system connection & Start-up				
3 Laborers, 4 weeks @ 50 hrs/wk	600	hrs	$23	$14,070
1 Staff Engineer, 4 weeks @ 50 hrs/wk	200	hrs	$44	$8,800
Staff Geologist, 1 week @ 50 hrs/wk	50	hrs	$44	$2,200
1 Sr. Engineer, 20 hours per week	80	hrs	$58	$4,640
1 Electrician, 1 week @ 50 hrs/wk	50	hrs	$35	$1,773
Total Labor:				**$31,483**

Table D-5 (Continued)
Bioslurping Cost Alternative

TOTAL DIRECT COSTS **$284,644**

OPERATIONS AND MAINTENANCE

Administrative O&M

Work Plan for Monitoring and O&M Activities

Labor	Quantity	Unit	Unit Cost	Total Cost
Staff Engineer	80	hrs	$44	$3,520
Senior Engineer	16	hrs	$58	$928
Word Processor	16	hrs	$38	$608
CADD, 8 hrs/figure, 4 figures	32	hrs	$38	$1,216
Editor	8	hrs	$42	$337
Copying: 50 pgs x 25 copies	1250	page	$0.10	$125
Binding/shipping, 25 copies	25	ea	$20	$500
Total Work Plan				**$7,234**

REPORTING	Quantity	Unit	Unit Cost	Total Cost
Site Activities Report (quarterly)				
1 Staff Engineer	40	hrs	$44	$1,760
1 Senior Engineer	16	hrs	$58	$928
Production:				
Word processing	12	hrs	$38	$456
Technical Expert	6	hrs	$68	$407
Editor	8	hrs	$42	$337
CADD operator, 3 dwgs per report @ 8 hours per dwg	24	hrs	$38	$912
Reproduction: 100 pgs @ 20 copies	2000	pg	$0.10	$200
Shipping/binding: 20 reports	20	ea	$20	$400
Total Report Cost:				**$5,400**

Note: Costs for As Built Drawings are included in the CADD time.

TREATMENT SYSTEM O&M (annual)

System Maintenance

Labor				
Staff Engineer, 4 hrs per month, system operating data, control	48	hr	$44	$2,112
Technician, 8 hrs per month	96	hr	$38	$3,648
Project Mgr, 2 hrs per month	24	hr	$78	$1,877
Electrician, 4 hours per year	4	hr	$35	$142
Misc. equip/supplies	1	yr	$2,000	$2,000
Free Product disposal, per year	25	drum	$110	$2,750
Total System Maintenance (annual):				**$12,528**

Table D-5 (Continued)
Bioslurping Cost Alternative

Utilities				
Electricity	359160	kWh	$0.06	$21,550
Assume 41 kW*24 hr/day*365 day/yr (0.7457 kW per HP of all equipment)				
Total Utilities				**$21,550**
Total Treatment System O&M (Annual)				**$34,078**

APPENDIX E

REMEDIAL DESIGN CALCULATIONS

Appendix E
Water Table Depression
Total Pumping Rate and Number of Well Calculations

Remedial Action Plan
Sherman Field Former Fuel Farm, UST Site 000024
Naval Air Station Pensacola
Pensacola, Florida

Total Groundwater Flow

$Q_{gw} = W*B*K(\Delta h/\Delta L)$

W = Width of plume	500	ft
B = Saturated thickness of the aquifer	13	ft
K = average hydraulic conductivity	211.3	ft/day
$\Delta h/\Delta L$ = hydraulic gradient	0.00526	ft/ft
Q_{gw}	7224.35	ft^3/day
	37.53	gal/min

Design Pumping Rate

Assumption: Use a safety factor of 100% (USEPA, 1996)

$Q_{gw} + 100\%Q_{gw}$ =	14448.69	ft^3/day
	75.05	gal/min

Maximum Pumping Rate for a Single Well

$Q_{max} = S_{max}(2BK)/\ln(W/r_w)$

Smax = maximum allowable drawdown to minimize smearing (assume 1 ft)	1	ft
rw = well radius (2")	0.1667	ft
Q_{max}	686.196	ft^3/day
	3.56	gal/min

Total Pumping Wells Needed

Total wells = Q_{gw}/Q_{max}	Wells	21

Source: *How to Effectively Recover Free Product at Leaking Underground Storage Tank Sites*, USEPA, September 1996.

“HYPERVENTILATE” PROGAM SVE CALCULATIONS

Shell’s “Hyperventilate” program was used to calculate variables involved in the conceptual design of the SVE system discussed in Section 5.1.3.2. An explanation of the assumptions made and the calculations performed is as follows:

- The program does not calculate remediation time. Estimated remediation is entered by the user. However, analysis of the results is used to optimize the remediation time variable. If the chosen remediation time is too short design flow rates and necessary mass removal rates will be higher than is conventionally possible.

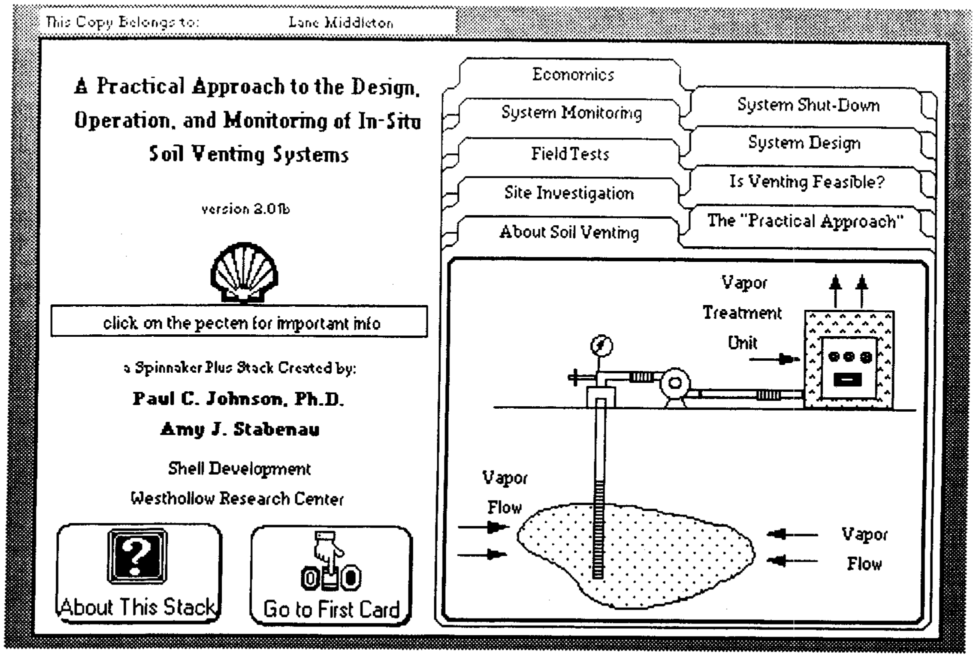
- Wells were assumed to be 2-inch PVC with a screened interval covering the entire impacted interval (23 ft).

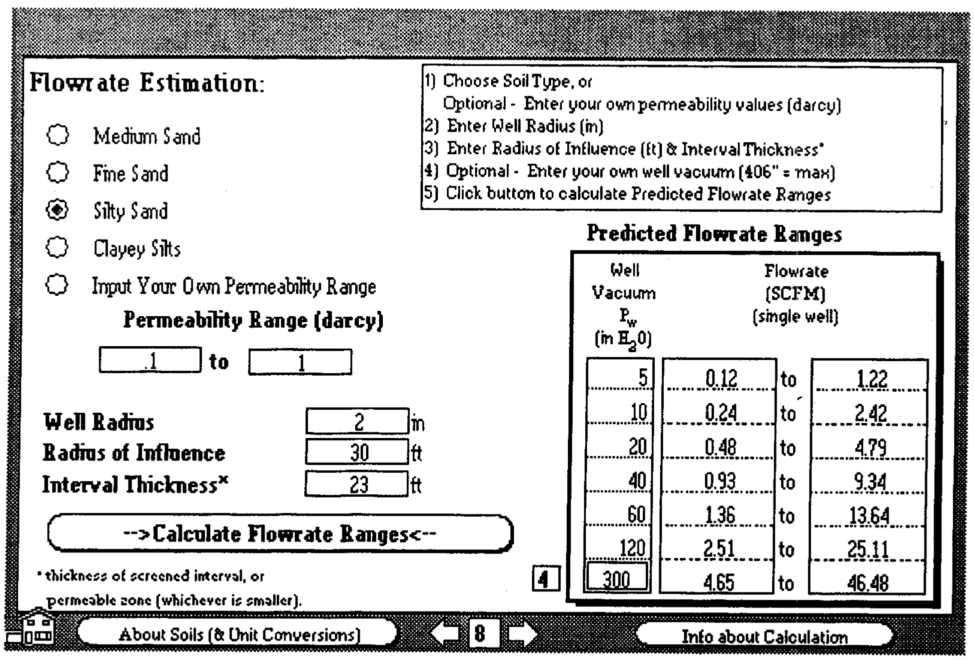
- Silty sand was chosen to indicate permeability range based on the lithology described in the SAR.

- A well vacuum of 300 inches of water was selected as it is within the pressure range of 5 to 25 inches of mercury commonly used by pumping systems.

- To determine vapor concentration “Weathered” gasoline was chosen as it exhibits characteristics similar to an old release of JP-4 (i.e. reduced volatile compounds, etc.)

- The calculations indicated a flow rate of 4 to 40 standard cubic feet per minute (SCFM). At 50 percent efficiency the desired flow rate of 20 to 25 SCFM is achievable.


This Copy Belongs to: Lane Middleton
A Practical Approach to the Design, Operation, and Monitoring of In-Situ Soil Venting Systems
version 2.01b
click on the pecten for important info
a Spinnaker Plus Stack Created by:
Paul C. Johnson, Ph.D.
Amy J. Stabenau
Shell Development
Westhollow Research Center
About This Stack
Go to First Card
Economics
System Monitoring
Field Tests
Site Investigation
About Soil Venting
System Shut-Down
System Design
Is Venting Feasible?
The "Practical Approach"
Vapor
Treatment
Unit
Vapor
Flow
Vapor
Flow


Flowrate Estimation:
Medium Sand
Fine Sand
Silty Sand
Clayey Silts
Input Your Own Permeability Range
Permeability Range (darcy)
.1 to 1
1) Choose Soil Type, or
Optional - Enter your own permeability values (darcy)
2) Enter Well Radius (in)
3) Enter Radius of Influence (ft) & Interval Thickness*
4) Optional - Enter your own well vacuum (406" = max)
5) Click button to calculate Predicted Flowrate Ranges
Predicted Flowrate Ranges
Well Vacuum Pw (in H2O)
Flowrate (SCFM) (single well)
5 0.12 to 1.22
10 0.24 to 2.42
20 0.48 to 4.79
40 0.93 to 9.34
60 1.36 to 13.64
120 2.51 to 25.11
300 4.65 to 46.48
Well Radius 2 in
Radius of Influence 30 ft
Interval Thickness* 23 ft
-->Calculate Flowrate Ranges<--
* thickness of screened interval, or
permeable zone (whichever is smaller).
4
About Soils (& Unit Conversions)
8
Info about Calculation

Vapor Concentration Estimation - Calculation

(1) Type in Temperature (C) (hit <return>) — 20

(2) Click to Enter Composition of Contaminant or Choose one of the Default Distributions
- ○ Enter Distribution
- ○ "Fresh" Gasoline
- ◉ "Weathered" Gasoline

(3) Click to View Distributions, (optional) — View Distributions

(4) Click to Perform Calculations — ◉ Perform Calculations

Results:

Sum of Mass Fractions	1.00000	
Calc. Vapor Pressure	0.06296	atm
Calc. Vapor Concentration	222.40432	mg/l

How Do I Measure a Distribution? — 10 — About Calculation — Print Card

Maximum Removal Rate Estimates

select your unit preference below
- ◉ [lb/d]
- ○ [kg/d]

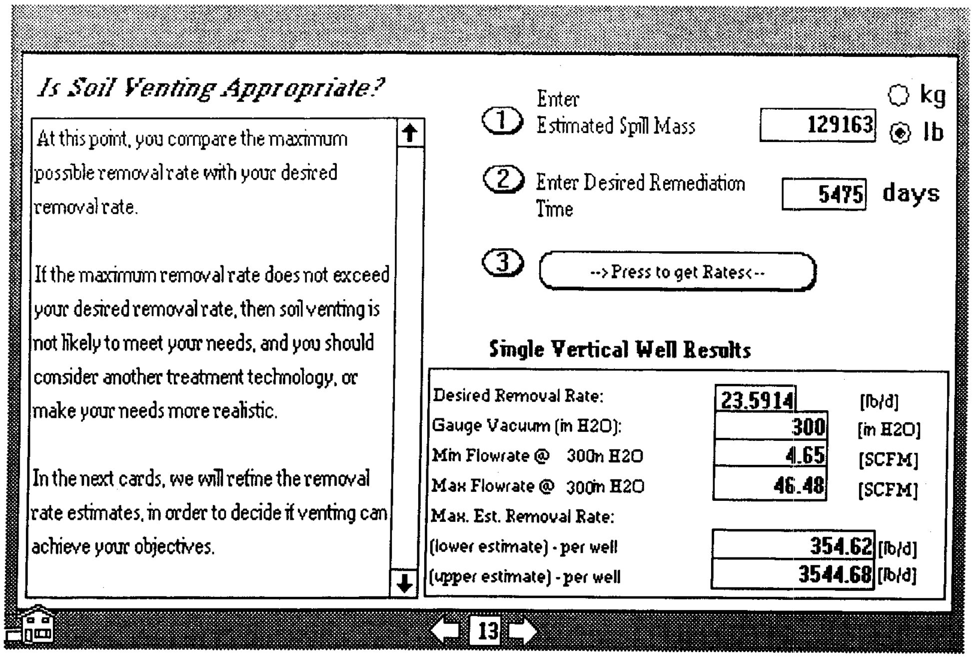
Temperature (C)	20		
Soil Type	Silty Sand		
Soil Permeability Range (darcy)	.1	to	1
Well Radius (in)	2		
Radius of Influence (ft)	30		
Contaminant Type	Weathered Gasoline		
Permeable Zone Thickness (ft)	23		

