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FINAL FEASIBILITY STUDY ADDENDUM SITE 32 NAS WHITING FIELD FL
9/30/2004
TETRA TECH NUS

# Feasibility Study Addendum
for
# Site 32, North Field Maintenance Hangar
# Surface and Subsurface Soil

# Naval Air Station Whiting Field
## Milton, Florida
USEPA ID No. FL2170023244


## Southern Division
## Naval Facilities Engineering Command
**Contract Number N62467-94-D-0888**
**Contract Task Order 0028**

September 2004

# FEASIBILITY STUDY ADDENDUM
# FOR
# SITE 32, NORTH FIELD MAINTENANCE HANGAR
# SURFACE AND SUBSURFACE SOIL

**NAVAL AIR STATION WHITING FIELD**
**MILTON, FLORIDA**

**USEPA ID No. FL2170023244**

**COMPREHENSIVE LONG-TERM**
**ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT**

**Submitted to:**

**Southern Division**
**Naval Facilities Engineering Command**
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**CONTRACT NO. N62467-94-D-0888**
**CONTRACT TASK ORDER 0028**

**SEPTEMBER 2004**

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## PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify this document, *Feasibility Study Addendum for Site 32 Surface and Subsurface Soil, Naval Air Station, Whiting Field, Milton, Florida*, was prepared under my direct supervision in accordance with acceptable standards of engineering practice.

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# ACRONYMS

| | |
|---|---|
| ARAR | applicable or relevant and appropriate requirement |
| BaPEq | benzo(a)pyrene equivalent |
| bls | below land surface |
| CCI | CH2M Hill Constructors, Inc. |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CG | cleanup goal |
| COC | constituent of concern |
| COPC | constituent of potential concern |
| ELCR | Excess lifetime cancer risk |
| F.A.C. | Florida Administrative Code |
| FDEP | Florida Department of Environmental Protection |
| FS | Feasibility Study |
| FSA | Feasibility Study Addendum |
| GIR | General Information Report |
| HHRA | Human Health Risk Assessment |
| HI | Hazard Index |
| LUC | Land Use Control |
| LUCAP | Land Use Control Assurance Plan |
| LUCIP | Land Use Control Implementation Plan |
| mg/kg | milligrams per kilogram |
| NAS | Naval Air Station |
| PAH | polynuclear aromatic hydrocarbon |
| PRG(s) | preliminary remediation goal(s) |
| RAO | Remedial Action Objective |
| RBC | risk-based concentration |
| RfD | reference dose |
| RI | Remedial Investigation |
| RME | reasonable maximum exposure |
| SCTL | soil cleanup target level |
| SSL | soil screening level |
| TBC | to be considered |
| TCE | trichloroethene |
| TEF | Toxicity Equivalency Factor |

| | |
|---|---|
| TRPH | total recoverable petroleum hydrocarbons |
| TtNUS | Tetra Tech NUS, Inc. |
| UCL | upper confidence limit |
| USEPA | United States Environmental Protection Agency |
| UST | underground storage tank |

# 1.0 INTRODUCTION

Tetra Tech NUS, Inc. (TtNUS), under contract N62467-94-D-0888 to the Department of the Navy, Southern Division, Naval Facilities Engineering Command is submitting this Feasibility Study (FS) Addendum (FSA) to address changes at Site 32, North Field Maintenance Hangar, Building 1424, since submittal of the original FS in March 2001 (TtNUS, 2001a). The original FS included six Naval Air Station (NAS) Whiting Field sites: Sites 3, 4, 6, 30, 32 and 33. Surface and subsurface soil at Site 32 was addressed in Section 6 of the FS.

The changes at Site 32 addressed in this FSA include the following activities undertaken and determinations made after the submittal of the FS:

- Underground Storage Tank (UST) Removal - In September 2000, the four USTs at Site 32 were removed along with a small amount of petroleum-contaminated soil [CH2M HILL Constructors Inc. (CCI), 2001]. Confirmation soil sampling identified the following contaminants at concentrations exceeding regulatory screening levels: naphthalene, tetrachloroethene, trichloroethene (TCE), total xylenes, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1-methylnaphthalene, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and total recoverable petroleum hydrocarbons (TRPH).

- Arsenic was determined to be naturally occurring at Site 32 – Based on additional review of inorganic data from the facility and surrounding area in April 2001, the observed arsenic values were determined to represent naturally occurring levels [Florida Department of Environmental Protection (FDEP), 2001]. In the FS (TtNUS, 2001a), Section 6.1.2 identified arsenic as the carcinogenic risk driver under the hypothetical future condition assuming concrete removal at Site 32. Because the identified human health risks associated with arsenic are now considered to be due to naturally occurring levels, arsenic will not be retained as a constituent of concern (COC) and remediation of arsenic in surface and subsurface soil is not required at Site 32.

- Change in screening criteria - Over the course of the investigations at this site, United States Environmental Protection Agency (USEPA) Region IV changed its screening criteria for evaluation of hazardous waste-related sites from USEPA Region III Risk-Based Concentrations (RBCs) to USEPA Region IX Preliminary Remedial Goals (PRGs) (USEPA, 2002a). Therefore, analytical results are now compared to the USEPA Region IX PRGs and FDEP soil cleanup target levels (SCTLs) (FDEP, 1999).

- The individual metal constituents aluminum, iron, manganese and vanadium have no direct evidence of site-related use at Site 32 and the process and procedures at this site did not likely contribute to the presence of these inorganic analytes in surface or subsurface soil. Additionally, the site-specific values for these inorganics are within the range of levels found at NAS Whiting Field and of naturally occurring levels throughout the southeastern United States. The Remedial Investigation (RI) for NAS Whiting Field Site 40, Basewide Groundwater, contains the appendix "Inorganics in Soil at NAS Whiting Field", presenting the technical basis for this determination. Considering the information presented above, aluminum, iron, manganese, and vanadium are not considered constituents of potential concern (COPCs) for Site 32 surface and subsurface soils.

## 1.1 PURPOSE

The purpose of this FSA is to evaluate the impact of the changes discussed above on the remedial alternatives for surface and subsurface soil at Site 32, as developed for the FS (TtNUS, 2001a). The specific items to be evaluated include:

- Removal of the four abandoned USTs including the excavation and removal of petroleum-contaminated soil in late summer 2000
- New analytical data collected during UST removal activities
- Soil screening criteria changed to USEPA Region IX PRGs
- Revised Human Health Risk Assessment (HHRA) and COC selection

## 1.2 REPORT ORGANIZATION

This FSA is organized into four chapters. Chapter 1.0 presents the purpose of the FSA. Chapter 2.0 discusses environmental conditions at the site including a summary of UST removal activities and the revised HHRA, and Chapter 3.0 presents remedial action objectives. Revised remedial action alternatives are discussed in Chapter 4.0.

This addendum also includes the following Appendices.

Appendix A UST Removal Data

Appendix B Revised Human Health Risk Assessment

Appendix C Summary of Constituents Remaining in Surface and Subsurface Soil

Appendix D Original FS (TtNUS 2001a), Tables 6-8 and 6-9

Appendix E Remedial Alternatives Cost Estimate

# 2.0 ENVIRONMENTAL CONDITIONS

Site 32 is located at the North Field Maintenance Hangar, Building 1424. The site includes Building 1424, the adjacent wash rack area, and the location of the former abandoned waste oil tanks east of Building 1424 (Figure 2-1).

Environmental conditions at Site 32 are described in detail in the RI Report issued in 1999 (TtNUS, 1999) and the FS (TtNUS, 2001a). Only UST removal activities and the associated revised HHRA at Site 32 are discussed in the following sections.

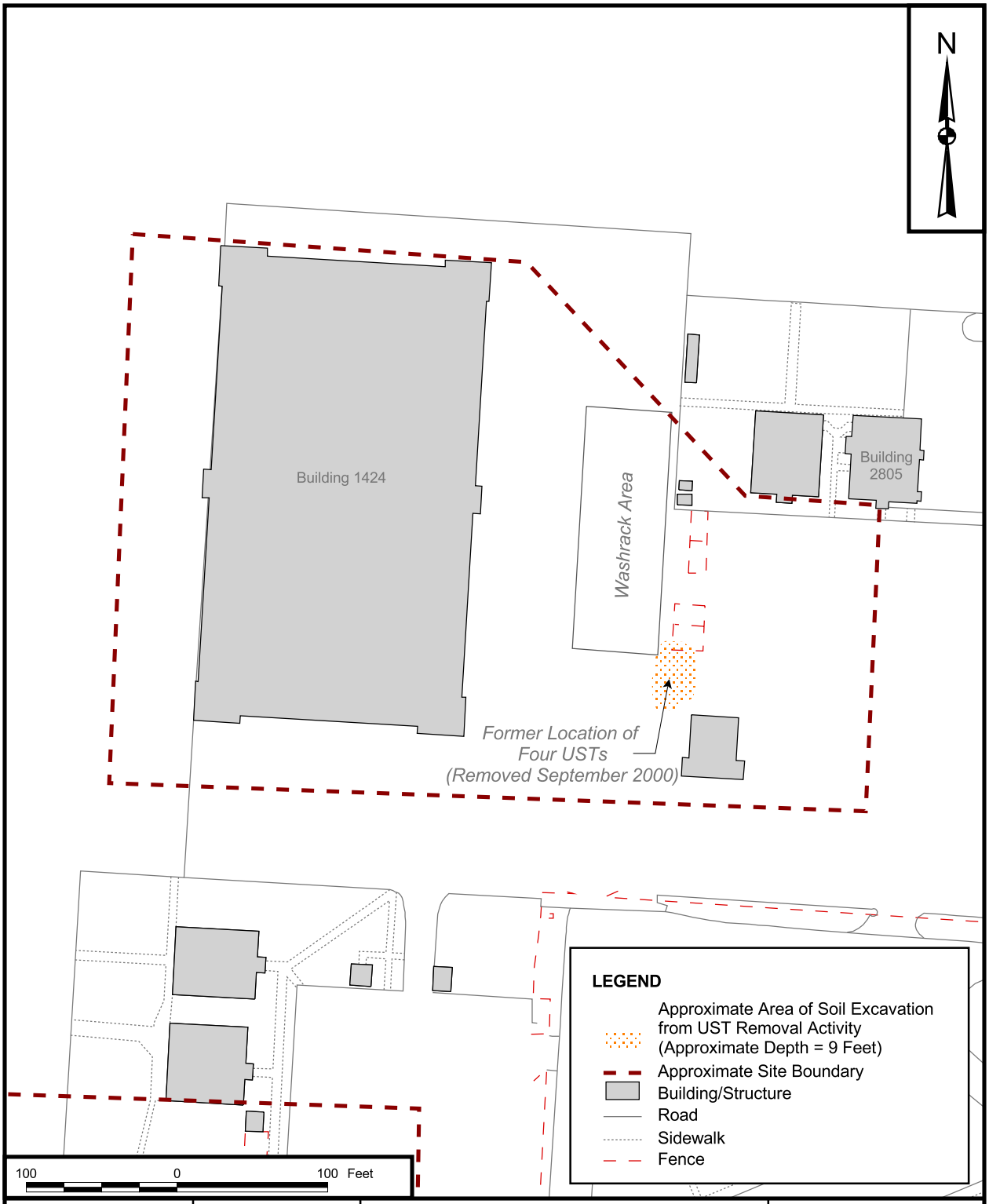
## 2.1 UST REMOVAL ACTIVITIES

In September 2000, the USTs at Site 32 were removed by CCI. Removal activities are described in detail in the Project Completion Report, UST Removal at Sites 30, 32, and 33 (CCI, 2001). The project scope included excavation and removal of four previously abandoned USTs, transportation and disposal of petroleum-contaminated soil, collection and analysis of confirmatory soil samples, placement and compaction of clean backfill soil in excavation areas, and site restoration.

The four USTs ranged in capacity from 846 to 1,868 gallons and were in operation from 1943 through 1986. The tanks reportedly contained new/used oil and kerosene. Upon inspection, the tanks were determined to be either partially or totally full of liquids with minor amounts of sand. Waste disposal profile samples were collected from the individual tanks, and all solid and liquid wastes were disposed of off-site in accordance with state and local regulations.

The intent of the limited excavation was to remove contaminated soil surrounding the USTs, thereby eliminating the potential contamination source and to obtain clean closure, if possible. Depth to groundwater is approximately 80 to 90 feet below land surface (bls) and was not encountered during the soil excavation.

Site 32 excavation activities began on 24 September 2000. The concrete cradles found under the USTs were removed during the excavation and loaded into roll-off boxes for disposal with the soil. The excavation measured approximately 30 by 50 feet and was approximately 9 feet deep. Approximately 299 cubic yards of TRPH-contaminated soil were removed. Of the 299 cubic yards, approximately 283 cubic yards were shipped as non-hazardous waste, and 16 cubic yards were shipped as hazardous waste due to the presences of tetrachloroethene and lead. The areal extent of the excavation and confirmation sample data are included in Appendix A.

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Post-excavation confirmation sampling included collection of five soil samples plus a duplicate. Samples from the sidewalls of the excavation were collected from 8 feet bls. The bottom sample and its duplicate were collected from 10 feet bls. Analytical results are summarized in Appendix A.

After the confirmation samples were collected, the excavation was filled with clean backfill to within 6 inches of the surrounding surface, compacted, and a new concrete pad was constructed.

The TRPH concentrations in five samples exceeded the FDEP SCTL (residential) for direct exposure [340 milligrams per kilogram (mg/kg)]. The south, east, and north wall sample TRPH concentrations were 960 mg/kg, 350 mg/kg, and 1,200 mg/kg, respectively. The two samples from the bottom of the excavation had TRPH concentrations of 1,700 mg/kg and 2,400 mg/kg. Post-excavation sampling indicated complete delineation of the TRPH contamination was not achieved.

Several polynuclear aromatic hydrocarbons (PAHs) were also identified in the post-excavation confirmation samples. Benzo(a)pyrene was detected in the bottom sample and in its duplicate at 0.58 mg/kg and 0.55 mg/kg, respectively. These concentrations exceed the FDEP SCTL (industrial) of 0.5 mg/kg, as well as the USEPA Region IX PRG (industrial) of 0.211 mg/kg. Benzo(a)anthracene was detected in the east and south wall samples at 1.0 mg/kg and 0.82 mg/kg, respectively, as well as in the bottom sample and duplicate at 1.3 mg/kg and 1.1 mg/kg, respectively. These concentrations exceed the USEPA Region IX PRG (residential) of 0.62 mg/kg, but do not exceed the FDEP SCTL (residential) of 1.40 mg/kg. Benzo(b)fluoranthene was detected in the east wall sample at 1.1 mg/kg, as well as in the bottom sample and in its duplicate at 1.1 mg/kg and 1.0 mg/kg, respectively. These concentrations exceed the USEPA Region IX PRG (residential) of 0.62 mg/kg but do not exceed the FDEP SCTL (residential) of 1.4 mg/kg.

Since several PAHs exceeding regulatory standards were identified during UST removal activities, the human health risk was evaluated. A summary of the results of the revised HHRA are described in the following section.

## 2.2 SUMMARY OF REVISED HHRA

The revised HHRA conservatively estimates the potential risk to human health considering historic analytical data, recent UST removal analytical data, and arsenic being present at naturally occurring concentrations at Site 32. The UST removal subsurface analytical data was combined with previous subsurface soil data collected from 2 to 15 feet bls to evaluate human health risk due to subsurface soil. Since additional surface soil analytical data was not collected during UST removal activities, human health risks due to surface soil were not recalculated. The human health risk due to arsenic, calculated in

the RI, is deleted since arsenic is present at naturally occurring concentrations. Details of the revised HHRA are presented in Appendix B. A summary of the revised HHRA is provided below.

The following COPCs were identified for subsurface soil at Site 32: m-xylenes, naphthalene, tetrachloroethene, TCE, total xylenes, 1,2.4-trimethylbenzene, 1,3,5-trimethylbenzene, 1-methylnaphthalene, 2-methylnaphthalene, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene,m dibenzo(a,h)anthracene, benzo(k)fluoranthene, chrysene, ideno(1,2,3-cd)pyrene, and TRPH.

Revised cancer risk estimates and hazard indices (HIs) calculated for the subsurface soil COPCs are presented in Appendix B, Table 1-3. The excess lifetime cancer risk (ELCR) calculated for the hypothetical future resident and the typical construction worker are 4.75E-05 and 9.4E-07, respectively. The risk estimate for the construction worker does not exceed the FDEP benchmark of 1.0E-06 [Chapter 62-780 Florida Administrative Code (F.A.C.)]. The risk estimate for the hypothetical resident does exceed the FDEP benchmark of 1.0E-06, although it is within the USEPA target risk range often used to evaluate the need for remediation. Benzo(a)pyrene equivalent (BaPEq) is the main risk driver; however, benzo(a)pyrene and other cPAHs were detected in only 4 of 28 total samples.