Note:

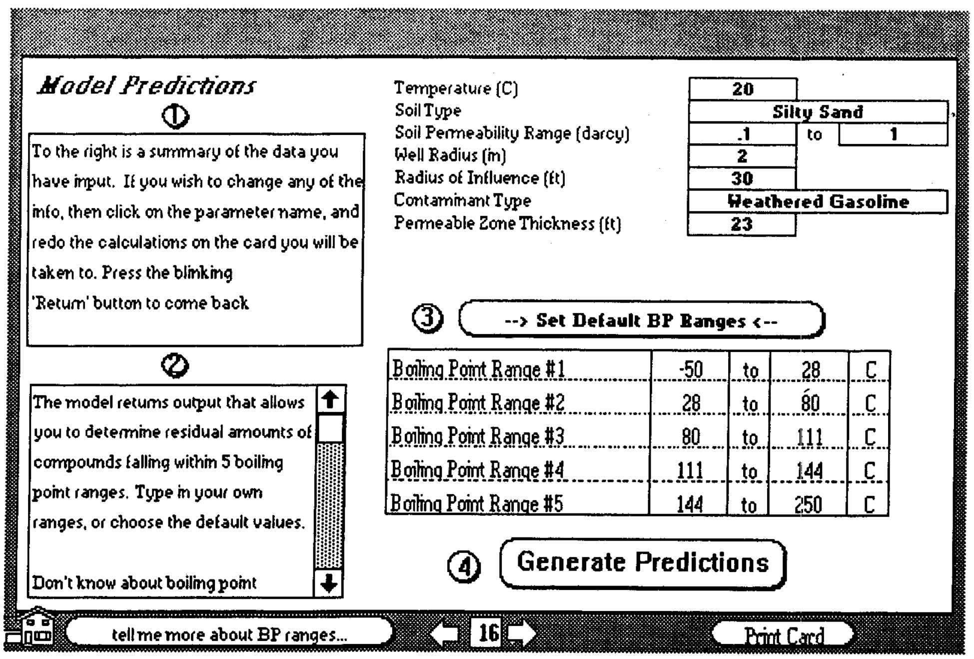
These are "maximum removal rates", and should only be used as screening estimates to determine if venting is even feasible at a given site. Continue on to the next card to assess if these rates are acceptable...

P_w - Well Vacuum (in H_2O)	Flowrate Estimates [SCFM] (single well)			Max. Removal Rate Estimates [lb/d] (single well)		
5	0.12	to	1.22	2.43	to	24.73
10	0.24	to	2.42	4.93	to	49.67
20	0.48	to	4.79	10.11	to	100.86
40	0.93	to	9.34	20.65	to	207.40
60	1.36	to	13.64	31.94	to	320.34
120	2.51	to	25.11	71.28	to	713.10
300	4.65	to	46.48	354.62	to	3544.68

12 — Print Card



Is Soil Venting Appropriate?
At this point, you compare the maximum possible removal rate with your desired removal rate.
If the maximum removal rate does not exceed your desired removal rate, then soil venting is not likely to meet your needs, and you should consider another treatment technology, or make your needs more realistic.
In the next cards, we will refine the removal rate estimates, in order to decide if venting can achieve your objectives.
1 Enter Estimated Spill Mass
129163
kg
lb
2 Enter Desired Remediation Time
5475
days
3 --> Press to get Rates<--
Single Vertical Well Results
Desired Removal Rate: 23.5914 [lb/d]
Gauge Vacuum (in H2O): 300 [in H2O]
Min Flowrate @ 300in H2O 4.65 [SCFM]
Max Flowrate @ 300in H2O 46.48 [SCFM]
Max. Est. Removal Rate:
(lower estimate) - per well 354.62 [lb/d]
(upper estimate) - per well 3544.68 [lb/d]
13



Model Predictions
1
To the right is a summary of the data you have input. If you wish to change any of the info, then click on the parameter name, and redo the calculations on the card you will be taken to. Press the blinking 'Return' button to come back
2
The model returns output that allows you to determine residual amounts of compounds falling within 5 boiling point ranges. Type in your own ranges, or choose the default values.
Don't know about boiling point
Temperature (C) 20
Soil Type Silty Sand
Soil Permeability Range (darcy) .1 to 1
Well Radius (in) 2
Radius of Influence (ft) 30
Contaminant Type Weathered Gasoline
Permeable Zone Thickness (ft) 23
3 --> Set Default BP Ranges <--
Boiling Point Range #1 -50 to 28 C
Boiling Point Range #2 28 to 80 C
Boiling Point Range #3 80 to 111 C
Boiling Point Range #4 111 to 144 C
Boiling Point Range #5 144 to 250 C
4 Generate Predictions
tell me more about BP ranges...
16
Print Card

① -> Import Data <-

FIRST PRESS THE IMPORT DATA BUTTON!

These are the results for the contaminant type that you have specified. All of this

Saturated Vapor Concentration at time=0	.2224E+03	[mg/L]
Min Volume to Remove >90% of Initial Residual	112.75	[L-air/g-residual]
Temperature (œC):	20	
Contaminant Type:	Weathered Gasoline	

Qt/M(0) L-air/ g-residual	Vapor Conc. [% Initial]	Residual Level [% Initial]	BP #1 Residual [% total]	BP #2 Residual [% total]	BP #3 Residual [% total]	BP #4 Residual [% total]	BP #5 Residual [% total]
.00	100.00	100.00	.69	11.65	24.01	22.14	41.51
.22	75.72	95.00	.14	9.27	23.97	22.99	43.63
.52	59.32	90.02	.00	6.79	23.46	23.81	45.95
.90	48.72	85.03	.00	4.55	22.39	24.55	48.50
1.36	40.05	80.03	.00	2.68	20.77	25.22	51.34
1.92	32.58	75.03	.00	1.27	18.52	25.73	54.49
2.61	26.49	70.03	.00	.41	15.60	25.98	58.00
3.46	21.66	65.03	.00	.08	12.13	25.87	61.92

17

Print Card

Is Venting Appropriate?

This is a complete summary of the data and results. Based upon these numbers, a "minimum number of wells" has been calculated, which should give you some indication of how appropriate venting is for your application. Note that this is the number of wells if circumstances are ideal, which they rarely are.

The next card discusses some of the conditions that may limit the effectiveness

Temperature [œC]:	20	
Contaminant Type:	Weathered Gasoline	
Soil Type:	Silty Sand	
Well Radius [in]:	2	
Est. Radius of Influence [ft]:	30	
Permeable Zone Thickness [ft]:	23	
Flowrate per Well (120" Vac) [SCFM]	2.51	
Flowrate per Well (120" Vac) [SCFM]	25.11	
Min. Vol. of Air [L/g-residual]:	112.75	
Estimated Spill Mass:	129163	lb
Desired Remediation Time [days]:	5475	

0.83 < **Minimum # of Wells Based on Your Input Parameters** < 8.28

18

Design Input Parameters...

Please enter (1) the desired time period for remediation, (2) the design gauge vacuum, and then (3) click the "update" button.

Note: - click on any table heading to get more info
- use arrow key to move between cells

③ Update

	Description of Soil Unit	① Time for Clean-up [days]	② Design Vacuum [in H2O]	Flowrate per Vapor Extraction Well [SCFM]			Minimum Number of Wells: Based on Area	Minimum Number of Wells: Based on Critical Volume**		
1	Shallow Zone	5475	300	4.04	to	40.40	43.1	0.4	to	4.4
2				NA	to	NA	NA	NA	to	NA
3				NA	to	NA	NA	NA	to	NA
4				NA	to	NA	NA	NA	to	NA
5				NA	to	NA	NA	NA	to	NA
6				NA	to	NA	NA	NA	to	NA
7				NA	to	NA	NA	NA	to	NA
8				NA	to	NA	NA	NA	to	NA

NA - not enough input data

** minimum volume of vapor required to achieve remediation

Clear All Entries | Return | SD4

Design Input Parameters...

Please enter the required information for each distinct soil layer, and then proceed to the next card.

Note: - click on any table heading to get more info
- use arrow key to move between cells

- Medium Sand
- Fine Sand
- Silty Sand
- Clayey Silts

	Description of Soil Unit	Permeability* [darcy]			Design Vacuum (in H2O)	Extraction Well Construction: well radius [in]	Extraction Well Construction: screen thickness [ft]	Extraction Well Construction: radius of influence [ft]	Critical Volume of Air** [L/g]	Efficiency [%]
1	Shallow Zone	0.1	to	1	300	2	20	30	112.75	50
2			to							
3			to							
4			to							
5			to							
6			to							
7			to							
8			to							

* Enter or choose from list at top right

** minimum volume of vapor required to achieve remediation

Clear All Entries | Return | SD3

Design Input Parameters...

(soil stratigraphy & contaminant characteristics)

Select the total mass units that you prefer ○ [kg] ◉ [lb]

Please enter the required information for each distinct soil layer, Please enter the required information for each distinct soil layer, click on the "Update" button, and then proceed to the next card (i.e. click on right arrow at bottom).

Clear All Entries

	Description of Soil Unit	Depth BGS* [ft]			Description of Contamination	Contaminant Distribution: radius [ft]	Contaminant Distribution: interval thickness [ft]	Contaminant Distribution: average conc. [mg/kg]	Calc. Total Mass [lb]
1	Shallow Zone	4	to	27	JP-4	197	23	501.4	149337.8
2			to						0.0
3			to						0.0
4			to						0.0
5			to						0.0
6			to						0.0
7			to						0.0
8			to						0.0

* Below Ground Surface

Update

Return

SD2

APPENDIX F

DESIGN SPECIFICATIONS

CARBONAIR®
ENVIRONMENTAL SYSTEMS

2731 Nevada Avenue North
New Hope, Minnesota 55427-2806
800 526.4999
763.544.2154
763.544.2151
www.carbonair.com

FAX TRANSMITTAL

October 11, 2002

Lane Middleton
Tetra Tech NUS
8640 Philips Highway
Suite 16
Jacksonville, FL 32256-1208

Phone: 904-636-6125
Fax: 904-636-6165

Re: Proposal Number: 15368
Project Name: Former Fuel Farm RAP
Project Location: Pensacola FL

Dear Lane,

Carbonair is pleased to quote products and services for the referenced project. The proposal is based on the specifications dated 10/10/02. Detailed product specifications are attached.

Summary

It is our understanding that Carbonair is to provide an air stripper for the above referenced site. The unit is to be capable of treating 200 gpm of water with the identified contaminants. We recommend either a Carbonair STAT 400 low profile air stripper with 5 trays or a Carbonair OS430 packed column air stripper with 30' of packing depth. We also recommend that either stripper be followed by a Carbonair PC 50 liquid phase carbon adsorber with 5,000 lbs. of carbon to treat the remaining semi-volatile compounds that will remain after the air stripper. We estimate that this carbon vessel will require changing out approximately every 320 days with the STAT 400 or 240 days with the OS430.

Budgetary Pricing

(1) Carbonair Model STAT 400 low profile air stripper — $ 29,359.00

- SST sump with high level alarm and pump operation switches
- 5 trays with demister and fasteners
- 25 hp, 230 V, 3 phase, XP blower (2,100 cfm @ 40" wc)
- Blower low pressure alarm switch
- Blower pressure gauge
- Blower air flow meter kit
- 7.5 hp, 230V, 3 phase, XP pump (200 gpm @ 80' TDH)

(1) Carbonair OS 430 packed column air stripper — $ 51,471.00

- 4' diameter FRP construction
- 30' of 3.5" dia. LanPac packing
- Mist eliminator media
- 230V, 3 phase, XP blower (2,140 cfm @ 6" wc)
- Blower low pressure switch

CARBONAIR
ENVIRONMENTAL SYSTEMS

- (2) Packing access manways
- Air inlet sleeve
- Water inlet riser pipe with support brackets
- Sight glass with level controls
- 7.5 hp, 230V, 3 phase, XP pump (200 gpm @ 80' TDH)

(1) Carbonair PC 50 liquid phase carbon adsorber $ 21,640.00

- 8 ft. diameter x 13.5 ft. high steel vessel
- 5,000 lbs. of reactivated liquid phase carbon
- Maximum design pressure 75 psi
- 6" influent and effluent flanges
- (2) 12" x 16" access ports
- (2) 4" carbon slurry flanges

General Conditions

- Terms of payment are 30% down with order, 30% after submittal approval, balance due Net 30 days after shipment of equipment to site with approved credit.
- Proposal is subject to the attached terms and conditions.
- Proposal and pricing valid for 30 days.
- This proposal and pricing is based on our interpretation of the sections of the RFP or specification that have been made available to us. Exceptions have been noted where ever possible. In the event of a conflict between the language in the specification and the proposal, the language in the proposal takes precedence and is the basis of the proposed pricing. Carbonair reserves the right to reject any order based on differences in pricing. Carbonair reserves the right to reject any order based on differences in interpretation of the specification, or for any reason, at the time an order is tendered.
- Carbonair will not initiate work with out a fully executed contract or purchase order. Fabrication will not be initiated until complete submittal approvals have been received.
- Submittals will be provided within two weeks of receipt of a fully executed contract or purchase order.
- The proposed equipment can generally be shipped within 8-10 weeks after receipt of completely approved submittals. Lead time will be updated at the time of order execution.
- Shipping charges are not included in the prices quoted. Actual freight costs will be pre-paid and added to the invoice.
- Sales tax is not included in the prices quoted. All applicable Federal, State and Local sales or use taxes must be paid by the customer.

For shipments to the states of California, Florida, Illinois, Indiana, Michigan, Minnesota, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, Washington, and Wisconsin: **State and local sales and use tax will be added to the invoice, unless a valid sales/use tax exemption certificate is supplied with the contract or purchase order for this project. Exemption certificates must be supplied at the time of order.**

For shipments to any other states: **The prices quoted do not include any state or local sales/use taxes. Customer is responsible for paying any applicable state and local taxes.**

CARBONAIR
ENVIRONMENTAL SYSTEMS

If you have any questions or comments concerning this information, please feel free to call Mr. Ron Hubp at 352-376-9528 or Mr. Chris Riddle at 763-544-2154. Thank you for the opportunity to bid on this project.

Sincerely,

Ron Hubp
Southeastern Regional Sales Manager

Chris Riddle
Sales Development Manager

Accepted by:
The proposal and terms & conditions herein are acknowledged and accepted:

Name/Title

Date

Authorized Signature

Purchase Order Number

CARBONAIR
ENVIRONMENTAL SYSTEMS

Terms & Conditions

ACCEPTANCE: This proposal is an invitation for an offer and will become a binding contract when accepted.

LIMITATION OF PROPOSAL: The prices and terms quoted in this proposal are subject to acceptance by the Purchaser within a period of (30) calendar days from the date heron.

EXCLUSIONS: This proposal is based solely and completely on specifications submitted to Carbonair Environmental Systems, Inc. (Carbonair) at the time of the writing of the proposal. General plans and specification not actually submitted shall not apply. This proposal, together with all annexed specifications, when accepted, shall be the complete agreement between the parties; and any alternations or unusual and undisclosed conditions or deviations from the above specifications involving extra costs shall be agreed upon in writing by both parties and shall become an additional charge over and above the proposal price set forth herein.

Delays or impossibility of performance by Carbonair because of strikes, accidents, or other reasons beyond the control of Carbonair shall relieve us from all liability herein.

SHIPMENT: Time of shipment shall be no longer than eight to ten (8-10) weeks after receipt of order and acceptance and final approval of all drawings and submittal.

TERMS OF PAYMENT: Subject to the payment terms described in the General Conditions section in the proposal. We reserve the right to cancel the contract or cease work if payments thereon are not received when due. 1.5% per month shall be charged on all unpaid balances.

TAXES: Any local, state or federal sales, excise or use tax imposed on the equipment or work covered by this proposal shall be paid by the Purchaser in addition to the prices quoted.

WARRANTY LIMITATION: There are no warranties which extend beyond the warranties herein after expressed.

WARRANTIES: All work shall be done in a workmanlike manner according to standard practices. We warrant performance against defects in workmanship for a period of twelve (12) months from date of shipment. We agree to pass on to the Purchaser such warranties, if any, as may be extended by the manufacturer for material supplied. Labor for replacing defective materials shall not be provided by us unless it is specifically spelled out in the proposal. We shall not be responsible for materials damaged, lost or stolen after delivery, through no fault of ours, or for failure to deliver and perform because of reasons beyond our control.

EXCLUSIVE REMEDIES: Remedies are limited to the repair or replacement at FOB point of delivery. Consequential damages are excluded. In no event shall Carbonair be responsible for consequential damages of any such defective material or workmanship including, but not limited to, the Purchaser's loss of material or profits, increased expenses of operation, downtime or reconstruction of the work, and in no event shall Carbonair's obligation under this warranty exceed the original contract price of the defective item. It is agreed that any action for breach of express or implied warranty shall be initiated within fifteen (15) months of the date of shipment by Carbonair and only those defects that are documented to have occurred within twelve (12) months of shipment will be covered by the warranty.

DISCLAIMER: Carbonair will not be responsible for damage to equipment or materials through improper installation, storage, improper services, or through attempts to operate it in excess of its rated capacity or recommended use, intentional or otherwise, by parties other than Carbonair or its authorized representatives.

CONDITIONS OF SALE: Prices quoted are those now in effect. Seller reserves the right to bill at the prices in effect at the time of shipment if the proposal is not accepted in writing within thirty (30) days, unless a longer term of validity is in writing on the proposal.

LIMITATIONS OF LIABILITY

A. Neither Seller nor its suppliers of any tier will be liable to Purchaser, whether in contract, in tort (including negligence and strict liability), under any warranty or otherwise, for any special, indirect, incidental, or consequential loss or damage whatsoever, or for loss of or to the plant, loss of use of equipment or power system, cost of capital, loss of profits or revenue or the loss of use thereof, cost of environmental damage or clean-up, or claims of customers of Purchaser. The remedies set forth herein are exclusive, and the total cumulative liability of seller and it suppliers under any purchase order or any act or omission in connection therewith or related thereto, whether in contract, in tort (including negligence and strict liability), under any warranty, or otherwise, will be limited to the price of the contract.

B. The provisions of this Article shall survive termination, cancellation or expiration of the purchase order and shall apply, notwithstanding any other provisions of this Agreement or any related document thereto, to the fullest extent permitted by law. Prior to the transfer of any equipment or material furnished or for which work is furnished hereunder from the project site (except temporarily for repair work or permanently for disposal), or the transfer of any interest therein or in the plant, Purchaser shall obtain for Seller written assurances from the transferee of limitation of and protection against liability following the proposed transfer at least equivalent to that afforded seller and its suppliers under the purchase order.

CARBONAIR
Water Treatment

STAT® Series
Low Profile Air Strippers

Carbonair's exclusive STAT series represents the best choice in low profile air strippers, combining high performance, flexibility and design simplicity. Carbonair's STAT units are available with a number of tray configurations, blowers and controls, and can achieve a removal efficiency of up to 99.99% for a long list of volatile organic compounds.

Construction Materials

Air Stripper
304 series stainless steel.

Gaskets
Gasoline-resistant neoprene.

Demister
Polypropylene material capable of removing 99.5% of the droplets 10 microns or larger; 95% of the droplets 5-10 microns in size.

Design

Flanged Inlet and Outlet
Flanged (150 pound) inlet and outlet configuration to maximize the integrity of piping connections.

Anti-bypass Valve*
Eliminates need for priming prior to system start-up.

Flapper Valve (Gravity units)*
Prevents air from bypassing the sieve trays through the effluent discharge during start-up.

Downcomer
Weir type square downcomer flow distribution system ensures uniform water distribution over the trays. Minimizes back pressure and head losses.

Sieve Trays
STAT 15, 30, 80: 10.25" high. Minimum water height of 4".
STAT 180, 400, 720: 12.25" high. Minimum water height of 4".

Tray Alignment Guides
Permanently installed for proper tray alignment.

Tray Fastening
Stainless steel over-center latching clips.

Collection Sump
Minimizes pump cycling and maintains sufficient turbulence.

Regenerative Blower
Direct coupled regenerative blower maintains high air pressure at low flow rates.

Accessories

Pump-out
Incorporates float switches in an externally-mounted clear PVC sight glass.

Pressure Gauge
Installed on sight glass.

Low Pressure Switch
Mounted in blower discharge piping.

Options

- Water temperature and flow monitoring.
- Air temperature and flow monitoring.
- Explosion-proof controls.
- Enclosures and trailers.
- Off-gas carbon filtration.
- Custom control panel.
- Humidity control.
- Discharge pump.
- Carbon polish.
- Well control.
- Pump down.
- Sample taps.

*U.S. Patent Numbers 5,478,507 and 5,378,267.
STAT is a registered trademark of Carbonair Environmental Systems, Inc.

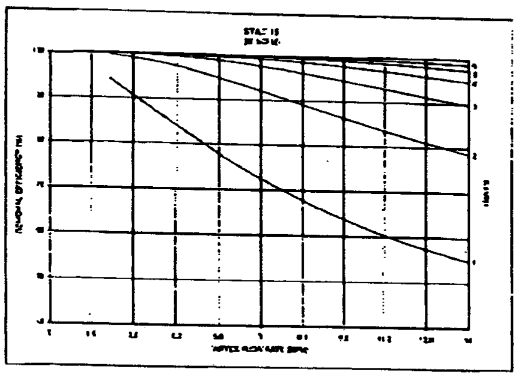
CARBONAIR®
ENVIRONMENTAL SYSTEMS
2731 Nevada Avenue North
New Hope, MN 55427-2806
800-526-4999 *Toll-free*
763-544-2154 *Voice*
763-544-2151 *Fax*
www.Carbonair.com

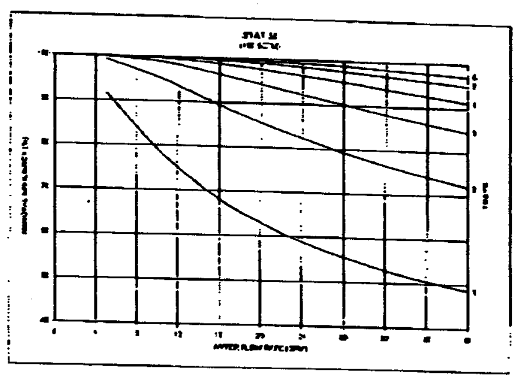
Specifications

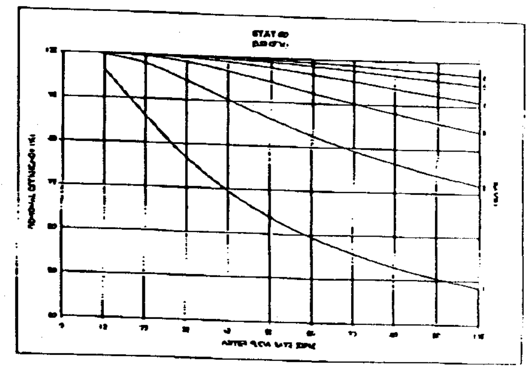
Model	STAT 15	STAT 30	STAT 80	STAT 180	STAT 400	STAT 720
Tray dimensions (LxWxH; inches)	24x9x10	36x12x10	48x24x10	72x36x12	120x48x12	144x72x12
Sump holding capacity (gallons)	13	30	70	250	560	1000
Maximum height (inches)*	93	96	97	120	122	130
Liquid flow (gpm)	0.5-12	1-35	5-80	10-200	20-400	40-1000
Minimum air flow (cfm)	60	100	300	650	1800	3000
Maximum air flow (cfm)	80	150	350	900	2100	4000

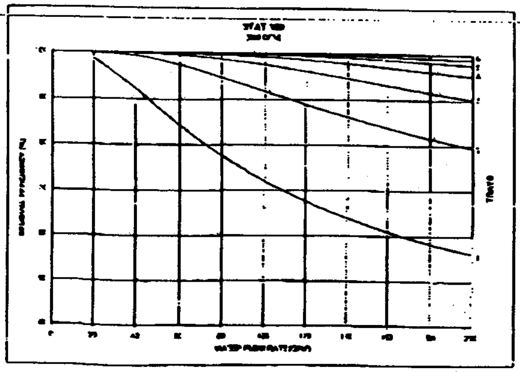
**Six-tray STAT without skid*

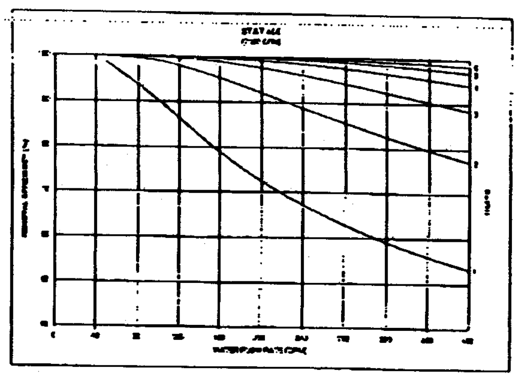
Benzene removal efficiency at 55° F predicted by computer modeling.

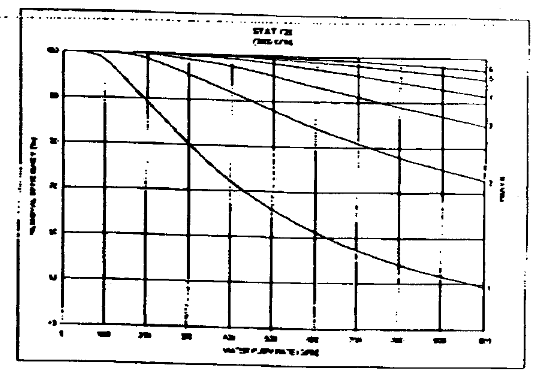




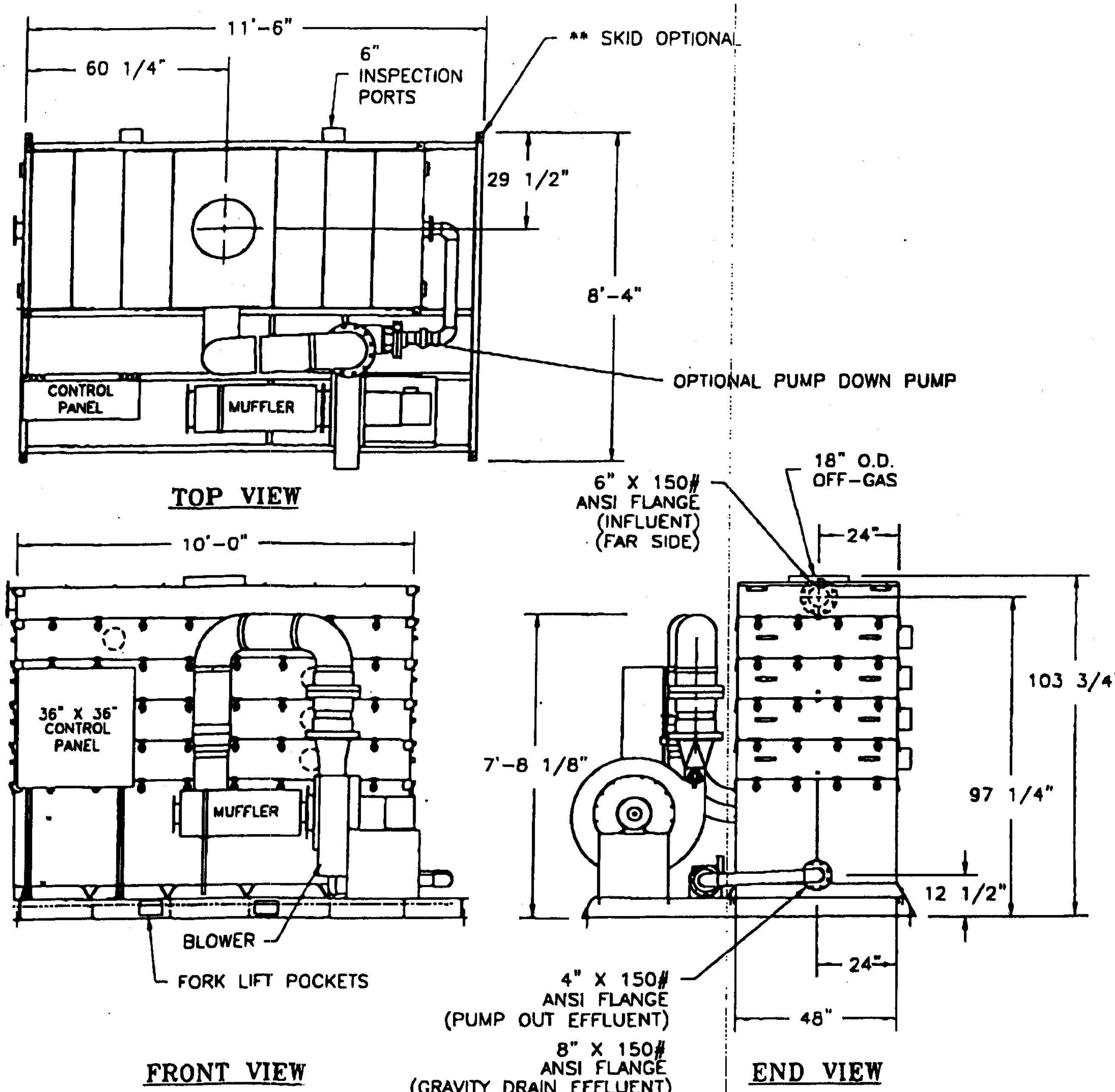








STAT 400



NOTE:

1. STAT 400 CONSTRUCTED OF 304 GRADE STAINLESS STEEL
2. ADJUST OVERALL HEIGHT BY 12 1/4" FOR EACH AERATION TRAY ADDED OR DELETED. INFLUENT FLANGE ON THE SAME SIDE AS EFFLUENT WITH ODD NUMBER OF TRAYS.
3. ACTUAL DIMENSIONS SUBJECT TO CHANGE WITHOUT NOTICE.