The total HI exceeds unity for the hypothetical future resident (HI = 3.10), but does not exceed unity for the construction worker (HI = 0.01). HIs calculated on a target organ specific basis for the resident and for the construction worker do not exceed 1.0.

# 3.0 REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) for Site 32 are:

- To prevent residential development on the site.
- To protect the industrial worker from carcinogenic and non-carcinogenic risks associated with incidental ingestion of, inhalation of, and dermal contact with contaminated soils.
- To comply with federal and state applicable or relevant and appropriate requirements (ARARs) and to be considered (TBC) guidance in accordance with accepted USEPA and FDEP guidelines.

The RAOs for this site are based on the following criteria:

- Unacceptable human health risk exists for direct exposure to surface or subsurface soil based on the current and anticipated future commercial/industrial use of the site.
- FDEP SCTLs (commercial/industrial landuse).
- USEPA Region IX PRG (commercial/industrial land use).

The current and future use of the property at this site remains industrial, and the current and future receptors are occupational and construction workers.

## 3.1 REVISED CLEANUP GOALS

Cleanup Goals (CGs) establish acceptable exposure levels protective of human health and the environment. CGs are based on regulatory requirements, USEPA-acceptable risk levels, and assumptions regarding ultimate land uses, as well as contaminant pathways. Specifically, CGs are used to determine COCs, to estimate areas and volumes of impacted media and set performance standards for potential remedial alternatives.

CGs are determined based on ARARs and “to be considered” criteria, constituents and media of interest, and exposure pathways. The CGs for this site are now formulated based on the following criteria: FDEP SCTLs for direct commercial/industrial exposure (Chapter 62-777, F.A.C.), and USEPA Region IX PRGs. The current and future use of the site is for industrial purposes; therefore, the exposure pathways are occupational and construction workers.

Cleanup of inorganic analytes below their established background concentrations will not be performed; therefore, background concentrations will be used as the lower limit for CGs. The CG selection process is summarized below.

1. The lower value of the FDEP SCTLs (Chapter 62-777, F.A.C.) and the USEPA Region IX PRGs for commercial/industrial direct exposure will be used as CGs.

2. Background concentration will be used as the lower limit for the CG of inorganic COCs.

Table 3-1 provides a list of the revised surface and subsurface soil CGs for Site 32.

## 3.2 REVISED CONSTITUENTS OF CONCERN

A re-evaluation of the constituents remaining in surface and subsurface soil was conducted for this FSA. Appendix C contains a summary of the location and depths of constituents remaining in surface soil (Table C-1) and subsurface soil (Table C-2) at the site. Soil from 0 to approximately 9 feet bls at boring location 32SB05 was excavated during the UST removal project. Table C-2 includes the subsurface soil analytical data collected during the RI and the UST removal project.

The original FS identified one COC: TRPH in both surface and subsurface soil. TRPH remains the only surface soil COC. The revised subsurface soil COCs for Site 32, presented in Table 3-2, have been determined by comparing the soil CG value against the COPC's site-specific representative concentration (or maximum value if less than 10 samples). Any COPC with a site-specific representative concentration exceeding the CG becomes a COC. In summary, as shown in Table 3-2, TRPH remains a COC for subsurface soil. Additional subsurface soil COCs identified in this revised evaluation include TCE, 1,2,4,-trimethylbenzene, 1,3,5,-trimethylbenzene, and BaPEq. Areas impacted by COCs in surface and subsurface soil are shown on Figure 3-1.

## 3.3 REVISED AREAS AND VOLUMES OF SOIL REQUIRING REMEDIAL ACTION

The areas and volumes of soil with COCs exceeding CGs are estimated by comparing the direct contact soil CGs for all COCs to the site-specific analytical data. This information, in addition to analytical data from nearby locations not exceeding CGs, is used to estimate the areas and volumes of soil requiring remedial action.

The revised estimated volume of impacted soil calculated for each location exceeding CGs is based on Table 6-4 of the original FS. The rationale for estimating the area and vertical extent of impacted soil at each location is presented in the following paragraphs.

The area excavated during the UST removal project is shown on Figure 2-1 and in Appendix A. The depth of excavation was approximately 9 feet. Samples from the bottom of the excavation (32-C-B-01 and 32-C-B-02) had BaPEq concentrations above the CG.

# TABLE 3-1
# DETERMINATION OF REVISED CLEANUP GOALS AT SITE 32

## NAS WHITING FIELD
## MILTON, FLORIDA

| Constituent of Potential Concern[1] | Units | 62-777, F.A.C. Commercial/ Industrial SCTL[2] | USEPA Region IX Industrial PRGs[3] | Lower Value | Risk Driver[4] | Surface Soil Background[5] | Surface Soil CG | Subsurface Soil Background[5] | Subsurface Soil CG |
|---|---|---|---|---|---|---|---|---|---|
| M-Xylene [(6)] | mg/kg | 4000 | 42 | 42 | N | NA | 42 | NA | 42 |
| Naphthalene | mg/kg | 27 | 18.8 | 18.8 | N | NA | 18.8 | NA | 18.8 |
| Tetrachloroethene | mg/kg | 17 | 3.4 | 3.4 | C | NA | 3.4 | NA | 3.4 |
| Trichloroethene | mg/kg | 8.5 | 0.11 | 0.11 | C | NA | 0.11 | NA | 0.11 |
| Xylenes, Total | mg/kg | 4000 | 42 | 42 | N | NA | 42 | NA | 42 |
| 1,2,4-Trimethylbenzene | mg/kg | 8.8 | 17.0 | 8.8 | N | NA | 8.8 | NA | 8.8 |
| 1,3,5-Trimethylbenzene | mg/kg | 7.4 | 6.97 | 6.97 | N | NA | 6.97 | NA | 6.97 |
| 1-Methylnaphthalene[(7)] | mg/kg | 47 | 18.8 | 18.8 | N | NA | 18.8 | NA | 18.8 |
| 2-Methylnaphthalene [(7)] | mg/kg | 56 | 18.8 | 18.8 | N | NA | 18.8 | NA | 18.8 |
| Benzo(a)anthracene | mg/kg | 5 | 2.1 | 2.1 | C | NA | 2.1 | NA | 2.1 |
| Benzo(a)pyrene | mg/kg | 0.5 | 0.21 | 0.21 | C | NA | 0.21 | NA | 0.21 |
| Benzo(b)fluoranthene | mg/kg | 4.8 | 2.1 | 2.1 | C | NA | 2.1 | NA | 2.1 |
| Benzo(k)fluoranthene | mg/kg | 52 | 21.1 | 21.1 | C | NA | 21.1 | NA | 21.1 |
| Chrysene | mg/kg | 450 | 211 | 211 | C | NA | 211 | NA | 211 |
| Indeno(1,2,3,cd)pyrene | mg/kg | 5.3 | 2.1 | 2.1 | C | NA | 2.1 | NA | 2.1 |
| TRPH | mg/kg | 2,500 | NA | 2,500 | N | NA | 2,500 | NA | 2,500 |

[1] Combined list of all COPCs for Site 32.

[2] Table 2, Soil Cleanup Target Levels, Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C. (May 1999). (note: 1/10$^{th}$ value used for non-carcinogens.) Values for vanadium are based on acute toxicity therefore, vanadium value is not multiplied by 1/10 m.

[3] USEPA Region IX Preliminary Remediation Goal Table, October 2002. (note: 1/10$^{th}$ value used for non-carcinogens).

[4] Risk Driver Codes: N = Non-carcinogen, C = Carcinogen.

[5] Table 3-18, General Information Report, Remedial Investigation and Feasibility Study, ABB-ES, 1998. Background screening value for inorganic analyte is two times the mean detected concentration.

[6] Value is for Xylenes.

[7] Value is for Naphthalene.

CG – Cleanup Goal

GIR – General Information Report

mg/kg – milligrams per kilogram

NA – Not Applicable

TRPH – Total Recoverable Petroleum Hydrocarbons

# TABLE 3-2
# REVISED CONSTITUENT OF CONCERN EVALUATION
# SUBSURFACE SOIL
# SITE 32

## NAS WHITING FIELD
## MILTON, FLORIDA

| Constituent of Potential Concern | Units | Maximum Detected Concentration | Maximum Qualifier | Representative Concentration[1] | | | CG | COC |
|---|---|---|---|---|---|---|---|---|
| | | | | Value | Statistic[2] | Rationale[3] | | |
| M-Xylene | mg/kg | 39 | -- | 39 | max | n<10 | 42 | no |
| Naphthalene | mg/kg | 24 | -- | 6.8 | bootstrap | (3) | 18.8 | no |
| Tetrachloroethene | mg/kg | 4.2 | -- | 1.02 | bootstrap | (3) | 3.4 | no |
| **Trichlororethene** | mg/kg | 3.6 | -- | 0.82 | bootstrap | (3) | 0.11 | **yes** |
| Xylenes, Total | mg/kg | 32 | -- | 5.31 | bootstrap | (3) | 42 | no |
| **1,2,4-Trimethylbenzene** | mg/kg | 63 | -- | 63 | max | n<10 | 8.8 | **yes** |
| **1,3,5-Trimethylbenzene** | mg/kg | 26 | -- | 26 | max | n<10 | 6.97 | **yes** |
| 1-Methylnaphthalene | mg/kg | 11 | -- | 11 | max | n<10 | 18.8 | no |
| 2-Methylnaphthalene | mg/kg | 40 | -- | 9.966 | bootstrap | (3) | 18.8 | no |
| **BaPEq** | mg/kg | 2.6 | -- | 1.88 | bootstrap | (3) | 0.21 | **yes** |
| **TRPH** | mg/kg | 2,650 | -- | * | * | * | 2,500 | **yes*** |

[1]For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.

[2]Statistics: 95% UCL of log-transformed data (95% UCL-T), 95% UCL of data (95% UCL-N). Maximum value used (max) since the sample size was <10 samples.

[3]Rationale
(1) Shapiro-Wilk W Test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test indicates data are normally distributed.
(3) Shapiro-Wilk W Test is inconclusive; therefore, a non-parametric method (boot-strap) was used.
(4) The 95% UCL exceeded the maximum; therefore, the maximum was used.

BaPEq = benzo(a)pyrene equivalent

CG = Cleanup goal

COC = Constituent of concern

mg/kg = milligrams per kilogram

UCL = upper confidence limit

*TRPH is being retained as a COC. The maximum detected concentration in subsurface soil of 2,650 mg/kg is the 30 – 32' interval at location 32 SB07.

Constituents exceeding the CG are bolded.

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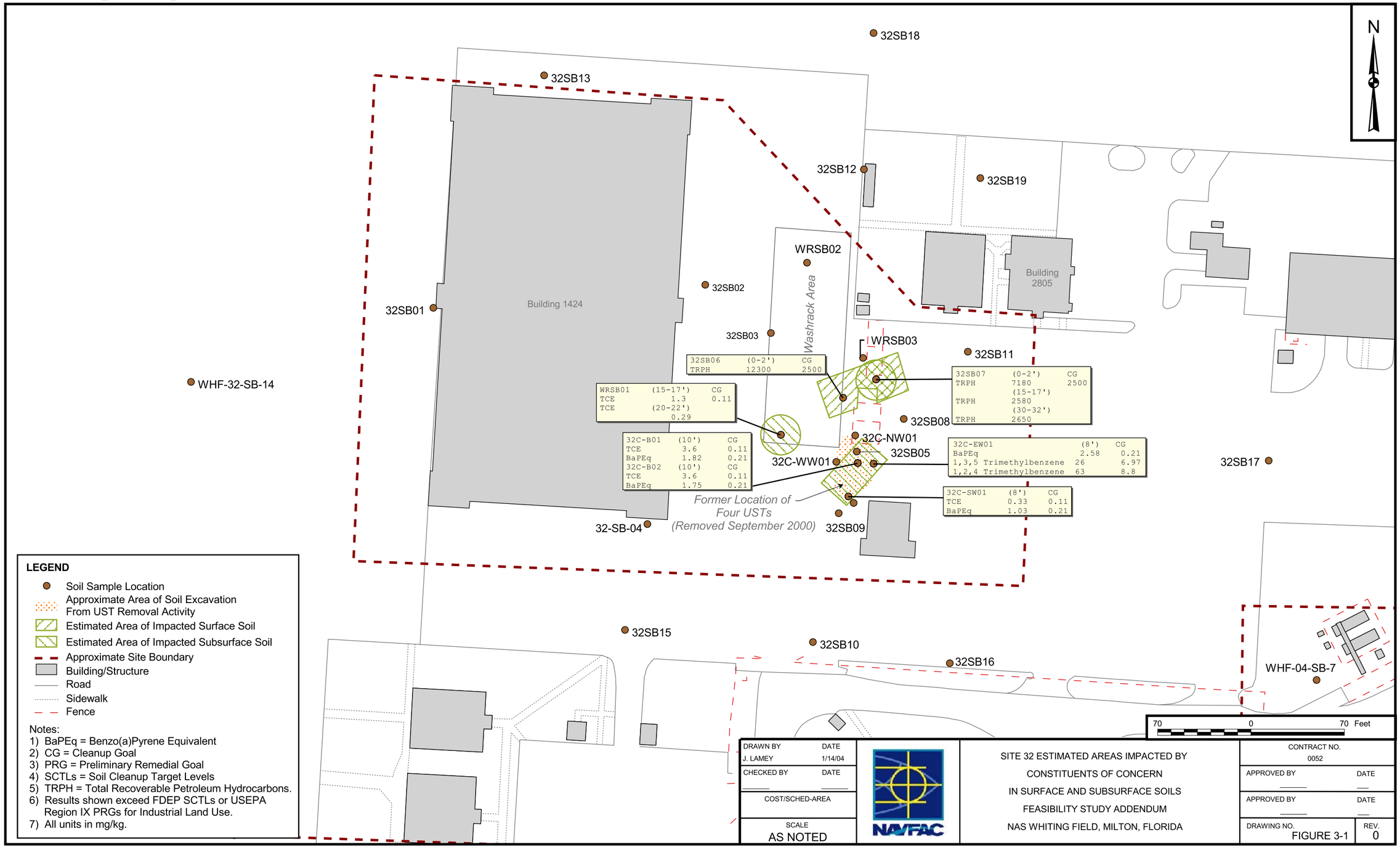


**LEGEND**

- Soil Sample Location
- Approximate Area of Soil Excavation From UST Removal Activity
- Estimated Area of Impacted Surface Soil
- Estimated Area of Impacted Subsurface Soil
- Approximate Site Boundary
- Building/Structure
- Road
- Sidewalk
- Fence

Notes:
1) BaPEq = Benzo(a)Pyrene Equivalent
2) CG = Cleanup Goal
3) PRG = Preliminary Remedial Goal
4) SCTLs = Soil Cleanup Target Levels
5) TRPH = Total Recoverable Petroleum Hydrocarbons.
6) Results shown exceed FDEP SCTLs or USEPA Region IX PRGs for Industrial Land Use.
7) All units in mg/kg.

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| CHECKED BY | DATE |
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SITE 32 ESTIMATED AREAS IMPACTED BY
CONSTITUENTS OF CONCERN
IN SURFACE AND SUBSURFACE SOILS
FEASIBILITY STUDY ADDENDUM
NAS WHITING FIELD, MILTON, FLORIDA

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| CONTRACT NO. 0052 | |
| APPROVED BY | DATE |
| APPROVED BY | DATE |
| DRAWING NO. FIGURE 3-1 | REV. 0 |

The estimated contaminated surface soil volume (156 cubic yards) and subsurface soil volume (1019 cubic yards) associated with sample locations 32SB06 and 32SB07 remains the same as presented in the FS.

Because the USEPA Region IX industrial PRGs were used to determine the CGs in this FSA, additional contaminated subsurface soil has been identified. The TCE concentrations at sample location WRSB01 are above the CG in the 15- to 17-foot and the 20- to 22-foot interval. No other exceedances of the CGs for TCE are found in the RI data for surface or subsurface soil. Although TCE was detected at location 32-C-B-01 at the 10-foot depth, TCE was not detected at location 32-C-WW-01. Thus, subsurface impact at WRSB01 is considered localized from a depth of 10 to 25 feet. Considering a 15-foot radius (area equals 707 $ft^2$), the estimated volume of impacted subsurface soil at WRSB01 is 393 cubic yards.

Impacted subsurface soil associated with the UST removal activities has been identified at the following confirmation sample locations:

- TCE at locations 32-C-SW-01 (8-foot depth) and 32-C-B-01(10-foot depth)
- Benzo(a)pyrene at locations 32-C-B-01 (10-foot depth), 32-C-EW-01 and 32-C-SW-01 (8-foot depth)
- 1,2,4,-trimethylbenzene and 1,3,5-trimethylbenzene at location 32-C-EW-01 (8-foot depth)

The area including these sample locations is estimated to be a 25- by 45- foot rectangle. The subsurface impact was estimated to extend an additional 22 feet below the 8 foot sample depth to a total depth of 30 feet bls. The estimated volume of impacted subsurface soil volume is 920 cubic yards. The estimated volume of uncontaminated soil to excavate above the impacted soil is 333 cubic yards.