Sales Drawing #164236
8/14/98

STAT MODEL CALCULATIONS 10/10/02
VERSION 4.1 14:17:34

CARBONAIR ENVIRONMENTAL SYSTEMS
2731 NEVADA AVENUE NORTH, NEW HOPE, MN 55427
PHONE: 763-544-2154 FAX: 763-544-2151

UNIT MODEL:	STAT 400	WATER TEMPERATURE (F):	68.0
WATER FLOW RATE (GPM):	200.0	AIR TEMPERATURE (F):	68.0
AIR FLOW RATE (ACFM):	2100.0	AIR-TO-WATER RATIO:	79:1
OPERATING PRESS (ATM):	1.0	SAFETY FACTOR (%):	0.0

Influent Conc. for 1,1-DICHLOROETHANE 2.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	78.05782	0.4388	0.0198	0.0037
2	95.00945	0.0998	0.0241	0.0046
3	98.85586	0.0229	0.0250	0.0047
4	99.73722	0.0053	0.0252	0.0048
5	99.93962	0.0012	0.0253	0.0048
6	99.98612	0.0003	0.0253	0.0048

Influent Conc. for 1,1-DICHLOROETHENE 17.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	85.82179	2.4103	0.1847	0.0350
2	97.97623	0.3440	0.2108	0.0400
3	99.71085	0.0492	0.2146	0.0407
4	99.95868	0.0070	0.2151	0.0408
5	99.99410	0.0010	0.2152	0.0408
6	99.99916	0.0001	0.2152	0.0408

Influent Conc. for 1,2-DICHLOROETHANE 14.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	59.83664	5.6229	0.1060	0.0201
2	82.51849	2.4474	0.1462	0.0277
3	92.14159	1.1002	0.1633	0.0310
4	96.41762	0.5015	0.1709	0.0324
5	98.35662	0.2301	0.1743	0.0331
6	99.24395	0.1058	0.1759	0.0334

Influent Conc. for 1,2-DICHLOROPROPANE 3.6 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	66.48195	1.2066	0.0303	0.0057
2	88.06592	0.4296	0.0401	0.0076
3	95.66322	0.1561	0.0436	0.0083
4	98.41251	0.0571	0.0448	0.0085
5	99.41735	0.0210	0.0453	0.0086
6	99.78595	0.0077	0.0455	0.0086

Influent Conc. for TRICHLOROETHENE 1.8 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	80.32817	0.3541	0.0183	0.0035
2	96.04469	0.0712	0.0219	0.0042
3	99.20127	0.0144	0.0226	0.0043
4	99.83857	0.0029	0.0227	0.0043
5	99.96737	0.0006	0.0228	0.0043
6	99.99340	0.0001	0.0228	0.0043

Influent Conc. for BENZENE 670.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	78.27944	145.5278	6.6389	1.2593
2	95.11654	32.7192	8.0668	1.5301
3	98.89369	7.4123	8.3872	1.5909
4	99.74895	1.6821	8.4597	1.6047
5	99.94301	0.3819	8.4762	1.6078
6	99.98706	0.0867	8.4799	1.6085

Influent Conc. for CHLOROFORM 6.6 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	74.50113	1.6829	0.0622	0.0118
2	93.17665	0.4503	0.0778	0.0148
3	98.15120	0.1220	0.0820	0.0156
4	99.49738	0.0332	0.0831	0.0158
5	99.86323	0.0090	0.0834	0.0158
6	99.96278	0.0025	0.0835	0.0158

Influent Conc. for CHLOROMETHANE 0.8 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	90.06764	0.0834	0.0096	0.0018
2	99.00779	0.0083	0.0105	0.0020
3	99.90082	0.0008	0.0106	0.0020
4	99.99009	0.0001	0.0106	0.0020
5	99.99901	0.0000	0.0106	0.0020
6	99.99990	0.0000	0.0106	0.0020

Influent Conc. for ETHYLBENZENE 1700.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	75.90372	409.6367	16.3337	3.0982
2	94.03156	101.4635	20.2346	3.8382
3	98.51174	25.3004	21.1987	4.0210
4	99.62828	6.3192	21.4390	4.0666
5	99.90712	1.5790	21.4990	4.0780
6	99.97679	0.3946	21.5140	4.0808

Influent Conc. for MTBE 5.1 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	46.50826	2.7281	0.0300	0.0057
2	68.94289	1.5839	0.0445	0.0084
3	81.19367	0.9591	0.0524	0.0099
4	88.33842	0.5947	0.0570	0.0108
5	92.66604	0.3740	0.0598	0.0113
6	95.34761	0.2373	0.0616	0.0117

Influent Conc. for METHYLENE CHLORIDE 0.8 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	68.87159	0.2490	0.0070	0.0013
2	89.55970	0.0835	0.0091	0.0017
3	96.41497	0.0287	0.0098	0.0019
4	98.75916	0.0099	0.0100	0.0019
5	99.56935	0.0034	0.0101	0.0019
6	99.85040	0.0012	0.0101	0.0019

Influent Conc. for TOLUENE 64.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	74.73097	16.1722	0.6054	0.1148
2	93.36654	4.2454	0.7564	0.1435
3	98.24158	1.1254	0.7959	0.1510
4	99.53268	0.2991	0.8063	0.1529
5	99.87572	0.0795	0.8091	0.1535
6	99.96694	0.0212	0.8099	0.1536

Influent Conc. for XYLENES (TOTAL) 4810.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	76.37486	1136.3690	46.5017	8.8206
2	94.27185	275.5240	57.3984	10.8875
3	98.60255	67.2175	60.0352	11.3877
4	99.65856	16.4232	60.6782	11.5097
5	99.91655	4.0141	60.8353	11.5394
6	99.97960	0.9812	60.8737	11.5467

Influent Conc. for TOTAL VOCs 7295.7 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	76.39058	1722.4819	70.5476	13.3817
2	94.25048	419.4703	87.0414	16.5103
3	98.58124	103.5088	91.0409	17.2690
4	99.64451	25.9353	92.0228	17.4552
5	99.90824	6.6949	92.2664	17.5014
6	99.97480	1.8387	92.3279	17.5131

STAT MODEL CALCULATIONS 10/10/02
VERSION 4.1 14:23:07

CARBONAIR ENVIRONMENTAL SYSTEMS
2731 NEVADA AVENUE NORTH, NEW HOPE, MN 55427
PHONE: 763-544-2154 FAX: 763-544-2151

UNIT MODEL:	STAT 400	WATER TEMPERATURE (F):	68.0
WATER FLOW RATE (GPM):	200.0	AIR TEMPERATURE (F):	68.0
AIR FLOW RATE (ACFM):	2100.0	AIR-TO-WATER RATIO:	79:1
OPERATING PRESS (ATM):	1.0	SAFETY FACTOR (%):	0.0

Influent Conc. for 1-METHYLNAPHTHALENE 84.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	24.65680	63.2883	0.2622	0.0497
2	39.91215	50.4738	0.4244	0.0805
3	50.27841	41.7661	0.5346	0.1014
4	57.77852	35.4660	0.6144	0.1165
5	63.45466	30.6981	0.6747	0.1280
6	67.89837	26.9654	0.7220	0.1369

Influent Conc. for 2-METHYLNAPHTHALENE 96.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	23.37505	73.5600	0.2841	0.0539
2	37.96695	59.5517	0.4614	0.0875
3	47.94297	49.9747	0.5826	0.1105
4	55.19410	43.0137	0.6707	0.1272
5	60.70252	37.7256	0.7377	0.1399
6	65.02901	33.5721	0.7902	0.1499

Influent Conc. for ACENAPHTHENE 1.4 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	10.85569	1.2480	0.0019	0.0004
2	18.07474	1.1470	0.0032	0.0006
3	23.12786	1.0762	0.0041	0.0008
4	26.79308	1.0249	0.0047	0.0009
5	29.52077	0.9867	0.0052	0.0010
6	31.58982	0.9577	0.0056	0.0011

Influent Conc. for ANTHRACENE 0.8 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	1.13727	0.8304	0.0001	0.0000
2	1.93868	0.8237	0.0002	0.0000
3	2.50660	0.8189	0.0003	0.0001
4	2.91067	0.8156	0.0003	0.0001
5	3.19897	0.8131	0.0003	0.0001
6	3.40510	0.8114	0.0004	0.0001

Influent Conc. for DIBENZO-a,h-ANTHRACENE 0.3 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	0.10853	0.2697	0.0000	0.0000
2	0.18974	0.2695	0.0000	0.0000
3	0.25052	0.2693	0.0000	0.0000
4	0.29603	0.2692	0.0000	0.0000
5	0.33012	0.2691	0.0000	0.0000
6	0.35566	0.2690	0.0000	0.0000

Influent Conc. for FLUORANTHENE 1.7 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	54.10594	0.7802	0.0116	0.0022
2	77.75824	0.3781	0.0167	0.0032
3	88.95051	0.1878	0.0191	0.0036
4	94.44478	0.0944	0.0203	0.0039
5	97.19050	0.0478	0.0209	0.0040
6	98.57490	0.0242	0.0212	0.0040

Influent Conc. for FLUORENE 2.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	7.22126	1.8556	0.0018	0.0003
2	12.09746	1.7581	0.0031	0.0006
3	15.50870	1.6898	0.0039	0.0007
4	17.95456	1.6409	0.0045	0.0009
5	19.73936	1.6052	0.0050	0.0009
6	21.05855	1.5788	0.0053	0.0010

Influent Conc. for INDENO(1,2,3-CD)PYRENE 9.9 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	0.13703	9.8864	0.0002	0.0000
2	0.23774	9.8765	0.0003	0.0001
3	0.31180	9.8691	0.0004	0.0001
4	0.36629	9.8637	0.0005	0.0001
5	0.40639	9.8598	0.0005	0.0001
6	0.43592	9.8568	0.0005	0.0001

Influent Conc. for NAPHTHALENE 200.0 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	35.27255	129.4549	0.8930	0.1694
2	55.00501	89.9900	1.3925	0.2641
3	67.37198	65.2560	1.7056	0.3235
4	75.68207	48.6359	1.9160	0.3634
5	81.53061	36.9388	2.0641	0.3915
6	85.78207	28.4359	2.1717	0.4119

Influent Conc. for PYRENE 1.1 ppb

NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	0.85995	1.0905	0.0001	0.0000
2	1.47095	1.0838	0.0002	0.0000
3	1.90688	1.0790	0.0003	0.0001
4	2.21885	1.0756	0.0003	0.0001
5	2.44258	1.0731	0.0003	0.0001
6	2.60328	1.0714	0.0004	0.0001

Influent Conc. for TOTAL VOCs 397.2 ppb

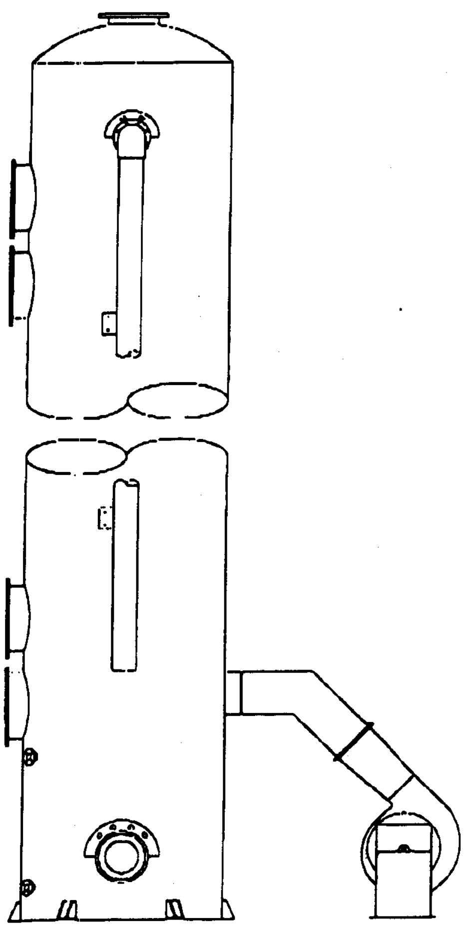
NO OF TRAY	REMOVAL EFF %	EFF CONC ppb	OFF-GAS CONC ug/l	AIR EMISSION lb/d
1	28.93833	282.2641	1.4550	0.2760
2	45.78382	215.3521	2.3020	0.4367
3	56.70118	171.9872	2.8509	0.5408
4	64.27585	141.8999	3.2318	0.6130
5	69.78493	120.0173	3.5088	0.6656
6	73.93247	103.5428	3.7173	0.7051

CARBONAIR
Water Treatment

OS Series
Packed Column Air Strippers

Carbonair has a complete line of standard packed column air strippers. These units can be built according to specifications or custom designed for a particular site.

OS series packed column air strippers are designed to remove volatile organic compounds (VOC's) from contaminated water and can accommodate a wide range of flow rates and contaminant concentrations. The OS series are one-piece units constructed of durable fiberglass-reinforced plastic with corrosion-resistant PVC internals. Units are designed for all wind and siesmic conditions.



Standard Components

- Inspection/media replacement access manways.
- External riser pipe with brackets.
- Water inlet and outlet ports.
- Blower and blower ducting.
- Water distribution piping.
- Air inlet and outlet ports.
- Tower sump drain valve.
- Guy wire support lugs.
- Mist eliminator.

Options

- Off gas downcomer ducting and brackets.
- Carbon steel or aluminum construction.
- Discharge pump and piping.
- Free-standing construction.
- Integrated control systems.
- Level control assembly.
- P.E. stamped design.
- Guy wire kit.

CARBONAIR®
ENVIRONMENTAL SYSTEMS

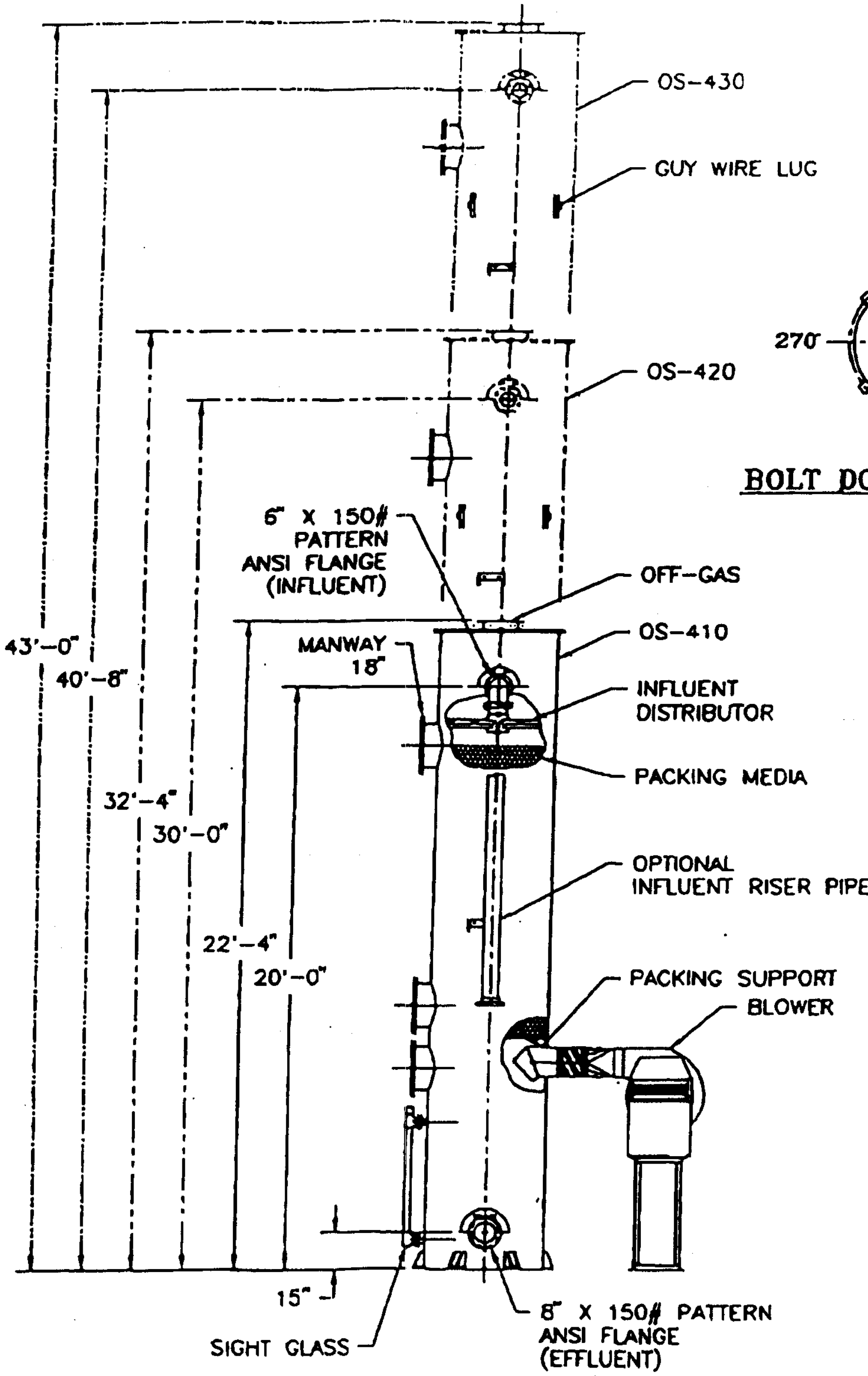
2731 Nevada Avenue North
New Hope, MN 55427
800-526-4999 *Toll-free*
763-544-2154 *Voice*
763-544-2151 *Fax*
www.Carbonair.com

Model	OS-100	OS-200	OS-300	OS-400	OS-500	OS-600	OS-800	OS-1000
Tower Diameter (feet)	1.33	2	3	4	5	6	8	10
Liquid Flow Range (gpm)	1 - 50	5 - 100	10 - 250	25 - 450	40 - 700	60 - 1,000	100 - 1,800	160 - 2,700
Nominal Liquid Flow (gpm)[1]	30	60	140	250	390	570	1,010	1,570
Nominal Air Flow Rate (cfm)[2]	200	400	940	1,670	2,610	3,810	6,750	10,500
Standard Blower HP @ 10" w.c.[3]	3/4	2	5	7 ½	7 ½	10	15	20
Standard Packing (inches)	1	2	2	3-1/2	3-1/2	3-1/2	3-1/2	3-1/2
Packing Volume (ft3/10 ft section)	14	31	71	126	196	283	503	785
Overall Height (feet)[4]								
10 feet of packing	24	24	24	24	24	24	24	24
20 feet of packing	34	34	34	34	34	34	34	34
30 feet of packing	44	44	44	44	44	44	44	44
Empty Weight (pounds)[5]								
10 feet of packing	271	466	798	1,309	1,765	2,274	3,893	5,585
20 feet of packing	407	730	1,392	2,076	2,854	3,735	6,450	9,077
30 feet of packing	562	1,020	1,825	2,913	4,031	5,302	9,145	12,990
Operating Weight (pounds)[6]								
10 feet of packing	850	1,800	3,500	6,800	10,400	14,600	26,000	40,000
20 feet of packing	1,100	2,300	4,800	8,300	12,500	17,900	31,500	48,000
30 feet of packing	1,350	2,800	5,800	10,000	15,000	21,200	37,500	57,000
Piping Size (inches)[7]								
Water inlet pipe	2 ½	3	4	6	6	8	10	10
Water outlet pipe	4	4	6	8	8	10	12	12
Air outlet pipe	6	8	10	12	16	18	22	25
Footprint (feet²)	3	7	13	20	28	38	64	95

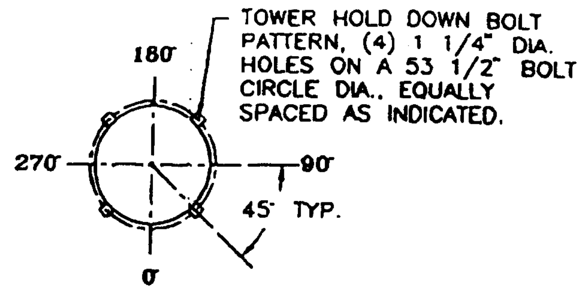
NOTES
1. The nominal liquid flow rates are based on a hydraulic loading of 20 gpm/ft² which yields a pressure drop across the packing of <0.1in/ft of packing at nominal air flow rates
2. The nominal air flow rates are based on an air-to-water ratio of 50:1
3. The standard blower horse powers are based on the corresponding nominal flow rates and on the assumption that the air outlets are open to the atmosphere
4. The overall height estimate includes a one-piece tower containing a sump, packing media supporting material, packing media, distribution system, demisting media, and air outlet pipe
5. The empty weight estimate includes the FRP tower and packing media
6. The operating weight estimate includes the FRP tower, packing media, liquid holdup on the packing media (assuming 10% of packing section volume), and liquid holdup in the sump (assuming a liquid height of 6 feet)
7. The water and air pipe sizing is based on nominal flow rates.

All specifications subject to change without notice

Air Stripper
OS-410, OS-420, OS-430



TOWER ELEVATION
0°



BOLT DOWN PATTERN

NOTE:
1. MATERIAL OF CONSTRUCTION TO BE FIBERGLASS REINFORCED PLASTIC.
2. EXTERIOR GELCOAT FINISH TO BE ANTIQUE BROWN.
3. OPTIONAL KITS:
   - DISCHARGE PUMP
   - RISER PIPE
   - OFF-GAS DOWNCOMER
   - GUY WIRES
   - LEVEL CONTROLS
   - TOWER ANCHORS

ALL OS-SERIES AIRSTRIPPERS ARE CUSTOM MADE TO MEET YOUR PROJECT SPECIFICATIONS. ACTUAL DIMENSIONS MAY VARY DEPENDING ON PROJECT NEED.

Sales Drawing #140746
95.04.03

PACKED-TOWER AERATION MODEL CALCULATIONS 10/10/02
VERSION 1.3 14:36:31

CARBONAIR ENVIRONMENTAL SYSTEMS
2731 NEVADA AVENUE NORTH, NEW HOPE, MN 55427
PHONE: 763-544-2154 FAX: 763-544-2151

PAT MODEL:	OS400	PACKING:	3.50"-LANPAC
TOWER DIA (FT):	4.0	A/W RATIO:	80.0
PACKING HT. (FT):	30.0	WATER TEMP. (F):	55.0
TOWER AREA (FT2):	12.6	AIR TEMP. (F):	55.0
WATER FLOW (GPM):	200.0	OPERATING PRESS. (ATM):	1.0
WATER LOADING (GPM/FT2):	15.9	PRESS DROP PER FT (IN/FT):	0.057
AIR FLOW (CFM):	2139.0	TOTAL PRESS DROP (IN)	1.708
AIR LOADING (CFM/FT2):	170.2	SAFETY FACTOR (%):	15.0

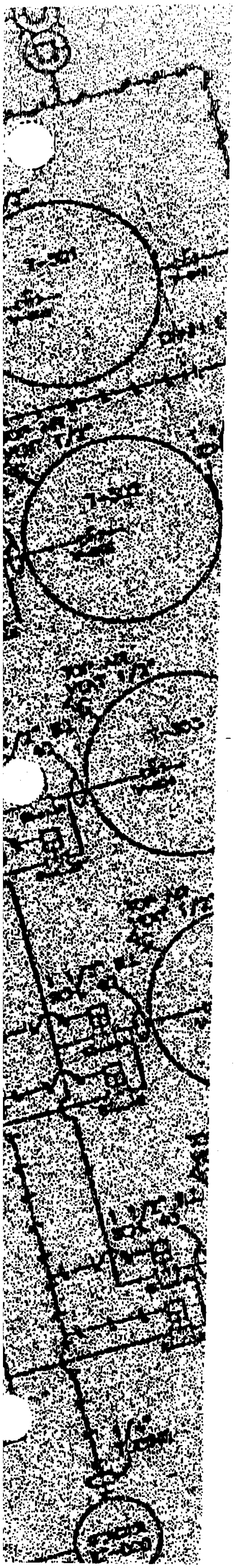
COMPOUND	INFLUENT CONC. (UG/L)	EFFLUENT CONC. (UG/L)	REMOVAL EFF. (%)	OFF-GAS CONC. (UG/L)	OFF-GAS EMISSION (LBS/DAY)
1,1-DICHLOROETHANE	2.000	0.002	99.902	0.025	0.005
1,1-DICHLOROETHENE	17.000	0.001	99.996	0.212	0.041
1,2-DICHLOROETHANE	14.000	0.567	95.947	0.168	0.032
1,2-DICHLOROPROPANE	3.600	0.051	98.576	0.044	0.009
TRICHLOROETHENE	1.800	0.001	99.961	0.022	0.004
BENZENE	670.000	0.584	99.913	8.368	1.605
CHLOROFORM	6.600	0.017	99.743	0.082	0.016
CHLOROMETHANE	0.840	0.000	100.000	0.010	0.002
ETHYLBENZENE	1700.000	2.360	99.861	21.221	4.071
MTBE	5.100	0.801	84.284	0.054	0.010
METHYLENE CHLORIDE	0.800	0.009	98.897	0.010	0.002
TOLUENE	64.000	0.143	99.777	0.798	0.153
XYLENES (TOTAL)	4810.000	5.755	99.880	60.053	11.520
TOTAL VOCS	7295.740	10.291	99.859	91.068	17.470

PACKED-TOWER AERATION MODEL CALCULATIONS 10/10/02
VERSION 1.3 14:40:11

CARBONAIR ENVIRONMENTAL SYSTEMS
2731 NEVADA AVENUE NORTH, NEW HOPE, MN 55427
PHONE: 763-544-2154 FAX: 763-544-2151

PAT MODEL:	OS400	PACKING:	3.50"-LANPAC
TOWER DIA (FT):	4.0	A/W RATIO:	80.0
PACKING HT. (FT):	30.0	WATER TEMP. (F):	55.0
TOWER AREA (FT2):	12.6	AIR TEMP. (F):	55.0
WATER FLOW (GPM):	200.0	OPERATING PRESS. (ATM):	1.0
WATER LOADING (GPM/FT2):	15.9	PRESS DROP PER FT (IN/FT):	0.057
AIR FLOW (CFM):	2139.0	TOTAL PRESS DROP (IN)	1.708
AIR LOADING (CFM/FT2):	170.2	SAFETY FACTOR (%):	15.0

COMPOUND	INFLUENT CONC. (UG/L)	EFFLUENT CONC. (UG/L)	REMOVAL EFF. (%)	OFF-GAS CONC. (UG/L)	OFF-GAS EMISSION (LBS/DAY)
1-METHYLNAPHTHALENE	84.000	43.756	47.909	0.503	0.097
2-METHYLNAPHTHALENE	96.000	52.442	45.373	0.544	0.104
ACENAPHTHENE	1.400	1.114	20.421	0.004	0.001
ANTHRACENE	0.840	0.822	2.102	0.000	0.000
DIBENZO-a,h-ANTHRACENE	0.270	0.269	0.206	0.000	0.000
FLUORANTHENE	1.700	0.118	93.055	0.020	0.004
FLUORENE	2.000	1.731	13.433	0.003	0.001
INDENO(1,2,3-CD)PYRENE	9.900	9.874	0.258	0.000	0.000
NAPHTHALENE	200.000	65.055	67.472	1.687	0.324
PYRENE	1.100	1.082	1.595	0.000	0.000
TOTAL VOCS	397.210	176.266	55.624	2.762	0.530



CARBONAIR
Water Treatment

High Pressure Liquid Phase Carbon Vessels

Carbonair's carbon vessels are designed and manufactured in accordance with engineering standards set forth by the American Society of Mechanical Engineers (ASME). The materials used in construction are in accordance with standards established by AWWA, FDA and EPA.