**Summary**

The Site 32 estimated volume of contaminated surface soil remains the same as in the FS (156 cubic yards). The estimated volume of contaminated subsurface volume increases by 1,300 cubic yards for a total of 2,340 cubic yards. The total estimated volume of surface and subsurface contaminated soil is 2,496 cubic yards. All of the contaminated surface and subsurface soil is presently covered by concrete/asphalt.

# 4.0 AMENDED DESCRIPTION AND EVALUATION OF REMEDIAL ALTERNATIVES

## 4.1 AMENDED DESCRIPTION OF ALTERNATIVES

Identification and screening of appropriate remedial alternative technologies addressing the RAOs developed for Site 32 were presented in the FS. Each technology was then screened based on site- and waste-limiting characteristics. Four soil remedial alternatives were developed in the original FS representing a range of options. All of those options, except the No Action alternative, included UST removal. For reference, Appendix D contains a copy of the original description and evaluation of remedial alternatives for Site 32 presented in the FS (TtNUS, 2001a) This section of the FSA presents a revised description of the four original remedial alternatives eliminating the UST removal component. Table 4-1 shows a comparision between the soil remedial alternatives identified in the original FS and this FSA.

## 4.2 AMENDED EVALUATION OF ALTERNATIVES

This section compares the impact of the changes in subsurface soil COCs (addition of TCE, 1,2,4-trimethylbenzene, 1,3,5,-trimethylbenzene, and BaPEq) on the evaluation of the four remedial alternatives in accordance with the seven Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) criteria, as originally provided in the FS. A summary of this comparison is provided in Table 4-2.

### 4.2.1 Overall Protection of Human Health and the Environment

There is no change in the relative overall protection of human health and the environment of Alternatives 1 through 4. Alternative 1 remains least protective and Alternative 4 still provides the highest level of overall protection.

### 4.2.2 Compliance with ARARs

The changes in COCs only impact the compliance of Alternatives 2 and 3 with constituent-specific ARARs. Compliance with the ARARs for the BaPEq will require significant time.

There is no change in the compliance of Alternatives 1 and 4 with constituent-specific ARARs. There is no change in the compliance of Alternatives 1, 2, 3, and 4 and with location- and action-specific-ARARs.

### 4.2.3 Long-Term Effectiveness and Permanence

The changes in COCs only impact the long-term effectiveness and permanence of Alternatives 2 and 3. Residual risks associated with these two alternatives slightly increase because of the addition of BaPEq as a COC.

**TABLE 4-1**
**COMPARISON OF ORIGINAL FS AND FSA DESCRIPTION OF SOIL REMEDIAL ALTERNATIVES**
**Site 32, NAS WHITING FIELD**

**MILTON, FLORIDA**

| Alternative Number | | Alternative Type | | Representative Process Options Combined into Alternatives | | Alternative Description | |
|---|---|---|---|---|---|---|---|
| FS (March 2001) | **FSA (September 2004)** | FS (March 2001) | **FSA (September 2004)** | FS (March 2001) | **FSA (September 2004)** | FS (March 2001) | **FSA (September 2004)** |
| Alternative S32-1<br>No Action | Alternative 1<br>No Action | No Action | None | None | None | • Five-year Reviews. | • No Action |
| Alternative S32-2<br>UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs | Alternative 2<br>ECs and LUCs | Source Removal / Containment /Limited Action – No or Minimal Treatment | Limited Action – No or Minimal Treatment | LUCs, Remove USTs, Excavation, Disposal, Soil Cover | ECs and LUCs | • LUCs including LUCAP and LUCIP<br>• Delineation/confirmatory sampling of surface soil adjacent to 32SB06, 32SB07.<br>• Excavate and remove USTs.*<br>• Excavation/disposal of surface soil exceeding PRGs at 32SB06, 32SB07.<br>• Backfill excavations with clean fill.<br>• Replace concrete cover.<br>• Posting of warning signs.<br>• Five-year site reviews. | • ECs and LUCs *(LUC RD will establish LUCIP).*<br>• *(No surface soil excavation planned, therefore no delineation sampling)*<br>• *(USTs removed during the UST removal project, September 2000)*<br>• *(No surface soil excavation planned*)<br>• *(Completed during UST removal project)*<br>• *(This component, now considered part of the ECs, was completed during the UST removal project)*<br>• Posting of warning signs<br>• *(Five-year review will be part of LUC RD).* |
| Alternative S32-3<br>UST Removal, Soil Venting, and LUCs | Alternative 3<br>Soil Venting and LUCs | Source Removal / Containment / Limited Action – Treatment | Limited Treatment Action – Minimal Treatment | LUCs, Remove USTs, In-Situ Soil Venting | LUCs and Soil Venting | • LUCs including LUCAP and LUCIP<br>• Delineation/confirmatory sampling of surface soil adjacent to 32SB06, 32SB07.<br>• Excavate and remove USTs.*<br>• Replace concrete cover.<br>• Install and operate an in situ soil venting system for subsurface soil at locations 32SB06 and 32SB07.<br>• Posting of warning signs.<br>• Five-year site reviews. | • LUCs *(LUC RD will establish LUCIP)*<br>• Delineation/confirmatory sampling of surface soil adjacent to 32SB06, 32SB07, WRSB01, 32-C-SW-01, 32-C-EW-01, 32-C-B-01.<br>• *(USTs removed September 2000)*<br>• *(This component, now considered part of the ECs, was completed during the UST removal project.)*<br>• Install, operate, and monitor a soil venting system for subsurface soil at locations 32SB06, 32SB07, WRSB01, 32-C-SW-01, 32-C-EW-01, 32-C-B-01.<br>• Posting of warning signs.<br>• *(Five-year review will be part of LUC RD).* |
| Alternative S32-4<br>UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs | Alternative 4<br>Surface and Subsurface Soil (exceeding CGs) Removal and LUCs | Treatment / Bulk Removal – Minimizes Long-Term Management | Treatment/Bulk Removal – Minimizes Long-Term Management | LUCs, Remove USTs, Bulk Excavation, Disposal | LUCs, Bulk Excavation, Disposal | • LUCs including LUCAP and LUCIP<br>• Delineation/confirmatory sampling of surface soil adjacent to 32SB06 and 32SB07<br>• Excavate, remove, and dispose of USTs.*<br>• Demolition and removal/disposal of asphalt and concrete pavement.<br>• Excavation/disposal of surface and subsurface soil exceeding PRGs at 32SB06 and 32SB07.<br>• Backfill excavations with clean fill.<br>• Replacement of asphalt or concrete pavement.<br>• Establish vegetative cover.<br>• Posting of warning signs.<br>• Five-year site reviews. | • LUCs *(LUC RD will establish LUCIP).*<br>• Delineation/confirmatory sampling of surface and subsurface soil adjacent to 32SB06, 32SB07, WRSB01, 32-C-SW-01, 32-C-EW-01, 32-C-B-01.<br>• *(USTs removed September 2000)*<br>• Demolition and removal/disposal of asphalt and concrete pavement and uncontaminated surface soil.<br>• Excavation/disposal of surface and subsurface soil exceeding CGs at 32SB06, 32SB07. Excavation/disposal of subsurface soil exceeding CGs at locations WRSB01, 32-C-SW-01, 32-C-EW-01, 32-C-B-01.<br>• Backfill excavations with clean fill.<br>• Replace asphalt or concrete pavement.<br>• Establish vegetative cover.<br>• Posting of warning signs.<br>• *(Five-year review will be part of LUC RD).* |

CG = Cleanup Goal
ECs = Engineering Controls to prohibit digging into or disturbing existing concrete or asphalt cover areas.
LUCs = Land Use Controls
LUCAP = LUC Assurance Plan
LUCIP = LUC Implementation Plan
PRGs = Preliminary Remediation Goals (site specific goal as defined in the FS; similar to the CG in the FSA).
RD = Remedial Design
TRPH = Total Recoverable Petroleum Hydrocarbons (FS refers to TPH; FSA refers to TRPH)
Reference Table 5-8, FS (TtNUS, 2001)
*The Project Completion Report, UST Removal at Sites 30, 32, and 33 (CCI, 2001) documenting the September 2000 removal of the USTs at Site 32 was finalized in August 2001. The FS (TtNUS, 2001a) was finalized in March 2001 and did not incorporate the UST removal activities.

## TABLE 4-2

## SUMMARY OF COMPARATIVE IMPACT OF CHANGES IN COCs ON EVALUATION OF REMEDIAL ALTERNATIVES
## SITE 32 FS ADDENDUM
## NAS WHITING FIELD
## MILTON, FLORIDA



| Criteria | Alternative 1<br>No Action | ALTERNATIVE 2<br>ECs and LUCs | Alternative 3<br>Soil Venting and LUCs | Alternative 4<br>Surface and Subsurface Soil (exceeding CGs) Removal, and LUCs |
|---|---|---|---|---|
| **THRESHOLD CRITERIA** | | | | |
| **Overall Protection of Human Health and the Environment** | | | | |
| Human Health Protection | No change | No change | No change | No change |
| Environmental Protection | No change | No change | No change | No change |
| **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)** | | | | |
| Compliance with Chemical-Specific ARARs | No change | Compliance with ARARs for BaPEq will take significant time | Compliance with ARARs for BaPEq will take significant time | No change |
| Compliance with Action-Specific ARARs | No change | No change | No change | No change |
| Compliance with Location-Specific ARARs | No change | No change | No change | No change |
| Compliance with Other Criteria | No change | No change | No change | No change |
| **BALANCING CRITERIA** | | | | |
| **Long-Term Effectiveness and Permanence** | | | | |
| Reduction in Residual Risk | No change | Increased residual risk because of added BaPEq | Increased residual risk because of added BaPEq | No change |
| Long-Term Reliability of Controls | No change | No change | No change | No change |
| Need for 5-Year Review | No change | No change | No change | No change |
| Prevention of Exposure to Residuals | No change | No change | No change | No change |
| Potential Need for Replacement of Technical Components after Remedial Objectives Are Achieved | No change | No change | No change | No change |
| Long-Term Management | No change | No change | No change | No change |
| **Reduction of Mobility, Toxicity, or Volume through Treatment** | | | | |
| Amount Destroyed or Treated | No change | More COCs destroyed through natural attenuation because of added COCs and impacted volume | More COCs destroyed by treatment and natural attenuation because of added COCs and impacted volume | Greater amount of soil volume removed |
| Reduction in Mobility, Toxicity, or Volume | No change | No change of reduction in mobility and toxicity. Increased reduction of volume | No change of reduction in mobility and toxicity. Increased reduction of volume | No change in removal efficiency. Increased reduction of volume |
| Irreversibility of Treatment | No change | No change | No change | No change |
| Type and Quantity of Residuals Remaining after Treatment | No change | No change | No change | No change |

## TABLE 4-2

## SUMMARY OF COMPARATIVE IMPACT OF CHANGES IN COCs ON EVALUATION OF REMEDIAL ALTERNATIVES
## SITE 32 FS ADDENDUM
## NAS WHITING FIELD
## MILTON, FLORIDA



| Criteria | Alternative 1<br>No Action | Alternative 2<br>ECs and LUCs | Alternative 3<br>Soil Venting and LUCs | Alternative 4<br>Surface and Subsurface Soil (exceeding CGs) Removal and LUCs |
|---|---|---|---|---|
| **Short-Term Effectiveness** | | | | |
| Community Protection During Implementation | No change | No change | No change | No change |
| Worker Protection During Implementation | No change | No change | No change | No change |
| Environmental Impacts | No change | No change | No change | No change |
| Construction Time | No change | No change | No change | No change |
| Time Until RAOs and CGs are Achieved | No change | No change for time to meet RAOs. More time required to meet CGs because of added BaPEq | No change for time to meet RAOs. More time required to meet CGs because of added BaPEq | No change |
| **Implementability** | | | | |
| Ability to Construct and Operate the Technology | No change | No change | No change | No change |
| Reliability of Technology | No change | No change | No change | No change |
| Ease of Undertaking Additional Remedial Action, if Required | No change | No change | No change | No change |
| Ability to Monitor Effectiveness | No change | No change | No change | No change |
| Permitting Requirements | No change | No change | No change | No change |
| Coordination with Other Agencies | No change | No change | No change | No change |
| Availability of Services and Capabilities | No change | No change | No change | No change |
| Availability of Equipment, Specialists, and Materials | No change | No change | No change | No change |
| **Cost**[a] | | | | |
| Capital Costs | No change | $46,431 (decrease) | $6,670 (decrease) | $191,606 (increase) |
| Short-Term O&M | No change | No change | $10,201 (increase) | No change |
| Long-Term O&M | | | | |
| 5-Year Review | b | No change | No change | No change |
| Land-Use Controls | No change | $ 253 (increase) | No change | No change |
| Total Project Present Worth Cost | No change<br>$0 (Total) | $ 42,949 (decrease)<br>$82,186 (Total) | $20,598(increase)<br>$237,653 (Total) | $191,606 (increase)<br>$616,164 (Total) |

NOTES:

| | |
|---|---|
| ARAR | Applicable or relevant and appropriate requirement |
| BaPEq | Benzo(a)pyrene equivalent |
| COC | Constituent of concern |
| ECs | Engineering Controls to prohibit digging into or disturbing existing concrete or asphalt covered areas on the site. |
| LUC | Land use control |
| RAO | Remedial action objective |
| CG | Cleanup goal |
| a | Values shown represent the amount of decrease or increase in cost from original FS estimate. Present worth cost details are provided in Appendix E. |
| b | The original FS included costs for 5 year review; however the 5-year reviews are not included for the No Action Alternative in this re-evaluation. |

### 4.2.4 Reduction of Mobility, Toxicity, or Volume through Treatment

The changes in COCs do not impact the reduction of mobility, toxicity, or volume provided by Alternative 1, remaining non-existent. The changes in COCs do not impact the reduction of mobility or toxicity provided by Alternatives 2, 3, and 4, however, an increase in the reduction of volume would be provided by Alternatives 2, 3, and 4 due to additional subsurface soil COCs and the increased volume of impacted soil.

### 4.2.5 Short-Term Effectiveness

The changes in COCs have no impact on the short-term effectiveness of alternatives 1 and 4. Alternatives 2 and 3 will require more time to meet cleanup goals because of the addition of BaPEq as a COC.

### 4.2.6 Implementability

The changes in COCs have no impact on the implementability of any of the four alternatives.

### 4.2.7 Cost

The changes in COCs have an impact on the costs for Alternatives 2, 3, and 4. The UST removal activities (CCI, 2001) have eliminated the UST removal component from the original FS cost estimate for these alternatives. The increase in capital costs for Alternative 4 is due to the increase in impacted soil areas and volumes. Table 4-2 shows the amount of decreased cost for Alternative 2 and increased costs for Alternatives 3 and 4. The NPW costs for Alternatives 2, 3, and 4 are detailed in Appendix E. The net effect of these changes produces an overall decrease in cost for Alternative 2 and increase in cost for Alternatives 3 and 4.

## 4.3 SUMMARY

As discussed in Sections 4.1 and 4.2 and as further illustrated on Table 4-2, recent developments at Site 32 have had very little impact on the findings of the original FS. In particular, the addition of TCE, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and BaPEq as subsurface soil COCs, the most significant development, has resulted in no significant changes to the CERCLA evaluation of remedial alternatives. Therefore the remedial alternatives and their comparative evaluation as presented in this FSA are not significantly different from those presented in the original FS.

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# APPENDIX A

# UST REMOVAL DATA

Legend

▲ Soil Sample Location

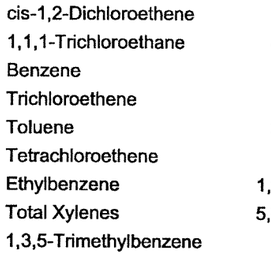
Notes:

1. All units are mg/kg.
2. TRPH = Total Recoverable Petroleum Hydrocarbons
3. The applicable residential/industrial soil criteria for Site 32 are:

| | 62-777 FAC Direct Exposure Residential | 62-777 FAC Direct Exposure Industrial | 62-777 FAC Leachability |
|---|---|---|---|
| 1,1-Dichloroethane | 290 | 2,000 | 0.4 |
| cis-1,2-Dichloroethene | 19 | 130 | 0.4 |
| 1,1,1-Trichloroethane | 400 | 3,300 | 1.9 |
| Benzene | 1.1 | 1.6 | 0.007 |
| Trichloroethene | 6 | 8.5 | 0.03 |
| Toluene | 380 | 2,600 | 0.5 |
| Tetrachloroethene | 8.9 | 17 | 0.03 |
| Ethylbenzene | 1,100 | 8,400 | 0.6 |
| Total Xylenes | 5,900 | 40,000 | 0.2 |
| 1,3,5-Trimethylbenzene | 11 | 74 | 0.3 |
| 1,2,4-Trimethylbenzene | 13 | 88 | 0.3 |
| Isopropylbenzene | 160 | 1,100 | 0.2 |
| Naphthalene | 40 | 270 | 1.7 |
| 1-Methylnaphthalene | 68 | 470 | 2.2 |
| 2-Methylnaphthalene | 80 | 560 | 6.1 |
| Benzo(a)pyrene | 0.1 | 0.5 | 8 |
| TRPH | 340 | 2,500 | 340 |
| Arsenic* | 0.8 | 3.7 | 29 |

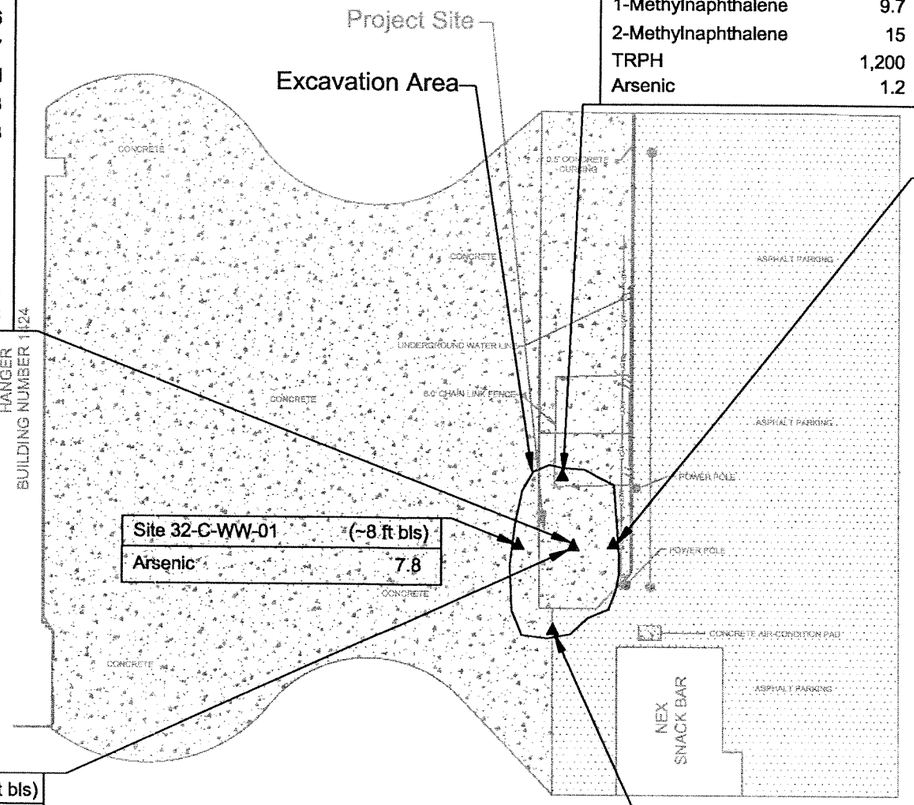
(*Arsenic has been determined to be natuarlly occurring throughout NASWF and does not appear to be site related.)

4. J = estimated value
5. ft bls = feet below land surface




| Site 32-C-B-01 | (~10 ft bls) |
|---|---|
| 1,1-Dichloroethane | 1.1 |
| cis-1,2-Dichloroethene | 1.5 |
| 1,1,1-Trichloroethane | 3.2 |
| Benzene | 0.14 J |
| Trichloroethene | 3.6 |
| Toluene | 1.7 |
| Tetrachloroethene | 4.1 |
| Ethylbenzene | 0.98 |
| Total Xylenes | 5.8 |
| 1,3,5-Trimethylbenzene | 3.9 J |
| 1,2,4-Trimethylbenzene | 8.6 |
| Isopropylbenzene | 0.5 |
| Naphthalene | 4.3 |
| Benzo(a)pyrene | 0.58 J |
| TRPH | 1,700 |
| Arsenic | 2.6 |

| Site 32-C-NW-01 | (~8 ft bls) |
|---|---|
| Ethylbenzene | 4.7 |
| 1,3,5-Trimethylbenzene | 0.38 J |
| 1,2,4-Trimethylbenzene | 0.66 |
| Isopropylbenzene | 2.8 |
| Naphthalene | 14 |
| 1-Methylnaphthalene | 9.7 |
| 2-Methylnaphthalene | 15 |
| TRPH | 1,200 |
| Arsenic | 1.2 |




| Site 32-C-WW-01 | (~8 ft bls) |
|---|---|
| Arsenic | 7.8 |

| Site 32-C-EW-01 | (~8 ft bls) |
|---|---|
| cis-1,2-Dichloroethene | 1.6 |
| Toluene | 1.2 J |
| Ethylbenzene | 6.3 |
| Total Xylenes | 52 |
| 1,3,5-Trimethylbenzene | 26 J |
| 1,2,4-Trimethylbenzene | 63 |
| Isopropylbenzene | 2.9 |
| Naphthalene | 17 |
| 1-Methylnaphthalene | 11 |
| 2-Methylnaphthalene | 15 |
| Benzo(a)pyrene | 0.44 J |
| TRPH | 350 |
| Arsenic | 4.7 |

| Site 32-C-B-02 | (~10 ft bls) |
|---|---|
| 1,1-Dichloroethane | 0.82 |
| cis-1,2-Dichloroethene | 1.2 |
| 1,1,1-Trichloroethane | 2.7 |
| Benzene | 0.12 J |
| Trichloroethene | 3.6 |
| Toluene | 1.8 |
| Tetrachloroethene | 4.2 |
| Total Xylenes | 2.8 |
| 1,3,5-Trimethylbenzene | 1.9 J |
| 1,2,4-Trimethylbenzene | 4.7 |
| Isopropylbenzene | 0.27 J |
| Naphthalene | 3.3 |
| Benzo(a)pyrene | 0.55 J |
| TRPH | 2,400 |
| Arsenic | 2.8 |

| Site 32-C-SW-01 | (~8 ft bls) |
|---|---|
| 1,1,1-Trichloroethane | 2 |
| Trichloroethene | 0.33 |
| Tetrachloroethene | 2.6 |
| Total Xylenes | 0.42 |
| 1,3,5-Trimethylbenzene | 1.9 J |
| 1,2,4-Trimethylbenzene | 1.2 |
| Benzo(a)pyrene | 0.61 J |
| TRPH | 960 |
| Arsenic | 3.1 |

# FIGURE 3-3

Excavation Area and Soil Sample Locations for Site 32

*Project Completion Report, NAS Whiting Field*

**TABLE 3-4**
Analytical Summary Results for Site 32
*Project Completion Report, NAS Whiting Field*

| Sample ID No. | | Site 32-C-SW-01 South Wall | Site 32-C-EW-01 East Wall | Site 32-C-NW-01 North Wall | Site 32-C-WW-01 West Wall | Site 32-C-B-01 Bottom | Site 32-C-B-02 Bottom | 62-777 FAC Direct Exposure | 62-777 FAC Direct Exposure | 62-777 FAC |
|---|---|---|---|---|---|---|---|---|---|---|
| Laboratory ID No. | | 10011-1 | 10011-2 | 10011-3 | 10011-4 | 10011-5 | 10011-6 | Residential | Industrial | Leachability |
| Depth | | 8 ft bls | 8 ft bls | 8 ft bls | 8 ft bls | 10 ft bls | 10 ft bls | | | |
| **LABORATORY ANALYSES** | **Units** | Soil | Soil | Soil | Soil | Soil | Soil | | | |
| **Volatile Organic Compounds (8260B)** | | | | | | | | | | |
| Dichlorodifluoromethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 UJ | 0.50 U | 0.47 U | 56 | 370 | 44 |
| Chloromethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 1.7 | 2.3 | 0.01 |
| Vinyl Chloride | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 0.03 | 0.04 | 0.007 |
| Bromomethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 2.2 | 15 | 0.05 |
| Chloroethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 2.9 | 4 | 0.06 |
| Trichlorofluoromethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 UJ | 0.37 J | 0.38 J | 200 | 1300 | 33 |
| 1,1-Dichloroethene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 0.09 | 0.1 | 0.06 |
| Methylene Chloride | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.004 J | 0.50 U | 0.47 U | 16 | 23 | 0.02 |
| trans-1,2-Dichloroethene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 31 | 210 | 0.7 |
| 1,1-Dichloroethane | mg/kg | 0.082 J | 1.3 U | 0.53 U | 0.0049 U | **1.1** | **0.82** | 290 | 2000 | 0.4 |
| 2,2-Dichloropropane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | | | |
| cis-1,2-Dichloroethene | mg/kg | 0.11 U | **1.6** | 0.53 U | 0.0049 U | **1.5** | **1.2** | 19 | 130 | 0.4 |
| Bromochloromethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 57 | 390 | 0.6 |
| Chloroform | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 0.4 | 0.5 | 0.03 |
| 1,1,1-Trichloroethane | mg/kg | **2** | 1.3 U | 0.53 U | 0.0049 U | **3.2** | **2.7** | 400 | 3300 | 1.9 |
| Carbon Tetrachloride | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 0.4 | 0.6 | 0.04 |
| 1,1-Dichloropropene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | | | |
| Benzene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | **0.14 J** | **0.12 J** | 1.1 | 1.6 | 0.007 |
| 1,2-Dichloroethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 0.5 | 0.7 | 0.01 |
| Trichloroethene | mg/kg | **0.33** | 1.3 U | 0.53 U | 0.0049 U | **3.6** | **3.6** | 6 | 8.5 | 0.03 |
| Vinyl Acetate | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 230 | 1600 | 0.4 |
| 1,2-Dichloropropane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 0.6 | 0.8 | 0.03 |
| Dibromomethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 0.01 | 0.04 | 0.0001 |
| Bromodichloromethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 1.4 | 2 | 0.004 |
| cis-1,3-Dichloropropene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 0.2 | 0.2 | 0.001 |
| Toluene | mg/kg | 0.037 J | **1.2 J** | 0.53 U | 0.0049 U | **1.7** | **1.8** | 380 | 2600 | 0.5 |
| trans-1,3-Dichloropropene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 0.2 | 0.2 | 0.001 |
| 1,1,2-Trichloroethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 1.3 | 1.8 | 0.03 |
| Tetrachloroethene | mg/kg | **2.6** | 1.3 U | 0.53 U | 0.0049 U | **4.1** | **4.2** | 8.9 | 17 | 0.03 |
| 1,3-Dichloropropane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | | | |

TABLE 3-4
Analytical Summary Results for Site 32
*Project Completion Report, NAS Whiting Field*

| Sample ID No. | | Site 32-C-SW-01 South Wall | Site 32-C-EW-01 East Wall | Site 32-C-NW-01 North Wall | Site 32-C-WW-01 West Wall | Site 32-C-B-01 Bottom | Site 32-C-B-02 Bottom | 62-777 FAC Direct Exposure | 62-777 FAC Direct Exposure | 62-777 FAC |
|---|---|---|---|---|---|---|---|---|---|---|
| Laboratory ID No. | | 10011-1 | 10011-2 | 10011-3 | 10011-4 | 10011-5 | 10011-6 | Residential | Industrial | Leachability |
| | Depth | 8 ft bls | 8 ft bls | 8 ft bls | 8 ft bls | 10 ft bls | 10 ft bls | | | |
| LABORATORY ANALYSES | Units | Soil | Soil | Soil | Soil | Soil | Soil | | | |
| Dibromochloromethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 UJ | 0.50 U | 0.47 U | 1.4 | 2.1 | 0.003 |
| 1,2-Dibromoethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 0.01 | 0.04 | 0.0001 |
| Chlorobenzene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 30 | 200 | 1.3 |
| 1,1,1,2-Tetrachloroethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 4 | 5.7 | 0.01 |
| Ethylbenzene | mg/kg | 0.11 U | **6.3** | **4.7** | 0.0049 U | **0.98** | 0.51 | 1100 | 8400 | 0.6 |
| Total Xylenes | mg/kg | **0.42** | **52** | 0.11 J | 0.015 U | **5.8** | **2.8** | 5900 | 40000 | 0.2 |
| Styrene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 2700 | 21000 | 3.6 |
| Bromoform | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 48 | 84 | 0.03 |
| 1-Methylethylbenzene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | | | |
| Bromobenzene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | | | |
| 1,1,2,2-Tetrachloroethane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 0.7 | 1.1 | 0.002 |
| 1,2,3-Trichloropropane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 0.01 | 0.02 | 0.001 |
| n-Propylbenzene | mg/kg | 0.066 J | 6.6 | 8.7 | 0.0049 UJ | 1 | 0.68 | | | |
| 2-Chlorotoluene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 UJ | 0.50 U | 0.47 U | 120 | 850 | 2.8 |
| 4-Chlorotoluene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 100 | 730 | 2.5 |
| 1,3,5-Trimethylbenzene | mg/kg | **1.9 J** | **26 J** | **0.38 J** | 0.0049 UJ | **3.9 J** | **1.9 J** | 11 | 74 | 0.3 |
| tert-Butylbenzene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | | | |
| 1,2,4-Trimethylbenzene | mg/kg | **1.2** | **63** | **0.66** | 0.0049 UJ | **8.6** | **4.7** | 13 | 88 | 0.3 |
| sec-Butylbenzene | mg/kg | 0.12 | 2.6 | 3.6 | 0.0049 UJ | 0.78 | 0.54 | | | |
| 1,3-Dichlorobenzene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 27 | 180 | 0.3 |
| 1,4-Dichlorobenzene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 6 | 9 | 2.2 |
| Isopropylbenzene | mg/kg | 0.11 U | **2.9** | **2.8** | 0.0049 U | **0.5** | **0.27 J** | 160 | 1100 | 0.2 |
| p-Isopropyltoluene | mg/kg | 0.62 | 4 | 0.53 U | 0.0049 UJ | 1.1 | 0.61 | | | |
| n-Butylbenzene | mg/kg | 0.11 U | 1.3 U | 5.9 | 0.0049 UJ | 0.50 U | 0.47 U | | | |
| 1,2-Dichlorobenzene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 650 | 4600 | 17 |
| 1,2-Dibromo-3-chloropropane | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 0.8 | 2.7 | 0.001 |
| 1,2,4-Trichlorobenzene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 560 | 7500 | 5.3 |
| Hexachlorobutadiene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 UJ | 0.50 U | 0.47 U | 6.3 | 12 | 1.1 |
| Naphthalene | mg/kg | 0.11 U | **17** | **14** | 0.0049 U | **4.3** | **3.3** | 40 | 270 | 1.7 |
| 1,2,3-Trichlorobenzene | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 560 | 7400 | 4.6 |
| Methyl-tert-butyl-ether | mg/kg | 0.11 U | 1.3 U | 0.53 U | 0.0049 U | 0.50 U | 0.47 U | 3200 | 22000 | 0.2 |