Design

PC 1 & PC 3

- High-pressure vessel.
- Reinforced fiberglass construction.
- Polyethylene liner.
- PVC internals.
- Top-mounted couplings.

Carbon Capacities: PC 1 - 90 pounds
PC 3 - 250 pounds

PC 5F & PC 7F

- High-pressure vessel.
- Reinforced fiberglass construction.
- PVC internals.
- Top influent, bottom effluent construction.

Carbon Capacities: PC 5F - 575 pounds
PC 7F - 900 pounds

PC 5, PC 7, PC 13 & PC 20

- Welded steel construction.
- Skid-mounted.
- Double-coated corrosion resistant epoxy interior.
- PVC or stainless steel internals.
- Two influent/effluent couplings.
- Bolt down lugs.
- Large carbon slurry lines.
- Dual access ports.
- Optional fiberglass construction.

Carbon Capacities: PC 5 - 575 pounds
PC 7 - 900 pounds
PC 13 - 1,500 pounds
PC 20 - 2,500 pounds

PC 28

- Welded steel construction.
- Double-coated corrosion resistant epoxy interior.
- Epoxy coated exterior.
- PVC and stainless steel internals.
- 4" diameter influent/effluent flanges.
- 4" carbon slurry line with quick connect.
- 3/4" drain coupling.
- Two access ports.

Carbon Capacity: PC 28 - 5,000 pounds

PC 50 & PC 78

- Welded steel construction.
- Double-coated corrosion resistant epoxy interiors.
- Epoxy coated exterior.
- PVC and stainless steel internals.
- 6" diameter influent/effluent flanges.
- 4" carbon slurry line with quick connect.
- Two access ports.
- Full range of flow rates.

Carbon Capacities: PC 50 - 10,000 pounds
PC 78 - 20,000 pounds

Options

- Influent/Effluent sample & pressure kit.
- Influent/Effluent quick connect kit.
- Quick connect industrial hose.
- Decon 3 2" piping package.
- ASME inspected & stamped.
- External sample/gauge kit.
- Flow instrumentation.
- Internal sampling kit.
- External piping kit.
- Sample ports.
- Hose kit.

CARBONAIR®
ENVIRONMENTAL SYSTEMS

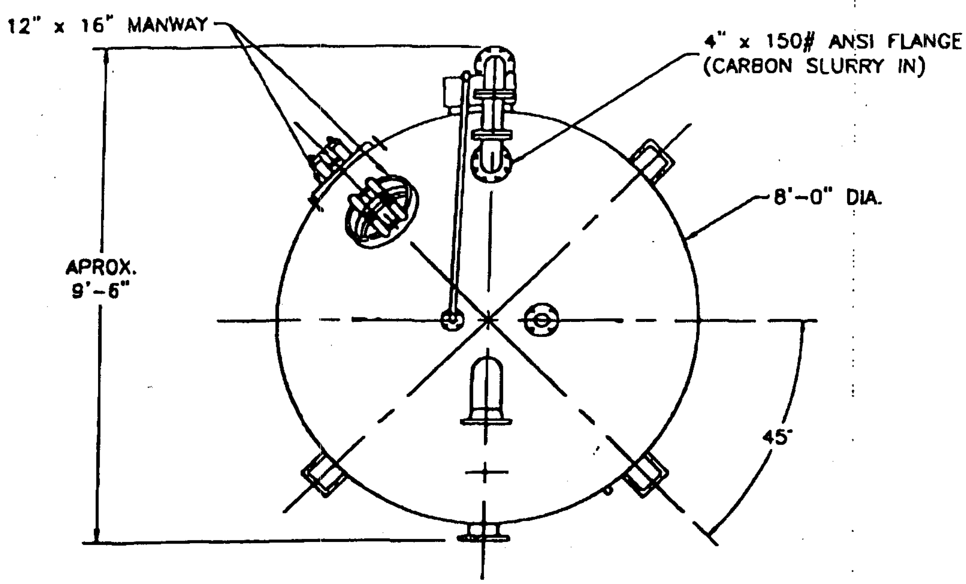
2731 Nevada Avenue North
New Hope, MN 55427
800-526-4999 *Toll-free*
763-544-2154 *Voice*
763-544-2151 *Fax*
www.Carbonair.com

Specifications

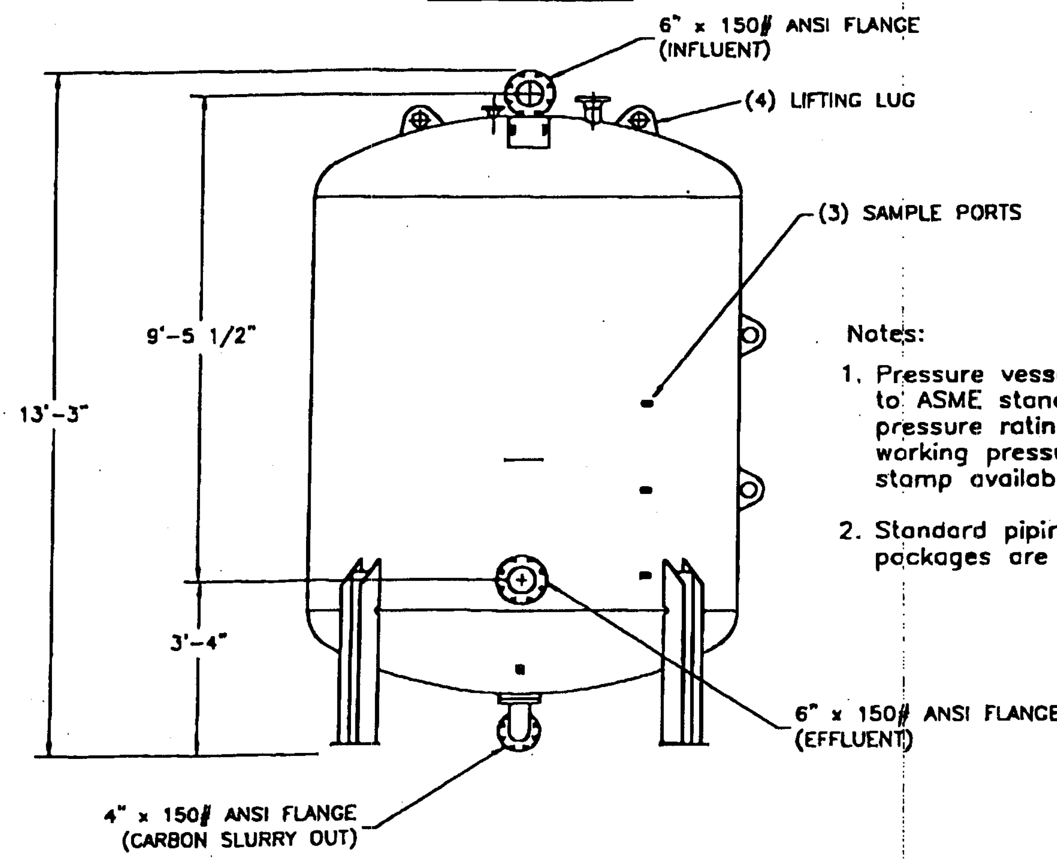
Model	PC 1	PC 3	PC 5	PC 5F	PC 7	PC 7F	PC 13	PC 20	PC 28	PC 50	PC 78
Vessel diameter	1.2 ft.	1.8 ft.	2.5 ft	2.5 ft.	3 ft	3 ft.	4 ft.	5 ft.	6 ft.	8 ft	10 ft.
Overall height	3.9 ft.	4.5 ft	7.5 ft.	7.5 ft	8 ft	7.5 ft.	8.5 ft.	9 ft.	12.5 ft.	13.5 ft.	18 ft.
Bed area	1.1 ft²	2.4 ft²	4.9 ft²	4.9 ft²	7 ft²	7 ft²	12.6 ft²	19.6 ft²	28 ft²	50 ft²	78.5 ft²
Flow range	5-10 gpm	1-20 gpm	3-35 gpm	3-35 gpm	4-50 gpm	4-50 gpm	6-100 gpm	10-138 gpm	14-200 gpm	25-280 gpm	4-550 gpm
Carbon capacity (pounds)	90	250	575	575	900	900	1,500	2,500	5,000	10,000	20,000
Fittings	(2) 1" influent/ effluent connections	(2) 1" influent/ effluent connections	(2) 2" influent/ effluent flanges, (2) 6" x 8" access ports	(2) 2" influent/ effluent flanges	(2) 2" influent/ effluent flanges, (2) 6" x 8" access ports	(2) 2" influent/ effluent flanges	(2) 2" influent/ effluent flanges, (2) 12" x 16" access ports, 3" air pressure relief coupling	(2) 3" influent/ effluent flanges, (2) 12" x 16" access ports, 3" air pressure relief coupling	(2) 4" influent/ effluent flanges, (2) 12" x 16" access ports, (2) 4" carbon slurry flanges	(2) 6" influent/ effluent flanges, (2) 12" x 16" access ports, (2) 4" carbon slurry flanges	(2) 6" influent/ effluent flanges, (2) 12" x 16" access ports, (2) 4" carbon slurry flanges
Design pressure	150 psi	150 psi	100 psi	150 psi	90 psi	150 psi	90 psi, optional ASME inspected and stamped relief coupling	75 psi, optional ASME inspected and stamped relief coupling	75 psi, optional ASME inspected and stamped	75 psi, optional ASME inspected	70 psi, optional ASME inspected
Empty weight (pounds)	25	55	1,200	250	1,400	300 lbs	1,510	2,100	4,000	8,100	10,900
Loaded weight (pounds)	130	320	1,775	825	2,300	1,200 lbs	3,010	4,600	9,000	18,100	30,000
Operating weight (pounds)	390	775	2,830	1,900	3,730	2,250 lbs	5,750	9,476	24,000	36,500	67,000
Spent & drained weight (pounds)	215	560	2,350	1,400	1,200	1,750 lbs	4,510	7,100	14,000	28,100	50,000

All specifications subject to change without notice

Carbon Adsorber-Liquid Phase
PC 50



TOP VIEW



Notes:

1. Pressure vessel manufactured to ASME standards with a pressure rating of 75 PSIG working pressure. ASME code stamp available on request.

2. Standard piping and valve packages are shown.

Sales Drawing #116210
5/28/99

10/10/02

LIQUID-PHASE CARBON ADSORPTION MODEL CALCULATIONS

CARBONAIR ENVIRONMENTAL SYSTEMS
2731 NEVADA AVENUE NORTH
NEW HOPE, MN 55427-2864
PHONE: 763-544-2154
FAX: 763-544-2151

CARBON ADSORBERS:	PC50
NO OF ADSORBERS IN SERIES:	1
TOTAL MASS OF CARBON (LBS):	5000.0
FLOW RATE (GPM):	200.00
HYDRAULIC LOADING (GPM/SQ.FT):	4.0060
EMPTY BED CONTACT TIME (MIN.):	6.8152

DESIGN COMPOUND:	NAPHTHALENE
EXPECTED INFLUENT CONCENTRATION (PPB):	37.000 ← STAT400
MODEL INFLUENT CONCENTRATION (PPB):	120.00
EFFLUENT CRITERIA (PPB):	20.000

TIME(DAYS)	VOLUME TREATED(GAL)	EFF. CONC.(PPB)	
20.0	5760000.	0.0000	
40.0	11520000.	0.0000	
60.0	17280000.	0.0000	
80.0	23040000.	0.0000	
100.0	28800000.	0.0000	
120.0	34560000.	0.0194	
140.0	40320000.	0.0409	
160.0	46080000.	0.0839	
180.0	51840000.	0.1785	
200.0	57600000.	0.3699	
220.0	63360000.	0.7459	
240.0	69120000.	1.4818	
260.0	74880000.	2.8584	
280.0	80640000.	5.2931	
300.0	86400000.	9.1663	
320.0	92160000.	14.4952	← breaking through
340.0	97920000.	20.6563	
360.0	103680000.	26.9978	
380.0	109440000.	33.1439	
400.0	115200000.	38.9267	
420.0	120960000.	44.2899	
440.0	126720000.	49.2656	
460.0	132480000.	53.8598	
480.0	138240000.	58.1192	
480.0	138240000.	58.1192	

Note: The model influent concentration results from the impact of the other background compounds, which is determined by using a competitive adsorption model

DISCLAIMER: ACTUAL RESULTS MAY VARY SIGNIFICANTLY FROM THE MODEL. THE MODEL IS BASED ON THE ASSUMPTIONS THAT THE FLOW RATE AND INFLUENT CONCENTRATION ARE CONSTANT, AND ONLY THE CONTAMINANTS PROVIDED TO CARBONAIR ARE PRESENT IN THE WATER. VARYING OPERATING CONDITIONS CAN HAVE ADVERSE EFFECTS ON CARBON ADSORPTIVE CAPACITY. THE PREDICTED BED LIFE IS NOT GUARANTEED.