TABLE 3-4
Analytical Summary Results for Site 32
*Project Completion Report, NAS Whiting Field*

| Sample ID No. | | Site 32-C-SW-01 South Wall | Site 32-C-EW-01 East Wall | Site 32-C-NW-01 North Wall | Site 32-C-WW-01 West Wall | Site 32-C-B-01 Bottom | Site 32-C-B-02 Bottom | 62-777 FAC Direct Exposure | 62-777 FAC Direct Exposure | 62-777 FAC |
|---|---|---|---|---|---|---|---|---|---|---|
| Laboratory ID No. | | 10011-1 | 10011-2 | 10011-3 | 10011-4 | 10011-5 | 10011-6 | Residential | Industrial | Leachability |
| Depth | | 8 ft bls | 8 ft bls | 8 ft bls | 8 ft bls | 10 ft bls | 10 ft bls | | | |
| **LABORATORY ANALYSES** | **Units** | Soil | Soil | Soil | Soil | Soil | Soil | | | |
| **Total Recoverable Petroleum Hydrocarbons (FL-PRO)** | | | | | | | | | | |
| TRPH | mg/kg | **960** | **350** | **1200** | 47 | **1700** | **2400** | 340 | 2500 | 340 |
| **Metals (6010)** | | | | | | | | | | |
| Arsenic | mg/kg | **3.1** | **4.7** | **1.2** | **7.8** | **2.6** | **2.8** | 0.8 | 3.7 | 29 |
| Chromium | mg/kg | 16 | 24 | 7 | 27 | 14 | 15 | 210 | 420 | 38 |
| Cadmium | mg/kg | 0.57 | 0.10 U | 0.09 U | 0.09 U | 0.45 J | 0.28 J | 75 | 1300 | 8 |
| Lead | mg/kg | 46 | 6.2 | 5.6 | 6.9 | 50 | 35 | 400 | 920 | |
| **Polycyclic Aromatic Hydrocarbons (8310)** | | | | | | | | | | |
| Naphthalene | mg/kg | 0.98 | **5.6** | **6.5** | 0.37 U | **1.9** | **1.8 J** | 40 | 270 | 1.7 |
| Acenaphthylene | mg/kg | 0.37 U | 3.6 U | 3.6 U | 0.37 U | 1.9 U | 1.8 U | 1100 | 11000 | 27 |
| 1-Methyl naphthalene | mg/kg | 1.8 | **11** | **9.7** | 0.37 U | 1.6 J | 1.5 J | 68 | 470 | 2.2 |
| 2-Methyl naphthalene | mg/kg | 1.9 | **15** | **15** | 0.37 U | 2.2 | 2.1 | 80 | 560 | 6.1 |
| Acenaphthene | mg/kg | 0.48 | 0.53 J | 3.6 U | 0.37 U | 1.2 J | 1.1 J | 1900 | 18000 | 2.1 |
| Fluorene | mg/kg | 0.38 | 0.69 J | 3.6 U | 0.37 U | 0.69 J | 0.69 J | 2200 | 28000 | 160 |
| Phenanthrene | mg/kg | 2.1 | 1.9 J | 3.6 U | 0.37 U | 3.8 | 3.7 | 2000 | 30000 | 250 |
| Anthracene | mg/kg | 0.52 | 0.39 J | 3.6 U | 0.37 U | 0.65 J | 0.69 J | 18000 | 260000 | 2500 |
| Fluoranthene | mg/kg | 2.8 | 2.2 J | 3.6 U | 0.063 J | 4.2 | 4.5 | 2900 | 48000 | 1200 |
| Pyrene | mg/kg | 2.6 | 2.2 J | 3.6 U | 0.059 J | 3.8 | 4.0 | 2200 | 37000 | 880 |
| Benzo(a)anthracene | mg/kg | 1 | 0.82 J | 3.6 U | 0.37 U | 1.3 J | 1.1 J | 1.4 | 5 | 3.2 |
| Chrysene | mg/kg | 0.95 | 0.65 J | 3.6 U | 0.37 U | 0.96 J | 0.93 J | 140 | 450 | 77 |
| Benzo(b)fluoranthene | mg/kg | 1.1 J | 0.62 J | 3.6 U | 0.37 U | 1.1 J | 1.0 J | 1.4 | 4.8 | 10 |
| Benzo(k)fluoranthene | mg/kg | 0.45 J | 3.6 UJ | 3.6 U | 0.37 U | 0.51 J | 0.44 J | 15 | 52 | 25 |
| Benzo(a)pyrene | mg/kg | **0.61 J** | **0.44 J** | 3.6 U | 0.37 U | **0.58 J** | **0.55 J** | 0.1 | 0.5 | 8 |
| Dibenz(a,h)anthracene | mg/kg | 0.37 UJ | 3.6 UJ | 3.6 U | 0.37 U | 1.9 U | 1.8 UJ | 0.1 | 0.5 | 30 |
| Benzo(g,h,i)perylene | mg/kg | 0.14 J | 3.6 UJ | 3.6 U | 0.37 U | 1.9 U | 1.8 UJ | 2300 | 41000 | 32000 |
| Ideno(1,2,3-cd)pyrene | mg/kg | 0.15 J | 3.6 UJ | 3.6 U | 0.37 U | 1.9 U | 1.8 UJ | 1.5 | 5.3 | 28 |

Note: results exceeding criteria are shown in **bold text.**
U = undetected
J = estimated

# APPENDIX B

# REVISED HUMAN HEALTH RISK ASSESSMENT

# REVISED HUMAN HEALTH RISK ASSESSMENT FOR SITE 32
# NORTH FIELD MAINTENANCE HANGAR

## SURFACE AND SUBSURFACE SOILS

## NAVAL AIR STATION WHITING FIELD
## MILTON, FLORIDA

## SEPTEMBER 2004

# ACRONYMS

| | |
|---|---|
| ABB-ES | ABB Environmental Services |
| BaPEq | Benzo(a)pyrene Equivalent |
| bls | below land surface |
| cPAH | carcinogenic polynuclear aromatic hydrocarbon |
| COPC | constituent of potential concern |
| CSF | cancer slope factor |
| ELCR | excess lifetime cancer risk |
| EPC | exposure point concentration |
| FDEP | Florida Department of Environmental Protection |
| FSA | Feasibility Study Addendum |
| GIR | General Information Report |
| HHRA | Human Health Risk Assessment |
| HI | Hazard Index |
| HQ | Hazard Quotient |
| ILCR | Incremental Lifetime Cancer Risk |
| mg/kg | milligrams per kilogram |
| NAS | Naval Air Station |
| OSWER | Office of Solid Waste and Emergency Response |
| PAH | Polynuclear Aromatic Hydrocarbon |
| PRG | Preliminary Remedial Goal |
| RBC | risk-based concentration |
| RfD | reference dose |
| RI | Remedial Investigation |
| RME | Reasonable Maximum Exposure |
| SCTL | soil cleanup target level |
| SSL | soil screening level |
| TEF | toxicity equivalency factor |
| TRPH | total recoverable petroleum hydrocarbon |
| UCL | upper confidence limit |
| USEPA | United States Environmental Protection Agency |

# 1.0 INTRODUCTION

This revised Human Health Risk Assessment (HHRA) was conducted in conjunction with the Feasibility Study Addendum (FSA) for Naval Air Station (NAS) Whiting Field Site 32 for surface and subsurface soils. The revised HHRA conservatively estimates the potential risk to human health considering historic analytical data, UST confirmation soil analytical data, and arsenic, aluminum, iron, manganese, and vanadium being present at naturally occurring concentrations at Site 32. The original HHRA was included in the Remedial Investigation (RI) Report (TtNUS, 1999).

The first step of the re-evaluation was to determine a revised list of constituents of potential concern (COPCs). United States Environmental Protection Agency (USEPA) Region IV currently requires the use of USEPA Region IX Preliminary Remedial Goal (PRGs) to select COPCs, therefore, Florida Department of Environmental Protection (FDEP) soil cleanup target level (SCTLs) and USEPA's Region IX PRGs were used in this analysis to select COPCs in surface and subsurface soils for this evaluation.

Arsenic concentrations at NAS Whiting Field have been determined to be naturally occurring (FDEP, 2001). The individual metal constituents aluminum, iron, manganese and vanadium have no direct evidence of site-related use at Site 32 and the process and procedures at this site did not likely contribute to the presence of these inorganic analytes in surface or subsurface soil. Additionally, the site-specific values for these inorganics are within the range of levels found at NAS Whiting Field and of naturally occurring levels throughout the southeastern United States. The RI for NAS Whiting Field Site 40, Basewide Groundwater, contains the appendix “Inorganics in Soil at NAS Whiting Field” presenting the technical basis for this determination. Considering the information presented above, aluminum, arsenic, iron, manganese, and vanadium are not considered COPCs for Site 32 surface and subsurface soils.

The steps employed in the RI baseline HHRA have been used in this revised HHRA. The steps include:

- Selection of COPCs – Section 1.1
- Exposure Assessment – Section 1.2
- Toxicity Assessment – Section 1.3
- Risk Characterization – Section 1.4
- Uncertainty Analysis – Section 1.6

The risk screening for human health uses the FDEP SCTLs (FDEP, 1999) and the USEPA Region IX PRGs (USEPA, 2002a) to conservatively assess exposure and toxicity. The five steps for performing the risk screening are described in detail in the following sections.

## 1.1 Selection of COPCs

The following factors are considered in the selection of COPCs for human receptors:

1) Occurrence and distribution of chemicals in the environmental media
2) Individual chemical toxicity
3) Adjustment for multiple chemical exposures
4) Comparisons of site-specific concentrations with corresponding background concentrations

**Subsurface Soil COPCs**

Candidate subsurface soil COPCs for Site 32 include any constituent detected at least once in environmental samples collected from 2 to 15 feet below land surface (bls).

The initial list of COPCs consists of those constituents where the maximum concentration detected in subsurface soil exceeds the lower of the FDEP SCTL or USEPA Region IX PRG for the residential soil direct exposure pathway.

The USEPA Region IX PRGs are screening levels corresponding to fixed levels of risk, either an excess lifetime cancer risk (ELCR) of one in a million (1.0E-06) or a non-cancer hazard quotient (HQ) of 1 or more. The USEPA Region IX PRGs consider the most sensitive receptor, a residential child, for constituents associated with non-cancer toxicity. For carcinogenic constituents, exposure is based upon the assumption of cumulative exposure for a residential child and a residential adult. The FDEP residential SCTLs are risk-based screening levels based on either cancer risk or non-cancer toxicity, using the lower of values protective against ELCR of 1.0E-06 or a non-cancer HQ of 1.0. Like the Region IX PRGs, the FDEP SCTLs account for exposure to constituents in soil via incidental ingestion, dermal contact, inhalation of volatiles, and inhalation of particulate dusts. To account for possible additivity of non-carcinogenic effects, screening levels for non-carcinogenic constituents were divided by 10.

As described in the RI (TtNUS, 1999), some constituents did not have PRGs or risk-based concentrations (RBCs) and, therefore, surrogate screening values were selected. Essential nutrients (calcium, magnesium, potassium, and sodium) were not considered COPCs. Inorganic analytes were screened against background concentrations but all constituents selected as COPCs had maximum concentrations above background values.

Constituents detected in soils were retained as COPCs if the maximum detected concentrations exceeded the adjusted screening levels and twice the mean of the background concentration. The development of the background concentrations for NAS Whiting Field, Florida is presented in the General Information Report (GIR), NAS Whiting Field [ABB Environmental Services, Inc. (ABB-ES), 1998].

Additional information regarding site-specific background concentrations for arsenic, aluminum, iron, manganese, and vanadium at NAS Whiting Field has been discussed previously in this FSA.

Table 1-1 lists the candidate constituents considered to be COPCs (those with at least one detection) and shows those selected as subsurface soil COPCs for the risk evaluation. The following COPCs were identified for subsurface soil at Site 32: m-xylenes, naphthalene, tetrachloroethene, trichloroethene, total xylenes, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene 1-methylnaphthalene, 2-methylnaphthalene, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and total recoverable petroleum hydrocarbon (TRPH).

As stated in USEPA Region IV guidance (USEPA, 1995), when one carcinogenic polynuclear aromatic hydrocarbon (PAH) (cPAH) is selected as a COPC, they all are selected. The cPAHs are benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene. For Site 32, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene did not have maximum detected concentrations exceeding any screening levels but rather were selected as COPCs because other cPAHs were selected.

### 1.2 Exposure Assessment

This exposure assessment was conducted to identify the pathways humans are potentially exposed, the magnitude of potential exposure, and the frequency and duration of exposure. The regional and site-specific environmental setting of Site 32 is discussed in the RI (TtNUS, 1999). The site is non-residential and is expected to remain non-residential in the foreseeable future. The receptors to be evaluated were selected based on the current and realistic future use of the site and surrounding areas. Given the current and anticipated future use of the site, only a construction (excavation) worker is likely to be exposed to COPCs in subsurface soils at Site 32. Future residential use of the site is not anticipated for military or non-military housing; however, the residential pathway was retained for completeness and comparison purposes. In most cases, exposures to environmental media predicted for the expected individuals are likely to be less intense than those anticipated for a home resident. Consequently, the use of the PRGs and SCTLs discussed in Section 1.1 of this revised HHRA to select COPCs and evaluate risk is a conservative approach toward exposure assessment because the PRGs and SCTLs were developed assuming exposure occurred under a residential land-use scenario. This conservative approach assures the sites will not be inappropriately dismissed as “no further action” sites during the COPC selection process.

TABLE 1-1
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN - SUBSURFACE SOIL
SITE 32
NAS WHITING FIELD, MILTON, FLORIDA

| | |
|---|---|
| Scenario Time Frame: | Current/Future |
| Medium: | Subsurface Soil |
| Exposure Medium: | Subsurface Soil (2 to 15 feet) |
| Exposure Point: | Site 32 |



| CAS Number | Constituent | Minimum Detected Concentration | Maximum Concentration | Units | Detection Frequency | Concentration Used for Screening | Background Value[1] | Screening Toxicity Value | | | | | COPC Flag | Rationale for[4] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Region IX [2] | | | Florida [3] | | | |
| | | | | | | | | Soil Residential | Soil[5] Basis | Soil Industrial | Soil Residential | Soil Industrial | | |
| **Volatiles** | | | | | | | | | | | | | | |
| 71556 | 1,1,1-Trichloroethane | 2 | 3.2 | mg/kg | 3/28 | 3.2 | NA | 1200 [sat] | N | 1200 [sat] | 40 | 330 | No | BSL |
| 75354 | 1,1-Dichloroethane | 0.082 | 1.1 | mg/kg | 3/28 | 1.1 | NA | 51 | N | 170 | 29 | 200 | No | BSL |
| 96128 | 1,2-Dibromo-3-Chloropropane | 0.00011 | 0.00011 | mg/kg | 1/6 | 0.00011 | NA | 0.45 | C | 2 | 0.8 | 2.7 | No | BSL |
| 78933 | 2-Butanone | 0.003 | 0.008 | mg/kg | 4/19 | 0.008 | NA | 733 | N | 2710 | 310 | 2100 | No | BSL |
| 67641 | Acetone | 0.002 | 2.1 | mg/kg | 13/22 | 2.1 | NA | 157 | N | 604 | 78 | 550 | No | BSL |
| 71432 | Benzene | 0.12 | 0.14 | mg/kg | 2/28 | 0.14 | NA | 0.6 | C | 1.3 | 1.1 | 1.6 | No | BSL |
| 156592 | Cis-1,2-Dichloroethene | 1.2 | 1.6 | mg/kg | 3/6 | 1.6 | NA | 4.3 | N | 14.6 | 1.9 | 13 | No | BSL |
| 100414 | Ethylbenzene | 0.44 | 6.3 | mg/kg | 8/28 | 6.3 | NA | 8.9 | C | 19.5 | 110 | 840 | No | BSL |
| 75092 | Methylene Chloride | 0.004 | 0.61 | mg/kg | 6/28 | 0.61 | NA | 9.1 | C | 20.5 | 16 | 23 | No | BSL |
| 108383 | **M-Xylene** [6] | 0.13 | 39 | mg/kg | 4/6 | 39 | NA | 27.5 | N | 42 | 590 | 4000 | **Yes** | ASL |
| 91203 | **Naphthalene** | 1.6 | 24 | mg/kg | 11/28 | 24 | NA | 5.6 | N | 18.8 | 4 | 27 | **Yes** | ASL |
| 95476 | O-Xylene [6] | 0.11 | 13 | mg/kg | 5/6 | 13 | NA | 27.5 | N | 42 | 590 | 4000 | No | BSL |
| 127184 | **Tetrachloroethene** | 1.175 | 4.2 | mg/kg | 5/28 | 4.2 | NA | 1.5 | C | 3.4 | 8.9 | 17 | **Yes** | ASL |
| 108883 | Toluene | 0.037 | 12 | mg/kg | 7/28 | 12 | NA | 52 | N | 52 | 38 | 260 | No | BSL |
| 540590 | Total 1,2-Dichloroethene [7] | 0.3 | 0.43 | mg/kg | 2/22 | 0.43 | NA | 4.29 | N | 14.6 | 1.9 | 13 | No | BSL |
| 79016 | **Trichloroethene** | 0.33 | 3.6 | mg/kg | 3/28 | 3.6 | NA | 0.053 | C | 0.11 | 6 | 8.5 | **Yes** | ASL |
| 75694 | Trichlorofluoromethane | 0.37 | 0.38 | mg/kg | 2/6 | 0.38 | NA | 39 | N | 200 | 20 | 130 | No | BSL |
| 1330207 | **Xylenes, Total** | 0.0028 | 32 | mg/kg | 6/24 | 32 | NA | 27.5 | N | 42 | 590 | 4000 | **Yes** | ASL |
| **Semivolatiles** | | | | | | | | | | | | | | |
| 95636 | **1,2,4-Trimethylbenzene** | 0.66 | 63 | mg/kg | 5/6 | 63 | NA | 5.16 | N | 17 | 1.3 | 8.8 | **Yes** | ASL |
| 108678 | **1,3,5-Trimethylbenzene** | 0.38 | 26 | mg/kg | 5/6 | 26 | NA | 2.13 | N | 6.97 | 1.1 | 7.4 | **Yes** | ASL |
| 90120 | **1-Methylnaphthalene** [8] | 1.5 | 11 | mg/kg | 5/6 | 11 | NA | 5.6 | N | 18.8 | 6.8 | 47 | **Yes** | ASI |
| 91576 | **2-Methylnaphthalene** [8] | 0.052 | 40 | mg/kg | 13/28 | 40 | NA | 5.6 | N | 18.8 | 8 | 56 | **Yes** | ASL |
| 99876 | P-Isopropyltoluene [9] | 0.61 | 4 | mg/kg | 4/6 | 4 | NA | 57.2 | N | 198 | NA | NA | No | BSL |
| 83329 | Acenaphthene | 0.48 | 1.2 | mg/kg | 4/28 | 1.2 | NA | 368 | N | 2900 | 190 | 1800 | No | BSL |
| 120127 | Anthracene | 0.39 | 0.69 | mg/kg | 4/28 | 0.69 | NA | 2190 | N | 100000 | 1800 | 26000 | No | BSL |
| 56553 | **Benzo(A)Anthracene** | 0.82 | 1.3 | mg/kg | 4/28 | 1.3 | NA | 0.62 | C | 2.1 | 1.4 | 5 | **Yes** | ASL |
| 50328 | **Benzo(A)Pyrene** | 0.44 | 0.61 | mg/kg | 4/28 | 0.61 | NA | 0.062 | C | 0.21 | 0.1 | 0.5 | **Yes** | ASL |
| 205992 | **Benzo(B)Fluoranthene** | 0.62 | 1.1 | mg/kg | 4/28 | 1.1 | NA | 0.62 | C | 2.1 | 1.4 | 4.8 | **Yes** | ASL |
| 191242 | Benzo(G,H,I)Perylene [10] | 0.14 | 0.14 | mg/kg | 1/28 | 0.14 | NA | 232 | N | 2913 | 230 | 4100 | No | BSL |
| 207089 | **Benzo(K)Fluoranthene** | 0.44 | 0.51 | mg/kg | 3/28 | 0.51 | NA | 6.2 | C | 21.1 | 15 | 52 | **Yes** | PAH |
| 117817 | Bis(2-Ethylhexyl)Phthalate | 0.067 | 0.59 | mg/kg | 3/22 | 0.59 | NA | 34.7 | C | 123 | 76 | 280 | No | BSL |
| 86748 | Carbazole | 0.039 | 0.039 | mg/kg | 1/22 | 0.039 | NA | 24 | C | 86 | 53 | 190 | No | BSL |
| 218019 | **Chrysene** | 0.65 | 0.96 | mg/kg | 4/28 | 0.96 | NA | 62.1 | C | 211 | 140 | 450 | **Yes** | PAH |
| 132649 | Dibenzofuran | 1.4 | 1.5 | mg/kg | 2/22 | 1.5 | NA | 29 | N | 310 | 28 | 500 | No | BSL |
| 117840 | Di-N-Octyl Phthalate | 0.04 | 0.04 | mg/kg | 1/22 | 0.04 | NA | 244 | N | 2460 | 150 | 2700 | No | BSL |
| 206440 | Fluoranthene | 0.039 | 4.5 | mg/kg | 6/28 | 4.5 | NA | 229 | N | 2200 | 290 | 4800 | No | BSL |
| 86737 | Fluorene | 0.38 | 0.97 | mg/kg | 5/28 | 0.97 | NA | 275 | N | 2628 | 220 | 2800 | No | BSL |
| 193395 | **Indeno(1,2,3-Cd)Pyrene** | 0.15 | 0.15 | mg/kg | 1/28 | 0.15 | NA | 0.62 | C | 2.1 | 1.5 | 5.3 | **Yes** | PAH |
| 98828 | Isopropylbenzene | 0.27 | 2.9 | mg/kg | 4/6 | 2.9 | NA | 57.2 | N | 198 | 16 | 110 | No | BSL |
| 104518 | N-Butylbenzene | 5.9 | 5.9 | mg/kg | 1/6 | 5.9 | NA | 240 [sat] | N | 240 [sat] | NA | NA | No | BSL |
| 103651 | N-Propylbenzene | 0.066 | 8.7 | mg/kg | 5/6 | 8.7 | NA | 24 | N | 24 | NA | NA | No | BSL |
| 85018 | Phenanthrene [10] | 0.059 | 3.8 | mg/kg | 5/28 | 3.8 | NA | 232 | N | 2913 | 200 | 3000 | No | BSL |
| 129000 | Pyrene | 0.059 | 4 | mg/kg | 5/28 | 4 | NA | 232 | N | 2913 | 200 | 3000 | No | BSL |
| 135988 | Sec-Butylbenzene | 0.12 | 3.6 | mg/kg | 5/6 | 3.6 | NA | 22 | N | 22 | NA | NA | No | BSL |

TABLE 1-1
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN - SUBSURFACE SOIL
SITE 32
NAS WHITING FIELD, MILTON, FLORIDA

| | |
|---|---|
| Scenario Time Frame: | Current/Future |
| Medium: | Subsurface Soil |
| Exposure Medium: | Subsurface Soil (2 to 15 feet) |
| Exposure Point: | Site 32 |



| CAS Number | Constituent | Minimum Detected Concentration | Maximum Concentration | Units | Detection Frequency | Concentration Used for Screening | Background Value[1] | Screening Toxicity Value | | | | | COPC Flag | Rationale for[4] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Region IX [2] | | | Florida [3] | | | |
| | | | | | | | | Soil Residential | Soil[5] Basis | Soil Industrial | Soil Residential | Soil Industrial | | |
| **Inorganics** | | | | | | | | | | | | | | |
| 7429905 | Aluminum | 1630 | 33200 | mg/kg | 16/16 | 33200 | 15848 | 7600 | N | 100000 | 7200 | * | No | NOIC |
| 7440382 | Arsenic | 0.81 | 7.8 | mg/kg | 18/22 | 7.8 | 3.2 | 0.39 | C | 1.6 | 0.8 | 3.7 | No | NOIC |
| 7440393 | Barium | 3.8 | 18.7 | mg/kg | 16/16 | 18.7 | 23.2 | 540 | N | 6658 | 520 | 8700 | No | BSL |
| 7440417 | Beryllium | 0.08 | 0.21 | mg/kg | 4/16 | 0.21 | 0.36 | 15 | N | 194 | 120 | 800 | No | BSL |
| 7440439 | Cadmium | 0.28 | 0.57 | mg/kg | 4/22 | 0.57 | 0.58 | 3.7 | N | 45.1 | 7.5 | 130 | No | BSL |
| 7440702 | Calcium | 18.8 | 418.5 | mg/kg | 14/16 | 418.5 | 396 | NA | | N/A | N/A | N/A | No | NUT |
| 7440473 | Chromium | 1.2 | 27 | mg/kg | 28/28 | 27 | 11 | 210 [11] | C | 448 | 210 [11] | 420 | No | BSL |
| 7440484 | Cobalt | 0.53 | 2.5 | mg/kg | 7/16 | 2.5 | 3 | 900 | C | 1920 | 4700 | 110000 | No | BSL |
| 7440508 | Copper | 0.64 | 8.4 | mg/kg | 16/16 | 8.4 | 9.4 | 310 | N | 4088 | 290 | 7600 | No | BSL |
| 57125 | Cyanide | 0.41 | 0.56 | mg/kg | 7/13 | 0.56 | ND | 122 | N | 1231 | 160 | 3900 | No | BSL |
| 7439896 | Iron | 448 | 16000 | mg/kg | 16/16 | 16000 | 8832 | 2300 | N | 100000 | 2300 | 48000 | No | NOIC |
| 7439921 | Lead | 2 | 50 | mg/kg | 22/22 | 50 | 11.4 | 400 [12] | | 75 | 400 | 92 | No | BSL |
| 7439954 | Magnesium | 41.5 | 284 | mg/kg | 16/16 | 284 | 268 | NA | | N/A | N/A | N/A | No | NUT |
| 7439965 | Manganese | 3.5 | 53.5 | mg/kg | 16/16 | 53.5 | 392 | 180 | N | 1946 | 160 | 2200 | No | BSL |
| 7439976 | Mercury | 0.02 | 0.04 | mg/kg | 9/16 | 0.04 | 0.12 | 2.3 [13] | N | 30.7 | 0.34 | 2.6 | No | BSL |
| 7440020 | Nickel | 1.7 | 4.7 | mg/kg | 10/16 | 4.7 | 7.2 | 160 | N | 2044 | 150 | 2800 | No | BSL |
| 7440097 | Potassium | 84.8 | 672 | mg/kg | 14/16 | 672 | 177 | NA | | N/A | N/A | N/A | No | NUT |
| 7782492 | Selenium | 0.11 | 2.2 | mg/kg | 7/16 | 2.2 | 0.46 | 39 | N | 511 | 39 | 1000 | No | BSL |
| 7440224 | Silver | 0.7 | 0.96 | mg/kg | 3/16 | 0.96 | 0.7 | 39 | N | 511 | 39 | 910 | No | BSL |
| 7440235 | Sodium | 18 | 235 | mg/kg | 11/16 | 235 | 406 | NA | | N/A | N/A | N/A | No | NUT |
| 7440622 | Vanadium | 5.1 | 43.1 | mg/kg | 16/16 | 43.1 | 21.8 | 55 | N | 715 | 15 | 740 | No | NOIC |
| 7440666 | Zinc | 0.52 | 9.1 | mg/kg | 14/16 | 9.1 | 15.4 | 2300 | N | 100000 | 2300 | 56000 | No | BSL |
| **Petroleum Hydrocarbons** | | | | | | | | | | | | | | |
| na | **TRPH** | 5.8 | 2400 | mg/kg | 14/25 | 2400 | NA | N/A | N | N/A | 340 [14] | 2500 [14] | **Yes** | ASL |

Notes:

(1) Troup Loamy Soil (Table 39), General Information Report (GIR), Remedial Investigation and Feasibility Study, ABB, January, 1998. Background screening value for inorganics is two times the mean detected concentration.
(2) Region IX Preliminary Remediation Goal Table, October, 2002. (note: 1/10th PRG value used for noncarcinogens)
(3) Table 2, Soil Cleanup Target Levels, Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., May, 1999. (note: 1/10th SCTL value used for non*carcinogens.) Values for vanadium based on acute toxicity.
(4) Rationale codes:
Above Screening Level (ASL)
If one cPAH is a COPC, all cPAHs are COPCs. (PAH)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Naturally Occurring Inorganic Chemical (NOIC)
(5) Soil basis codes:
N noncarcinogen
C carcinogen
(6) Value is for xylenes
(7) Value is for cis-1,2-dichloroethene.
(8) Value is for naphthalene
(9) Value is for isopropylbenzene
(10) Value is for pyrene.
(11) FDEP value is for hexavalent chromium, only SCTL given. PRGs are for total chromium. Hexavalent chromium is not known to have been used at NAS Whiting Field.
(12) Screening level for lead, "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities", OSWER Directive #9355.412.
(13) Value is for mercuric chloride.
(14) Value for Total Recoverable Petroleum Hydrocarbons
sat - screening level indicates soil saturation level for that Constituent and was therefore, not adjusted to 1/10th.
*Constituent is not a health concern for the commercial/industrial exposure scenario.
Constituents exceeding criteria are bolded.
The average of a sample and its duplicate is used for all calculations.
COPC = Constituent of Potential Concern
mg/kg = milligram per kilogram
N/A = not applicable
NA = not available

The PRGs and SCTLs consider the following exposure pathways:

- Soil ingestion
- Dermal contact
- Inhalation of particulates and volatiles in air

For purpose of the site risk-assessment process, the exposure assessment component of this risk assessment employs the exposure assumptions used to derive the PRGs and SCTLs. The equations and exposure factors used by Region IX to calculate the PRGs are provided in the User's Guide/Technical Background Document located at http://www.epa.gov/region09/waste/sfund/prg/index.htm (USEPA, 2002b). The equations and exposure factors used by FDEP to calculate the SCTLs are provided in the Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777 F.A.C., Final Report, dated May 26, 1999.

Maximum detected concentrations and other statistical values for each COPC are shown in Table 1-2. For the revised HHRA, the exposure point concentration (EPC) was considered to be the 95 percent upper confidence limit (UCL) of the arithmetic mean concentration for either a normal or lognormal distribution. If a best-fit test indicated the data were neither normally or lognormally distributed, a non-parametric method, the standard bootstrap method, was used to determine the 95 percent UCL. The maximum detected concentration was used if the sample size was less than 10.

### 1.3 Toxicity Assessment

In this revised HHRA, the toxicity assessment incorporates those toxicity values used to derive PRGs and SCTLs. These toxicity values are listed in the User's Guide/Technical Background Document (USEPA, 2002b) referenced in Section 1.2 of this revised HHRA. The tabulation of FDEP SCTLs contains toxicity criteria used to develop the SCTLs and is presented in the Technical Report (FDEP, 1999) also referenced in Section 1.2 of this revised HHRA.

For those constituents with both carcinogenic and non-carcinogenic effects, USEPA Region IX has developed PRGs using both a cancer slope factor (CSF) and reference dose (RfD). Consequently, non-carcinogenic risks for these constituents are evaluated using PRGs as well as carcinogenic risks.

The 95 percent UCL concentration of each constituent was used as the EPC for the risk-screening, unless the sample size was less than 10. However, USEPA Region IV guidance (USEPA, 1995) was followed to determine a benzo(a)pyrene equivalent concentration representative of total cPAHs in each sample. The USEPA Region IV guidance suggests the following Toxicity Equivalency Factors (TEFs) for each cPAH to calculate the benzo(a)pyrene equivalent concentration [referred to as benzo(a)pyrene

**TABLE 1-2**
**MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY**
**SITE 32**
**NAS WHITING FIELD, MILTON, FLORIDA**

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Subsurface Soil (2-15 feet)
Exposure Point: Site 32

| Constituent of Potential Concern | Units | Arithmetic Mean[1] | 95% UCL of Normal Data | Maximum Detected Concentration | Maximum Qualifier | EPC Units | Medium statistical EPC Value[1] | Medium EPC Statistic | Medium EPC Rationale |
|---|---|---|---|---|---|---|---|---|---|
| M-Xylene | mg/kg | 7.66 | 2.0E+01 | 39 | -- | mg/kg | 39 | max | n < 10 |
| Naphthalene | mg/kg | 4.56 | 6.9E+00 | 24 | | mg/kg | 6.8 | bootstrap | (3) |
| Tetrachloroethene | mg/kg | 0.67 | 1.0E+00 | 4.2 | | mg/kg | 1.02 | bootstrap | (3) |
| Trichloroethene | mg/kg | 0.53 | 8.4E-01 | 3.6 | | mg/kg | 0.82 | bootstrap | (3) |
| Xylenes, Total | mg/kg | 2.66 | 5.5E+00 | 32 | | mg/kg | 5.31 | bootstrap | (3) |
| 1,2,4-Trimethylbenzene | mg/kg | 13 | 3.3E+01 | 63 | | mg/kg | 63 | max | n < 10 |
| 1,3,5-Trimethylbenzene | mg/kg | 5.68 | 1.4E+01 | 26 | | mg/kg | 26 | max | n < 10 |
| 1-Methylnaphthalene | mg/kg | 4.3 | 8.2E+00 | 11 | | mg/kg | 11 | max | n < 10 |
| 2-Methylnaphthalene | mg/kg | 6.43 | 1.0E+01 | 40 | | mg/kg | 9.966 | bootstrap | (3) |
| Benzo(a)pyrene (equiv) | mg/kg | 2.75 | 4.1E+00 | 2.6 | | mg/kg | 1.9 | bootstrap | (3) |

[1]For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.
Statistics: 95% UCL of log-transformed data (95% UCL-L), 95% UCL of data (95% UCL-N),maximum if the sample size was <10 samples.

| | |
|---|---|
| mg/kg | milligram per kilogram |
| UCL | upper confidence limit |
| N/A | not applicable |
| EPC | exposure point concentration |

Rationale
(1) Shapiro-Wilk W Test indicates data are log-normally distributed
(2) Shapiro-Wilk W Test indicates data are normally distributed
(3) Shapiro-Wilk W Test is inconclusive. Therefore, a non-parametric method (bootstrap) was used.
(4) The 95% UCL exceeded the maximum; therefore the maximum was used.

equivalent (BaPEq) in this HHRA]. The following TEFs were used to convert each PAH concentration to a BaPEq concentration:

- benzo(a)pyrene, TEF = 1.0;
- benzo(a)anthracene, TEF = 0.1;
- benzo(b)fluoranthene, TEF = 0.1;
- dibenzo(a,h)anthracene, TEF = 1.0;
- benzo(k)fluoranthene, TEF = 0.01;
- chrysene, TEF = 0.001; and
- indeno(1,2,3-cd)pyrene, TEF = 0.1.