10/10/02

LIQUID-PHASE CARBON ADSORPTION MODEL CALCULATIONS

CARBONAIR ENVIRONMENTAL SYSTEMS
2731 NEVADA AVENUE NORTH
NEW HOPE, MN 55427-2864
PHONE: 763-544-2154
FAX: 763-544-2151

CARBON ADSORBERS:	PC50
NO OF ADSORBERS IN SERIES:	1
TOTAL MASS OF CARBON (LBS):	5000.0
FLOW RATE (GPM):	200.00
HYDRAULIC LOADING (GPM/SQ.FT):	4.0060
EMPTY BED CONTACT TIME (MIN.):	6.8152

DESIGN COMPOUND:	NAPHTHALENE
EXPECTED INFLUENT CONCENTRATION (PPB):	65.000 ← 034-30
MODEL INFLUENT CONCENTRATION (PPB):	180.00
EFFLUENT CRITERIA (PPB):	20.000

TIME(DAYS)	VOLUME TREATED(GAL)	EFF. CONC.(PPB)
20.0	5760000.	0.0000
40.0	11520000.	0.0000
60.0	17280000.	0.0000
80.0	23040000.	0.0125
100.0	28800000.	0.0391
120.0	34560000.	0.0976
140.0	40320000.	0.2536
160.0	46080000.	0.6406
180.0	51840000.	1.5595
200.0	57600000.	3.6604
220.0	63360000.	8.0836
240.0	69120000.	16.0227 ← breaking through
260.0	74880000.	27.0187
280.0	80640000.	39.1230
300.0	86400000.	50.8774
320.0	92160000.	61.7298
340.0	97920000.	71.5844
360.0	103680000.	80.5080
380.0	109440000.	88.6021
400.0	115200000.	95.9589
420.0	120960000.	102.6623
440.0	126720000.	108.7941
460.0	132480000.	114.4119
480.0	138240000.	119.5691
480.0	138240000.	119.5691

Note: The model influent concentration results from the impact of the other background compounds, which is determined by using a competitive adsorption model

DISCLAIMER: ACTUAL RESULTS MAY VARY SIGNIFICANTLY FROM THE MODEL. THE MODEL IS BASED ON THE ASSUMPTIONS THAT THE FLOW RATE AND INFLUENT CONCENTRATION ARE CONSTANT, AND ONLY THE CONTAMINANTS PROVIDED TO CARBONAIR ARE PRESENT IN THE WATER. VARYING OPERATING CONDITIONS CAN HAVE ADVERSE EFFECTS ON CARBON ADSORPTIVE CAPACITY. THE PREDICTED BED LIFE IS NOT GUARANTEED.

TUTHILL VACUUM SYSTEMS | Atlantic Fluidics
21 South Street
South Norwalk, Connecticut USA 06854
Tel 203 853-7315 Fax 203 866-8218

October 10, 2002
Mr. Lane Middleton
Tetra Tech NUS Inc.
7018 A.C.Skinner Pkwy, Suite 250
Jacksonville, FL 32256

Fax: 904-636-6165

Dear Lane,

It was a pleasure talking to you the other day about your remediation project. After reviewing your requirements with our engineering department we would like to make the following suggestions.

Since we are going to need four pump systems to achieve your desired air flow rate and considering the amount of water you are trying to remove we would recommend using four individual knockout tanks as well. This would mean that you would have to split your well field into four zones with approximately 11 wells to a zone.

There are several advantages in doing this. The first being the expense of a vacuum rated tank and transfer pump to handle your expected flow rate would be extremely high. The second being that the size of the tank and pipe manifold would awkward at best. The third being that if for some reason a pump should fail you could still perform your work on 75% of your field. The fourth being that once this site is cleaned you have more flexibility in using the equipment at several smaller sites.

I am enclosing a proposal for the system we would recommend, and since we are talking about using four of them I am extending a 10% discount off our list price.

If you have any questions or need any additional information please do not hesitate to contact me.

Sincerely,

Robert H. Huse

TUTHILL VACUUM SYSTEMS | Atlantic Fluidics
21 South Street
South Norwalk, Connecticut USA 06854
Tel 203 853-7315 Fax 203 866-8218

Mr. Lane Middleton
Tetra Tech NUS Inc.
7018 A.C.Skinner Pkwy. Ste. 250
Jacksonville, FL. 32256

10/10/02

Fax: 904636-6165

Dear Lane,

Per our conversation I am pleased to offer the following proposal:

EOPX-300 Remediation system consisting of an Atlantic Fluidics A300 liquid ring vacuum pump in cast iron construction close coupled to a 20 HP, 1150 RPM, 208/230/460/3/60 Class 1, Group D, explosion proof motor. Oil reservoir tank with built in baffles and coalescing filters for maximum air/oil separation and minimum oil emission. The tank is fitted with an oil level gauge, low oil level switch and pressure gauge. The oil is cooled by an air-cooled heat exchanger with a fan driven by an extended shaft from the liquid ring pump motor. The oil return line to the pump includes a 3-way thermostatic valve, two temperature gauges, a solenoid valve and flow control valve. A vertical 120 gallon, steel knock out tank built to ASME standards including a full length site tube, a multi level switch assembly with four floats, a vacuum relief valve, a vacuum gauge, 5" clean out access, and inner connecting piping to pump inlet. The transfer pump is a Grundfos multi-staged centrifugal pump driven by a ¾ HP, 3450 RPM, 208/230/460/3/60 Class 1, Group D, explosion proof motor rated for 25 gpm at 75ft head. The pump discharge is fitted with a pressure gauge, gate valve and check valve. All components are fully piped and mounted on a steel base plate.

$19,466.00 list

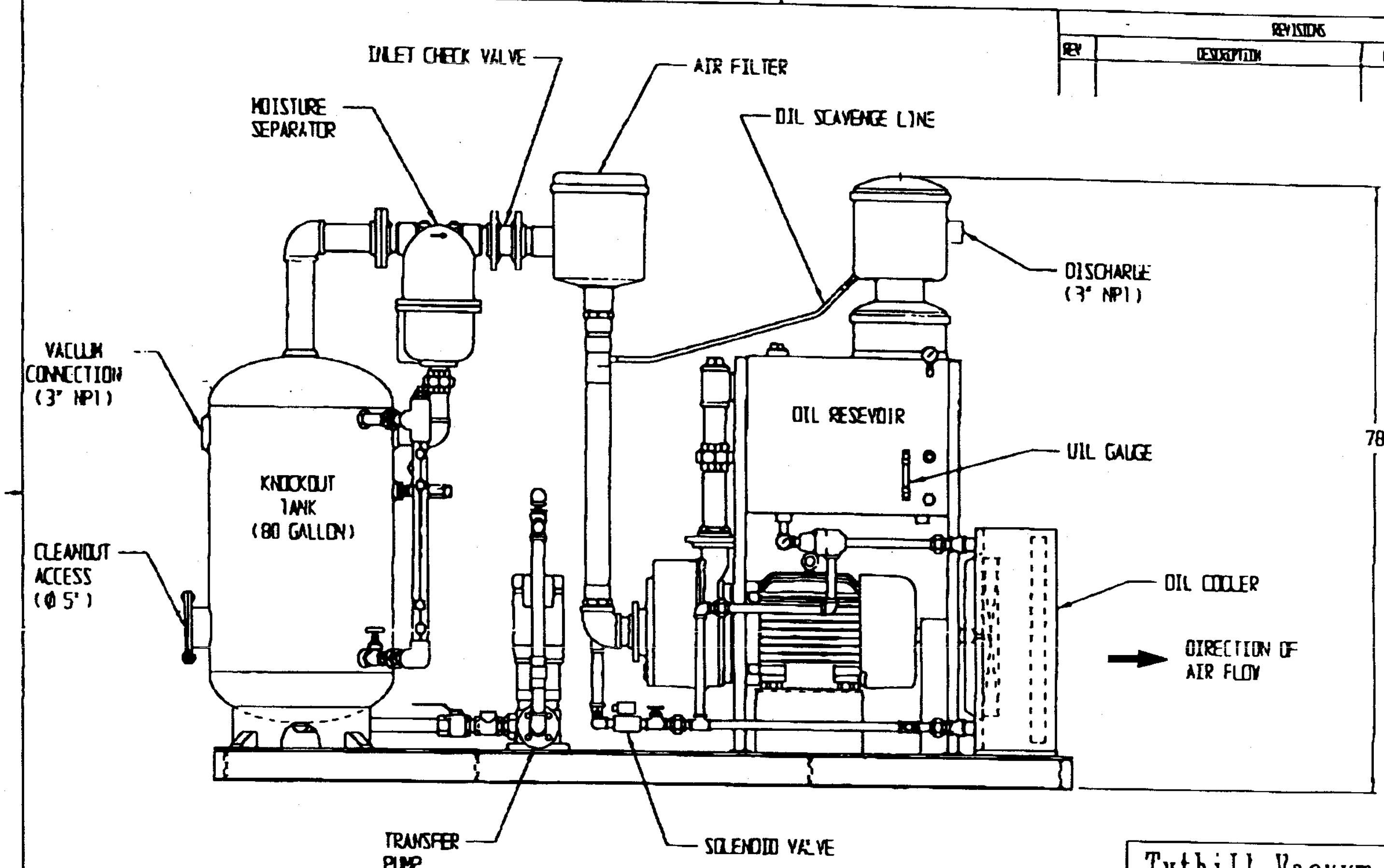
If you order four of these units at one time we would offer a 10% discount off of the quoted list price.