If any cPAHs were detected at a sample location, the BaPEq concentration was calculated for the location by multiplying the concentration of each cPAH by the appropriate TEF and summing these values. If any of the cPAHs were not detected in a sample, then half the detection limit of the PAH was used as a surrogate concentration. If no cPAHs were detected at a sample location, then the BaPEq concentration was calculated by using half the detection limit for benzo(a)pyrene. As with other analytes, the maximum BaPEq concentration in an environmental media was used to estimate potential risks. A summary of the calculated values for BaPEq concentrations for sample locations with cPAH detections in the subsurface soil (2 to 15 feet) is presented in Appendix B-1, Table B-1. The statistics for the calculation of the 95 percent UCL concentration for BaPEq is included in Appendix B-1 (page B-1-4).

### 1.4 Risk Characterization

Risk characterization evaluates the potential for adverse effects from exposure to COPC concentrations in environmental media by integrating information developed during the exposure and toxicity assessments. As noted previously, the exposure and toxicity assessments for this human health risk screening assessment are largely addressed during the development of the PRGs and SCTLs.

Risk characterization for the risk-screening of Site 32 consists of calculating a ratio between the EPC of a constituent in an environmental medium and the PRG and soil screening levels (SSLs) developed for construction workers using methodology presented in Supplemental Guidance For Developing Soil Screening Levels For Superfund Sites, December 2002, Office of Solid Waste and Emergency Response (OSWER) 9355.4-24. Carcinogenic and non-carcinogenic effects were evaluated separately. The algorithms to perform these calculations are presented in the following sections. Ratios were calculated for both the residential land-use scenario and a construction worker land-use scenario. The human health risk estimates produced for the residential scenario are not reflective of actual current or anticipated future conditions at the sites under investigation because the current and anticipated land use at the sites is military industrial, and the only likely exposure to subsurface soil at Site 32 would be by a

construction (excavation) worker. However, the risk characterization based on exposure assumptions reflecting a residential land-use scenario is conservative and is helpful for information and comparison purposes.

**Human Health Effects – Carcinogens**

The following equation is used to evaluate constituents having potential or known carcinogenic effects.

$$ELCR = \sum (C_{EPC} / SL) x 10^{-6}$$

where:

| | | |
|---|---|---|
| ELCR | = | Excess Lifetime Cancer Risk |
| $C_{EPC}$ | = | Exposure point concentration (mg/kg) |
| SL | = | Screening level (PRG or SSL) |
| $10^{-6}$ | = | Cancer risk at the screening level concentration |

Multiplying the $C_{EPC}$/SL ratio by 1.0E-06, USEPA's point-of-departure cancer risk level, produces a risk estimate for the detected constituent. The ELCR values for all COPCs are summed to account for potential carcinogenic effects associated with multiple constituent exposures. Because additivity of cancer risks is calculated directly in this manner, the individual screening levels used in the above equation represent the actual PRGs as published or SSLs as calculated and do not require any further adjustment for multiple constituent exposures as was done earlier for the COPC selection step.

The total ELCR is compared to the USEPA's cancer risk benchmarks to determine whether remediation may be necessary. USEPA has defined the range of 1.0E-04 to 1.0E-06 as the ELCR "target range" for most hazardous waste facilities evaluated. Cumulative ELCRs greater than 1.0E-04 generally indicate USEPA will require some degree of remediation, and ELCRs below 1.0E-06 normally will not require USEPA initiate remedial efforts. A 1.0E-04 ELCR estimate corresponds to one potential additional cancer in an exposed population of 10,000 individuals; a 1.0E-06 ELCR estimate corresponds to one potential additional cancer in an exposed population of 1,000,000 individuals.

**Human Health Effects – Non-carcinogens**

The potential for adverse non-carcinogenic health effects was evaluated using the following equation. The resultant HQs and hazard indices (HIs) reflect the potential for adverse non-carcinogenic health effects.

$$HQ = C_{EPC} / SL$$
$$HI = \sum HQ$$

where:

| | | |
|---|---|---|
| HQ | = | Hazard Quotient |
| $C_{EPC}$ | = | Exposure point concentration (mg/kg) |
| SL | = | Screening level (PRG or SSL) |
| HI | = | Hazard Index |

Additivity of non-carcinogenic effects is measured by summing the HQs associated with each affected target organ. For a given target organ, if the value of the HI exceeds unity (1.0), the potential for non-carcinogenic health risks associated with exposure to the particular constituent mixture cannot be ruled out. In the above equation, the individual screening levels used for each constituent represent the actual PRGs as published or SSLs as calculated and do not require any further adjustment for multiple constituent exposures as was done earlier for the COPC selection step.

### 1.4.1 Results

Revised cancer risk estimates and HIs calculated for the subsurface soil COPCs are presented in Table 1-3.

The ELCR calculated for the hypothetical future resident and the typical construction worker (based on PRGs and construction worker SSLs), are 4.75E-05 and 9.4E-07, respectively. The risk estimate for the construction worker does not exceed the FDEP benchmark of 1.0E-06 (Chapter 62-780 F.A.C.). The risk estimate for the hypothetical resident does exceed the FDEP benchmark of 1.0E-06, although it is within the USEPA target risk range often used to evaluate the need for remediation. BaPEq is the main risk driver; however, benzo(a)pyrene and other cPAHs were detected in only four of 28 total samples. The total HI exceeds unity for the hypothetical future resident (HI = 3.10), but does not exceed unity for the construction worker (HI = 0.01). HIs calculated on a target organ specific basis for the resident and for the construction worker do not exceed 1.0.

## 1.5 Uncertainty Analysis

Uncertainty in risk evaluation is discussed in the RI Report (TtNUS, 1999). Uncertainties associated specifically with this re-evaluation of Site 32 subsurface soil are provided in this section.

**Constituents Potentially Attributable to Background**

COPCs were selected using available background concentrations in soil. Twice the mean of the background values was selected as the representative background concentration and was used to conservatively screen detected concentrations of inorganics. This method of screening inorganic compounds may result in retaining inorganic compounds as COPCs otherwise omitted as COPCs based

# TABLE 1-3
## SUMMARY OF REVISED RECEPTOR RISKS AND HAZARDS FOR COPCs - SUBSURFACE SOIL
## SITE 32
## NAS WHITING FIELD, MILTON, FLORIDA

| Constituent of Potential Concern | Concentration (maximum) (mg/kg) | Excess Lifetime Carcinogenic Risk (ELCR) | | | | Estimated Non-Carcinogenic Hazard Quotient (HQ) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | EPA IX PRG[1] | Estimated Residential ELCR | Construction Worker SSL [2] | Estimated Construction ELCR | Primary Target Organs[3] | EPA IX PRG[1] | Estimated Residential HQ | Construction Worker SSL [2] | Estimated Construction HQ |
| M-Xylenes | 39 | NA | NA | NA | NA | Body Weight - Mortality - Neurological | 275 | 0.14 | 48000 | 0.001 |
| Naphthalene | 6.8 | NA | NA | NA | NA | Body Weight - Nasal | 56 | 0.12 | 4500 | 0.002 |
| Tetrachloroethene | 1.02 | 1.5 | 6.8E-07 | 40 | 2.6E-08 | NA | NA | NA | NA | NA |
| Trichloroethene | 0.82 | 0.05 | **1.6E-05** | 54 | 1.5E-08 | NA | NA | NA | NA | NA |
| Xylenes, Total | 5.31 | NA | NA | NA | NA | Body Weight - Mortality - Neurological | 275 | 0.02 | 48000 | 0.000 |
| 1,2,4-Trimethylbenzene | 63 | NA | NA | NA | NA | None specified | 51.6 | 1.22 | 15000 | 0.004 |
| 1,3,5-Trimethylbenzene | 26 | NA | NA | NA | NA | None specified | 21.3 | 1.22 | 15000 | 0.002 |
| 1-Methylnaphthalene [4] | 11 | NA | NA | NA | NA | Body Weight - Nasal | 56 | 0.20 | 4500 | 0.002 |
| 2-Methylnaphthalene [4] | 10 | NA | NA | NA | NA | Body Weight - Nasal | 56 | 0.18 | 4500 | 0.00 |
| Benzo(a)pyrene (equivalent) | 1.88 | 0.062 | **3.0E-05** | 2.1 | **9.0E-07** | NA | NA | NA | NA | NA |
| | Total Carcinogenic Risk | | **4.7E-05** | | **9.4E-07** | | Total HI | **3.10** | | 0.01 |

**Target Organ HIs - Residential**

| | |
|---|---|
| Total Body Weight HI = | 0.66 |
| Total Mortality HI = | 0.16 |
| Total Neurological HI = | 0.16 |
| Total Nasal HI = | 0.50 |

**Target Organ HIs - Industrial**

| | |
|---|---|
| Total Body Weight HI = | 0.01 |
| Total Mortality HI = | 0.001 |
| Total Neurological HI = | 0.001 |
| Total Nasal HI = | 0.01 |

(1) Residential Region IX Preliminary Remediation Goal (PRG) Table, October, 2002

(2) Construction Worker Soil Screening Levels (SSLs) developed using methodology presented in Supplemental Guidance For Developing Soil Screening Levels For Superfund Sites, December 2002, OSWER 9355.4-24.

(3) Target organs from Technical Report: Development of Soil Clean-up Levels for Chapter 62-777, F.A.C. (May 1999)

(4) PRG and SSL values are those for naphthalene.

NA - Not applicable. The USEPA has either not established a cancer slope factor (CSF) or non-carcinogenic reference dose (RfD) for this constituent.

**Bold** indicates result exceeds 1E-06 for Carcinogenic Risk or 1.0 for Hazard Index

on a more rigorous background evaluation, such as statistical testing. Therefore, overall site-related risks from soil may be overestimated by the background screening process.

A few constituents detected at the sites under investigation do not have screening levels. Surrogate values were chosen. Detected concentrations of phenanthrene and benzo(g,h,i)perylene were screened against 1/10$^{th}$ the values for pyrene. Detected concentrations of m-xylenes and o-xylenes were screened against 1/10$^{th}$ the values for total xylenes. Detected concentrations of total 1,2-dichloroethene were screened against 1/10$^{th}$ the values for (cis)-1,2-dichloroethene. Detected concentrations of 1-methylnaphthalene and 2-methylnaphthalene were screened against 1/10$^{th}$ the values for naphthalene. Detected concentrations of p-isopropyltoluene were screened against 1/10$^{th}$ the values for isopropylbenzene. In each case, the surrogate screening value was chosen to be as close as possible the actual constituent, thereby limiting the uncertainty added. Surrogates were chosen to be conservative and are not expected to add significantly to the underestimation of risk.

**Exposure Routes and Receptor Identification**

The USEPA Region IX PRGs and the FDEP SCTLs were calculated based on a combination of ingestion, dermal exposure, and inhalation pathways. Therefore, there was no underestimation of risks by the omission of exposure routes.

**Exposure Parameters**

The exposure factors (e.g., exposure frequency and duration) used to calculate the USEPA Region IX PRGs and FDEP SCTLs are based on reasonable maximum exposure (RME) assumptions. Generally, exposure factors are based on surveys of physiological and lifestyle profiles across the United States. The attributes and activities studied in these surveys generally have a broad distribution. To avoid underestimation of potential risks, the USEPA and the FDEP used RME exposure factors values in the development of the Region IX PRGs and FDEP SCTLs used in this risk evaluation. Therefore, the risk is not likely to be underestimated for maximum exposed individuals and is more likely to be overestimated for the general populations exposed to the constituents in the environmental media at the sites.

# APPENDIX B-1

# SUMMARY OF
# BaPEq CONCENTRATIONS
# SITE 32
# NAS WHITING FIELD, MILTON, FLORIDA

**TABLE B-1**
**SUMMARY OF BaPEq CONCENTRATIONS - SUBSURFACE SOIL**
**SITE 32**
**NAS WHITING FIELD, MILTON, FLORIDA**

| Boring | Calculated Value (ug/kg) |
|---|---|
| | |
| 32-C-B-01 | 1816.06 |
| 32-C-B-02 | 1755.33 |
| 32-C-EW | 2582.65 |
| 32-C-NW | 1800 |
| 32-C-SW | 1025.45 |
| 32-C-WW | 185 |
| 32SB1-10-12(93) | 190 |
| 32SB1-5-7(93) | 195 |
| 32SB2-12-14(93) | 190 |
| 32SB2-5-7(93) | 185 |
| 32SB3-10-12(93) | 195 |
| 32SB3-5-7(93) | 180 |
| 32SB5-10-12(93) | 190 |
| 32SB5-5-7(93) | 195 |
| 32SB6-10-12(93) | 200 |
| 32SB6-5-7(93)-D | 185 |
| 32SB7-5-7(93) | 185 |
| 32SB8-13-15(93) | 190 |
| 32SB8-5-7(93) | 180 |
| W32SB01201 | 55 |
| W32SB01801 | 55 |
| W32SB01901 | 55 |
| WR-SB01(10-12) | 4750* |
| WR-SB01(5-7)-D | 4750* |
| WR-SB02(10-12) | 4800* |
| WR-SB02(5-7) | 1750* |
| WR-SB03(10-12) | 4800* |
| WR-SB03(5-7) | 4700* |

Notes:

If concentrations were below detection limits for all carcinogenic PAHs at any one sample location, one half the detection limit for benzo(a)pyrene is given.
* The detection limit for these samples was unusually high.

**GENERAL STATISTICS**
**CALCULATION OF 95% UCL FOR BaPEq - SUBSURFACE SOIL**
**SITE 32**
**NAS WHITING FIELD, MILTON, FLORIDA**

From File C:\ProUCL\Data\Whiting Site 32 cpahs.xls

| Summary Statistics for | bap equiv |
|---|---|
| Number of Samples | 28 |
| Minimum | 55 |
| Maximum | 4800 |
| Mean | 1333.553 |
| Median | 195 |
| Standard Deviation | 1768.17 |
| Variance | 3126424 |
| Coefficient of Variation | 1.325909 |
| Skewness | 1.271519 |

| 95 % UCL (Assuming Normal Data) | |
|---|---|
| Student's-t | 1902.711 |

| 95 % UCL (Adjusted for Skewness) | |
|---|---|
| Adjusted-CLT | 1968.982 |
| Modified-t | 1916.094 |

| 95 % Non-parametric UCL | |
|---|---|
| CLT | 1883.185 |
| Jackknife | 1902.711 |
| Standard Bootstrap | 1880.319 |
| Bootstrap-t | 2039.187 |
| Chebyshev (Mean, Std) | 2790.091 |

| Summary Statistics for | ln(bap equiv) |
|---|---|
| Minimum | 4.007333185 |
| Maximum | 8.476371197 |
| Mean | 6.159350597 |
| Standard Deviation | 1.525925682 |
| Variance | 2.328449187 |
| Shapiro-Wilk Test Statisitic | 0.823116871 |
| Shapiro-Wilk 5% Critical Value | 0.924 |
| Data not Lognormal at 5% Significance Level | |
| Data not Normal: Try Non-parametric UCL | |

| Estimates Assuming Lognormal Distribution | |
|---|---|
| MLE Mean | 1515.6129 |
| MLE Standard Deviation | 4612.54936 |
| MLE Coefficient of Variation | 3.043355832 |
| MLE Skewness | 37.31767401 |
| MLE Median | 473.1207292 |
| MLE 80% Quantile | 1717.728056 |
| MLE 90% Quantile | 3361.575691 |
| MLE 95% Quantile | 5822.577687 |
| MLE 99% Quantile | 16459.42818 |
| MVU Estimate of Median | 453.8248442 |
| MVU Estimate of Mean | 1397.247892 |
| MVU Estimate of Std. Dev. | 3198.563619 |
| MVU Estimate of SE of Mean | 506.2615553 |

| UCL Assuming Lognormal Distribution | |
|---|---|
| 95% H-UCL | 3861.940918 |
| 95% Chebyshev (MVUE) UCL | 3603.99085 |
| 99% Chebyshev (MVUE) UCL | 6434.486765 |