Shipment: 6 weeks upon receipt of order
F.O.B. Norwalk, CT
Terms: Net 30 days

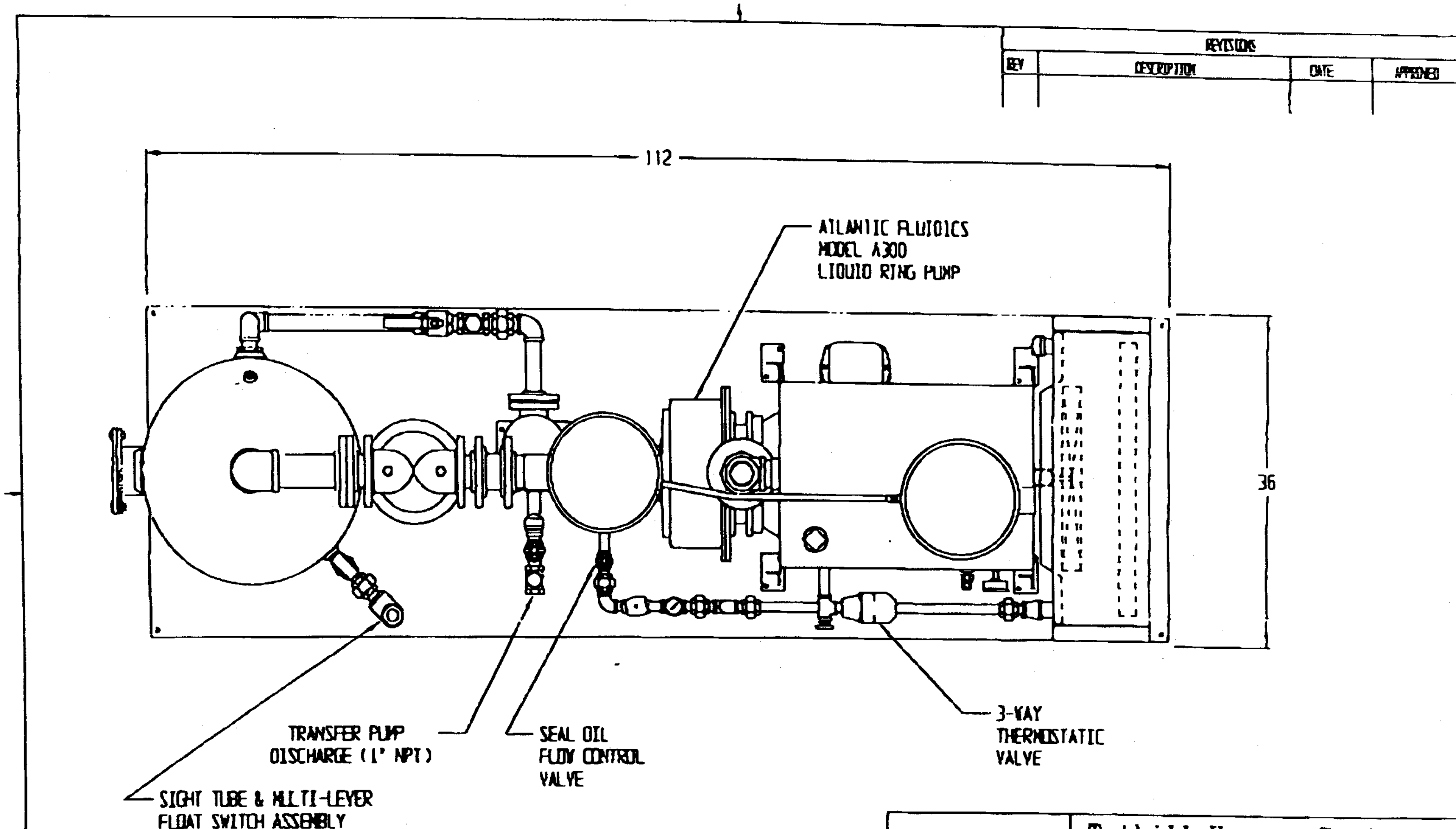
Sincerely,

Robert H. Huse

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



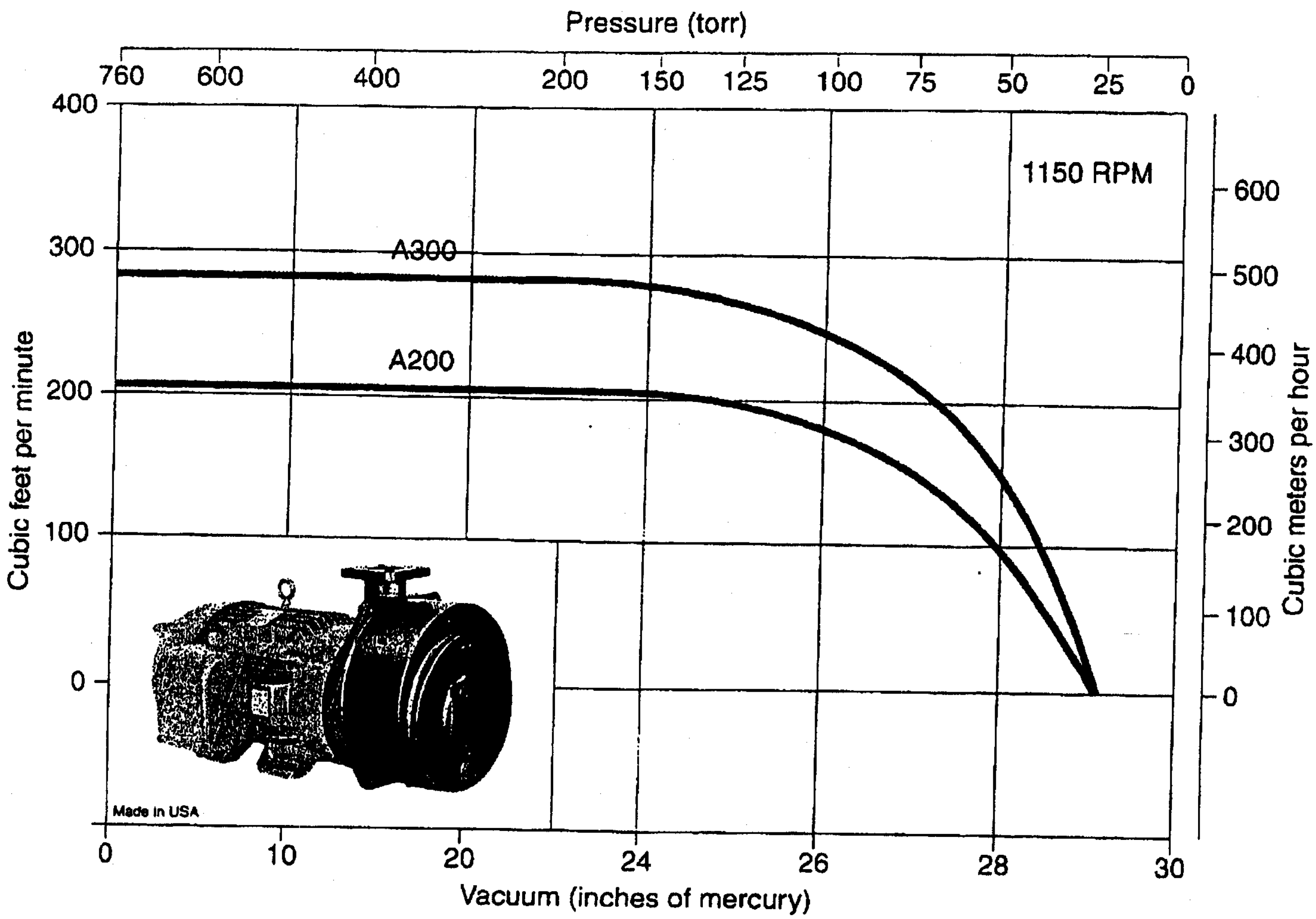
Tuthill Vacuum Systems				
EOPX-300 OIL SEALED PACKAGE				
DRAWN: TW	SIZE B	DATE 06/12/02	DWG NO. B937-A300-13	REV A
APPROVED:	SCALE 1:08	CAD FILE NO: 937-427A	SHEET 1 OF 2	

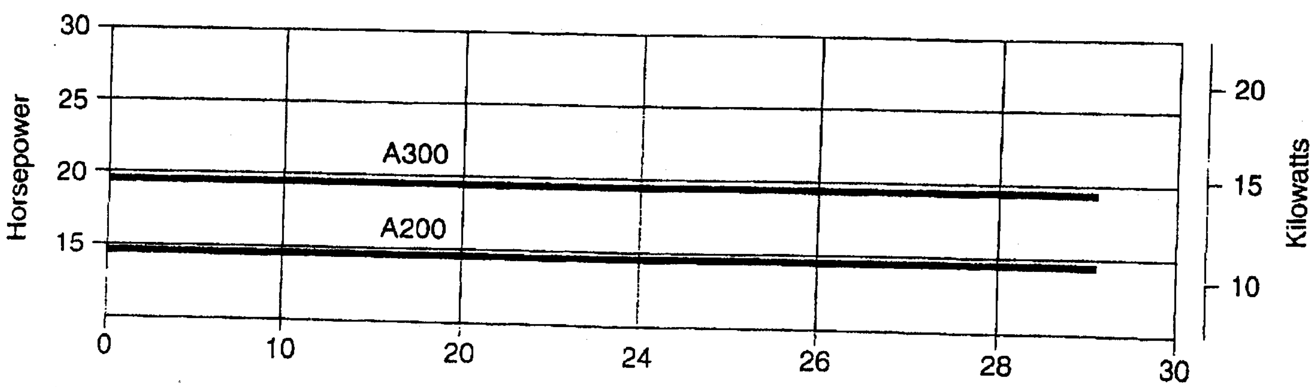


Tuthill Vacuum Systems	
EDPX-300 OIL SEALED PACKAGE	
DRAWN: TW	SIZE B · DATE 05/12/02 · DWG NO. B997-A300-13 · REV A
APPROVED:	SCALE 1:10 · CAD FILE NO: 997-427A · SHEET 2 OF 2

TUTHILL VACUUM SYSTEMS | atlantic fluidics

Dry air performance curves for Fluid-Vac® single stage vacuum pumps





21 South Street, South Norwalk, CT 06854 (203) 853-7315 Fax (203) 866-8218
www.atlanticfluidics.com

Quote No. 81790 Date: 10/09/2002

Highland Tank & Mfg. Co.

OIL WATER SEPARATOR QUOTE

TO:
TETRATECH
8640 PHILIPS HWY
SUITE 16
JACKSONVILLE FL
Attention: LANE MIDDLETON
Phone: 904-636-6125 Fax No: 904-636-6165

Payment Terms: All orders subject to credit approval by Highland Tank.
A: 5% Disc. for full payment w/ approved dwg.
B: 2% Discount for full payment within 15 days.

(No discount on Freight or Taxes)
Estimated Delivery: 3-4 WEEKS
From date of receipt of approved drawing if applicable.

RE:

Freight To: (If different from above)
MUST SHIP ON HT TRUCK
PENSACOLA FL 32593

QTY	DESCRIPTION	UNIT PRICE	AMOUNT
1	Model R-HTC 2000 Oil Water Separator Application: ABOVEGROUND Type: Single Wall Material: Mild Carbon Steel Width: 5' Height: 5' Length: 12' Fittings: Flow Rate: 200 GPM Inlet: 8" NPT ,Outlet: 8" NPT Oil Pump Out Mount: 4" NPT Level Sensor Mount: 2" NPT Vent Size: 2" Exterior Coating: EPOXY/URETHANE FINISH WHITE	13,196.00	13,196.00
1	POLYURETHANE INTERIOR COATING	2,610.00	2,610.00
1	Effluent Pump Model 3656M FLOW RATE 200 GPM TDH 20 CAT# 16BF2G7GO, 2 HP, 3PH-60HZ-230V ,1750 RPM, SIZE 3" X 4" FLA 6.2 (MOUNTED BY CONTRACTOR OUTSIDE OF TANK NEAR THE EFFLUENT CONNECTION)	2,725.20	2,725.20
1	Alarm Panel CC-HT-F WATER PUMP OUT W/HIGH WATER LEVEL, HIGH OIL LEVELS AND AUX CONTACTS (3PH-60HZ-230V-2HP) 6.2 FLA	700.00	700.00
1	(1) SET OF (3) ENM 10 FLOATS WITH 20' OF CABLE EACH	375.00	375.00
1	1 Float Interface Sensor		
	QUOTING HIGHLAND TANK & MFG CO STANDAR OIL WATER SEPARATOR.		

Prices quoted valid for 60 days from date above.

Quote No. 81790 Date 10/09/2002

Quoted By: KAREN DALEY *Karen Daley*

Description, prices and conditions accepted.

Accepted By: ______________________ Date: ____/____/____
Per the Terms and Conditions on reverse side of this form.

Please return one signed copy when placing order.

Representative:
CAMPBELL, JOHN
JOHN CAMPBELL ASSOCIATES
1414 WILEY STREET
HOLLYWOOD FL 33020-0000
Phone: 954-415-7883

Reply To: One Highland Road
Stoystown PA 15563
PH: 814-893-5701 FAX: 814-893-6126

Quote No. 81790 Date: 10/09/2002

HTMLKD1.0

Highland Tank & Mfg. Co.

OIL WATER SEPARATOR QUOTE

TO:
TETRATECH
8640 PHILIPS HWY
SUITE 16
JACKSONVILLE FL
Attention: LANE MIDDLETON
Phone: 904-636-6125 Fax No: 904-636-6165

Payment Terms: All orders subject to credit approval by Highland Tank.
A: 5% Disc. for full payment w/ approved dwg.
B: 2% Discount for full payment within 15 days.

(No discount on Freight or Taxes)
Estimated Delivery: 3-4 WEEKS
From date of receipt of approved drawing if applicable.

RE:

Freight To: (If different from above)
MUST SHIP ON HT TRUCK
PENSACOLA FL 32593

QTY	DESCRIPTION	UNIT PRICE	AMOUNT
	NO ACCESSORIES OTHER THAN THOSE LISTED ABOVE ARE INCLUDED..		
	QUOTING PER VERBAL REQUEST......		
	Sub Total		19,606.20
	FREIGHT		1,100.00
	Net Price (Excluding Taxes)		**20,706.20**

Prices quoted valid for 60 days from date above.

Quote No. 81790 Date 10/09/2002

Quoted By: KAREN DALEY *Karen Daley*

Description, prices and conditions accepted.

Accepted By: ______________________ Date: ____/____/____
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APPENDIX G

RAP SUMMARY CHECKLIST

DEP Form # 62-770.900(4)

Form Title: Remedial Action Plan Summary

Effective Date: September 23, 1997

Remedial Action Plan Summary

Site Name Sherman Field Former Fuel Farm UST Site

Location Naval Air Station Pensacola, Florida

Media Contaminated: ☐ Groundwater ☒ Soil

FDEP Facility ID No. ______

Current Date 11 / 15 /2002

Date of Last GW Analysis ___/___/___

Type(s) of Product(s) Discharged:

☐ Gasoline Analytical Group

☒ Kerosene Analytical Group (Diesel)

- Estimated Petroleum Mass (lbs):
  - Groundwater ______
  - Saturated Zone Soil ______
  - Vadose Zone Soil 112,833
- Area of Plume ______ (ft^2)
- Thickness of Plume ______ (ft)

Groundwater Recovery and Specifications:

- No. of Recovery Wells ______
  - ☐ Vertical ☐ Horizontal
- Design Flow Rate/Well ______ (gpm)
- Total Flow Rate ______ (gpm)
- Hydraulic Conductivity ______ (ft/day)
- Recovery Well Screen Interval ______ (ft)
- Depth to Groundwater ______ (ft)

Method of Groundwater Remediation:

☐ Pump-and-Treat

- ☐ Air Stripper
  - ☐ Low Profile ☐ Packed Tower
- ☐ Diffused Aerator
- ☐ Activated Carbon
  - ☐ Primary Treatment ☐ Polishing

☐ In Situ Air Sparging

- No. of Sparge Points ______
  - ☐ Vertical ☐ Horizontal
- Pressure ______ (psi)
- Design Air Flow Rate/Well ______ (cfm)
- Total Air Flow Rate ______ (cfm)

☐ Biosparging

- No. of Sparge Points ______
  - ☐ Vertical ☐ Horizontal
- Design Air Flow Rate/Well ______ (cfm)

☐ Bioremediation

- ☐ In Situ ☐ Ex Situ

☐ Other ______

Method of Groundwater Disposal:

☐ Infiltration Gallery ☐ Sanitary Sewer

☐ Surface Discharge/NPDES ☐ Injection Well

☐ Other ______

Free Product Present: ☒ Yes ☐ No

- Estimated Volume 525,000 (gal)
- Maximum Thickness 1.64 (in)
- Method of Recovery (check all that apply):
  - ☐ Manual Bailing ☐ Skimming Pump
  - ☒ Other Bioslurping

Method of Soil Remediation:

☐ Excavation

Volume to be Excavated ______ (yds^3)

- ☐ Thermal Treatment ☐ Land Farming On Site
- ☐ Landfill ☐ Bioremediation
- ☐ Other ______

☐ Vapor Extraction System (VES)

- No. of Venting Wells ______
  - ☐ Vertical ☐ Horizontal
- VES - Applied Vacuum ______ (wg)
- Design Air Flow Rate ______ (cfm)
- Design Radius of Influence ______ (ft)
- Air Emissions Treatment
  - ☐ Thermal Oxidizer ☐ Catalytic Converter
  - ☐ Carbon ☐ Other ______

☐ Soil Bioventing

- No. of Venting Wells ______
  - ☐ Vertical ☐ Horizontal
- Design Air Flow Rate ______ (cfm)

☐ In Situ Bioremediation

☒ Other Bioslurping

Natural Attenuation:

- Method of Evaluation
  - ☐ Rule 62-770.690(1)(e), F.A.C.
  - ☐ Rule 62-770.690(1)(f), F.A.C.

Estimated Time of Cleanup: 5475 (days)

- Method of Estimation
  - ☐ Pore Volumes (no. of pore vols. = ______)
  - ☐ Exponential Decay (Decay Rate) ____ (day^{-1})
  - ☐ Groundwater Model
  - ☒ Other Comparison to Similiar Site

Estimated Cost:

- Est. Capital Cost (incl. install.) $ 351,000
- Est. O & M Cost (per year) $ 57,000
- Est. Total Cleanup Cost $ 965,000