# APPENDIX C

# SUMMARY OF CONSTITUENTS REMAINING IN SURFACE AND SUBSURFACE SOIL

TABLE C-1
Constituents Remaining in Surface Soil at Site 32
NAS Whiting Filed, Milton,Florida

| SAMPLE IDENTIFICATION | SAMPLE CODE | SAMPLE DATE | TOP_DEPTH | BOTTOM_DEP | PARAMETER | DATA QUALIFIER | UNITS | CONCENTRATION | FDEP Residential DE 1999 | USEPA Region 9 Residential 2002 | FDEP Industrial DE 1999 | USEPA Region 9 Industrial 2002 | Exceeds FDEP Residential DE 1999 | Exceeds USEPA Region 9 Residential 2002 | Exceeds FDEP Industrial DE 1999 | Exceeds USEPA Region 9 Industrial 2002 | **Exceeds at least one Criteria** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32SB3-0-2 | ORIG | 1/12/1993 | 0 | 2 | ARSENIC | J | MG/KG | 0.91 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB3-0-2-AVG | AVG | 1/12/1993 | 0 | 2 | ARSENIC | J | MG/KG | 0.81 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB7-0-2 | NORMAL | 1/20/1993 | 0 | 2 | ARSENIC | | MG/KG | 2.8 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB1-1-2 | NORMAL | 1/9/1993 | 1 | 2 | VANADIUM | | MG/KG | 25.3 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB2-0-2 | NORMAL | 1/9/1993 | 0 | 2 | VANADIUM | | MG/KG | 36.8 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB3-0-2 | ORIG | 1/12/1993 | 0 | 2 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 401 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32SB3-0-2-AVG | AVG | 1/12/1993 | 0 | 2 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 592.5 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32SB3-0-2-D | DUP | 1/12/1993 | 0 | 2 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 784 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32SB6-0-2 | NORMAL | 1/12/1993 | 0 | 2 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 12300 | 340 | | 2500 | | Yes | Screening Value Not Available | Yes | Screening Value Not Available | **Yes** |
| 32SB7-0-2 | NORMAL | 1/20/1993 | 0 | 2 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 7180 | 340 | | 2500 | | Yes | Screening Value Not Available | Yes | Screening Value Not Available | **Yes** |

TABLE C-2
Constituents Remaining in Subsurface Soil at Site 32
NAS Whiting Field, Milton Florida

| SAMPLE IDENTIFICATION | SAMPLE CODE | SAMPLE DATE | TOP DEPTH | BOTTOM DEPTH | PARAMETER | DATA QUALIFIER | UNITS | CONCENTRATION | FDEP Residential DE 1999 | USEPA Region 9 Residential 2002 | FDEP Industrial DE 1999 | USEPA Region 9 Industrial 2002 | Exceeds FDEP Residential DE 1999 | Exceeds USEPA Region 9 Residential 2002 | Exceeds FDEP Industrial DE 1999 | Exceeds USEPA Region 9 Industrial 2002 | **Exceeds at least one Criteria** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32-C-EW | NORMAL | 8/23/2000 | 0 | 8 | 1,2,4-TRIMETHYLBENZENE | | UG/KG | 63 | 13 | 51.6 | 88 | 170 | Yes | Yes | No | No | **Yes** |
| 32SBB0212 | NORMAL | 6/28/2001 | 10 | 12 | 1,2,4-TRIMETHYLBENZENE | | UG/KG | 84.7 | 13 | 51.6 | 88 | 170 | Yes | Yes | No | No | **Yes** |
| 32-C-EW | NORMAL | 8/23/2000 | 0 | 8 | 1,3,5-TRIMETHYLBENZENE | | UG/KG | 26 | 11 | 21.3 | 74 | 69.7 | Yes | Yes | No | No | **Yes** |
| 32SBB0212 | NORMAL | 6/28/2001 | 10 | 12 | 1,3,5-TRIMETHYLBENZENE | | UG/KG | 32.5 | 11 | 21.3 | 74 | 69.7 | Yes | Yes | No | No | **Yes** |
| 32-C-B-01 | NORMAL | 8/23/2000 | 0 | 10 | ARSENIC | | MG/KG | 2.6 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32-C-B-02 | NORMAL | 8/23/2000 | 0 | 10 | ARSENIC | | MG/KG | 2.8 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32-C-EW | NORMAL | 8/23/2000 | 0 | 8 | ARSENIC | | MG/KG | 4.7 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | Yes | No | **Yes** |
| 32-C-NW | NORMAL | 8/23/2000 | 0 | 8 | ARSENIC | | MG/KG | 1.2 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32-C-SW | NORMAL | 8/23/2000 | 0 | 8 | ARSENIC | | MG/KG | 3.1 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32-C-WW | NORMAL | 8/23/2000 | 0 | 8 | ARSENIC | | MG/KG | 7.8 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | Yes | No | **Yes** |
| 32SB1-5-7 | NORMAL | 1/9/1993 | 5 | 7 | ARSENIC | J | MG/KG | 0.91 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB2-12-14 | NORMAL | 1/12/1993 | 12 | 14 | ARSENIC | J | MG/KG | 1 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB2-5-7 | NORMAL | 1/12/1993 | 5 | 7 | ARSENIC | J | MG/KG | 0.81 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB3-0-2 | ORIG | 1/12/1993 | 0 | 2 | ARSENIC | J | MG/KG | 0.91 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB3-0-2-AVG | AVG | 1/12/1993 | 0 | 2 | ARSENIC | J | MG/KG | 0.81 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB3-10-12 | NORMAL | 1/12/1993 | 10 | 12 | ARSENIC | J | MG/KG | 1.3 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB3-5-7 | NORMAL | 1/12/1993 | 5 | 7 | ARSENIC | J | MG/KG | 1.1 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB4-15-17 | NORMAL | 1/12/1993 | 15 | 17 | ARSENIC | J | MG/KG | 2.1 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB5-10-12 | NORMAL | 1/19/1993 | 10 | 12 | ARSENIC | J | MG/KG | 1.8 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB5-1-2 | NORMAL | 1/19/1993 | 1 | 2 | ARSENIC | J | MG/KG | 2.3 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB5-20-22 | NORMAL | 1/19/1993 | 20 | 22 | ARSENIC | J | MG/KG | 1.6 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB5-45-47 | ORIG | 1/19/1993 | 45 | 47 | ARSENIC | J | MG/KG | 1.1 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB5-45-47-AVG | AVG | 1/19/1993 | 45 | 47 | ARSENIC | J | MG/KG | 1.25 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB5-45-47-D | DUP | 1/19/1993 | 45 | 47 | ARSENIC | J | MG/KG | 1.4 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB5-5-7 | NORMAL | 1/19/1993 | 5 | 7 | ARSENIC | J | MG/KG | 2.1 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB6-10-12 | NORMAL | 1/12/1993 | 10 | 12 | ARSENIC | | MG/KG | 3.3 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB6-5-7 | ORIG | 1/11/1993 | 5 | 7 | ARSENIC | J | MG/KG | 1.8 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB6-5-7-AVG | AVG | 1/11/1993 | 5 | 7 | ARSENIC | J | MG/KG | 1.75 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB6-5-7-D | DUP | 1/11/1993 | 5 | 7 | ARSENIC | J | MG/KG | 1.7 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB7-0-2 | NORMAL | 1/20/1993 | 0 | 2 | ARSENIC | | MG/KG | 2.8 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB7-15-17 | NORMAL | 1/20/1993 | 15 | 17 | ARSENIC | J | MG/KG | 1.8 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB7-5-7 | NORMAL | 1/20/1993 | 5 | 7 | ARSENIC | | MG/KG | 2.7 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB8-13-15 | NORMAL | 1/21/1993 | 13 | 15 | ARSENIC | J | MG/KG | 1.2 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| 32SB8-5-7 | NORMAL | 1/21/1993 | 5 | 7 | ARSENIC | | MG/KG | 2.5 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| BKB00701 | NORMAL | 5/21/1996 | 5 | 7 | ARSENIC | | MG/KG | 5.4 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | Yes | No | **Yes** |
| BKB00702 | NORMAL | 5/21/1996 | 10 | 12 | ARSENIC | | MG/KG | 5.3 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | Yes | No | **Yes** |
| W32SB01704 | NORMAL | 3/4/1998 | 79 | 81 | ARSENIC | | MG/KG | 2.4 | 0.8 | 21.7 | 3.7 | 256 | Yes | No | No | No | **Yes** |
| WR-SB03_15-17 | NORMAL | 7/30/1993 | 15 | 17 | BENZENE | J | UG/KG | 1.4 | 1.1 | 0.601 | 1.6 | 1.32 | Yes | Yes | No | Yes | **Yes** |
| 32-C-B-01 | NORMAL | 8/23/2000 | 0 | 10 | BENZO(A)ANTHRACENE | J | UG/KG | 1.3 | 1.4 | 0.622 | 5 | 2.11 | No | Yes | No | No | **Yes** |
| 32-C-B-02 | NORMAL | 8/23/2000 | 0 | 10 | BENZO(A)ANTHRACENE | J | UG/KG | 1.1 | 1.4 | 0.622 | 5 | 2.11 | No | Yes | No | No | **Yes** |
| 32-C-EW | NORMAL | 8/23/2000 | 0 | 8 | BENZO(A)ANTHRACENE | J | UG/KG | 0.82 | 1.4 | 0.622 | 5 | 2.11 | No | Yes | No | No | **Yes** |
| 32-C-SW | NORMAL | 8/23/2000 | 0 | 8 | BENZO(A)ANTHRACENE | | UG/KG | 1 | 1.4 | 0.622 | 5 | 2.11 | No | Yes | No | No | **Yes** |
| 32-C-B-01 | NORMAL | 8/23/2000 | 0 | 10 | BENZO(A)PYRENE | J | UG/KG | 0.58 | 0.1 | 0.0622 | 0.5 | 0.211 | Yes | Yes | Yes | Yes | **Yes** |
| 32-C-B-02 | NORMAL | 8/23/2000 | 0 | 10 | BENZO(A)PYRENE | J | UG/KG | 0.55 | 0.1 | 0.0622 | 0.5 | 0.211 | Yes | Yes | Yes | Yes | **Yes** |
| 32-C-EW | NORMAL | 8/23/2000 | 0 | 8 | BENZO(A)PYRENE | J | UG/KG | 0.44 | 0.1 | 0.0622 | 0.5 | 0.211 | Yes | Yes | No | Yes | **Yes** |
| 32-C-SW | NORMAL | 8/23/2000 | 0 | 8 | BENZO(A)PYRENE | | UG/KG | 0.61 | 0.1 | 0.0622 | 0.5 | 0.211 | Yes | Yes | Yes | Yes | **Yes** |
| 32-C-B-01 | NORMAL | 8/23/2000 | 0 | 10 | BENZO(B)FLUORANTHENE | J | UG/KG | 1.1 | 1.4 | 0.622 | 4.8 | 2.11 | No | Yes | No | No | **Yes** |
| 32-C-B-02 | NORMAL | 8/23/2000 | 0 | 10 | BENZO(B)FLUORANTHENE | J | UG/KG | 1 | 1.4 | 0.622 | 4.8 | 2.11 | No | Yes | No | No | **Yes** |
| 32-C-SW | NORMAL | 8/23/2000 | 0 | 8 | BENZO(B)FLUORANTHENE | | UG/KG | 1.1 | 1.4 | 0.622 | 4.8 | 2.11 | No | Yes | No | No | **Yes** |
| 32SB0107 | NORMAL | 6/28/2001 | 5 | 7 | IRON | | MG/KG | 24900 | 23000 | 23500 | 480000 | 100000 | Yes | Yes | No | No | **Yes** |
| 32-C-B-01 | NORMAL | 8/23/2000 | 0 | 10 | TETRACHLOROETHENE | | UG/KG | 4.1 | 8.9 | 1.51 | 17 | 3.42 | No | Yes | No | Yes | **Yes** |
| 32-C-B-02 | NORMAL | 8/23/2000 | 0 | 10 | TETRACHLOROETHENE | | UG/KG | 4.2 | 8.9 | 1.51 | 17 | 3.42 | No | Yes | No | Yes | **Yes** |
| 32-C-SW | NORMAL | 8/23/2000 | 0 | 8 | TETRACHLOROETHENE | | UG/KG | 2.6 | 8.9 | 1.51 | 17 | 3.42 | No | Yes | No | No | **Yes** |
| WR-SB01_5-7-D | DUP | 7/30/1993 | 5 | 7 | TETRACHLOROETHENE | J | UG/KG | 1.7 | 8.9 | 1.51 | 17 | 3.42 | No | Yes | No | No | **Yes** |
| 32-C-B-01 | NORMAL | 8/23/2000 | 0 | 10 | TRICHLOROETHENE | | UG/KG | 3.6 | 6 | 0.053 | 8.5 | 0.115 | No | Yes | No | Yes | **Yes** |
| 32-C-B-02 | NORMAL | 8/23/2000 | 0 | 10 | TRICHLOROETHENE | | UG/KG | 3.6 | 6 | 0.053 | 8.5 | 0.115 | No | Yes | No | Yes | **Yes** |
| 32-C-SW | NORMAL | 8/23/2000 | 0 | 8 | TRICHLOROETHENE | | UG/KG | 0.33 | 6 | 0.053 | 8.5 | 0.115 | No | Yes | No | Yes | **Yes** |
| WR-SB01_15-17 | NORMAL | 7/30/1993 | 15 | 17 | TRICHLOROETHENE | J | UG/KG | 1.3 | 6 | 0.053 | 8.5 | 0.115 | No | Yes | No | Yes | **Yes** |
| WR-SB01_20-22 | NORMAL | 7/30/1993 | 20 | 22 | TRICHLOROETHENE | J | UG/KG | 0.29 | 6 | 0.053 | 8.5 | 0.115 | No | Yes | No | Yes | **Yes** |
| 32SB1-10-12 | NORMAL | 1/9/1993 | 10 | 12 | VANADIUM | | MG/KG | 28.3 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB1-1-2 | NORMAL | 1/9/1993 | 1 | 2 | VANADIUM | | MG/KG | 25.3 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB1-15-17 | ORIG | 1/11/1993 | 15 | 17 | VANADIUM | | MG/KG | 15.6 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB1-5-7 | NORMAL | 1/9/1993 | 5 | 7 | VANADIUM | | MG/KG | 18.7 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB2-0-2 | NORMAL | 1/9/1993 | 0 | 2 | VANADIUM | | MG/KG | 36.8 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB2-12-14 | NORMAL | 1/12/1993 | 12 | 14 | VANADIUM | | MG/KG | 15.2 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB2-5-7 | NORMAL | 1/12/1993 | 5 | 7 | VANADIUM | | MG/KG | 20.4 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB3-10-12 | NORMAL | 1/12/1993 | 10 | 12 | VANADIUM | | MG/KG | 15.8 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB3-5-7 | NORMAL | 1/12/1993 | 5 | 7 | VANADIUM | | MG/KG | 15.5 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB4-15-17 | NORMAL | 1/12/1993 | 15 | 17 | VANADIUM | | MG/KG | 50.5 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB5-10-12 | NORMAL | 1/19/1993 | 10 | 12 | VANADIUM | | MG/KG | 25.4 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB5-1-2 | NORMAL | 1/19/1993 | 1 | 2 | VANADIUM | | MG/KG | 29.3 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB5-5-7 | NORMAL | 1/19/1993 | 5 | 7 | VANADIUM | | MG/KG | 43.1 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB6-10-12 | NORMAL | 1/12/1993 | 10 | 12 | VANADIUM | | MG/KG | 42.4 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB6-5-7 | ORIG | 1/11/1993 | 5 | 7 | VANADIUM | | MG/KG | 23.2 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB6-5-7-AVG | AVG | 1/11/1993 | 5 | 7 | VANADIUM | | MG/KG | 23.75 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB6-5-7-D | DUP | 1/11/1993 | 5 | 7 | VANADIUM | | MG/KG | 24.3 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| 32SB7-5-7 | NORMAL | 1/20/1993 | 5 | 7 | VANADIUM | | MG/KG | 19.2 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| BKB00701 | NORMAL | 5/21/1996 | 5 | 7 | VANADIUM | | MG/KG | 27.6 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| BKB00702 | NORMAL | 5/21/1996 | 10 | 12 | VANADIUM | | MG/KG | 30.8 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| W32SB01001 | NORMAL | 3/10/1998 | 18 | 20 | VANADIUM | | MG/KG | 19.5 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| W32SB01101 | NORMAL | 3/9/1998 | 16 | 18 | VANADIUM | | MG/KG | 28.7 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| W32SB01604 | NORMAL | 3/5/1998 | 85 | 87 | VANADIUM | | MG/KG | 25.2 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |
| W32SB01704 | NORMAL | 3/4/1998 | 79 | 81 | VANADIUM | | MG/KG | 22.7 | 15 | 548 | 7400 | 7150 | Yes | No | No | No | **Yes** |

TABLE C-2
Constituents Remaining in Subsurface Soil at Site 32
NAS Whiting Field, Milton Florida

| SAMPLE IDENTIFICATION | SAMPLE CODE | SAMPLE DATE | TOP DEPTH | BOTTOM DEPTH | PARAMETER | DATA QUALIFIER | UNITS | CONCENTRATION | FDEP Residential DE 1999 | USEPA Region 9 Residential 2002 | FDEP Industrial DE 1999 | USEPA Region 9 Industrial 2002 | Exceeds FDEP Residential DE 1999 | Exceeds USEPA Region 9 Residential 2002 | Exceeds FDEP Industrial DE 1999 | Exceeds USEPA Region 9 Industrial 2002 | **Exceeds at least one Criteria** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32-C-B-01 | NORMAL | 8/23/2000 | 0 | 10 | DIESEL RANGE ORGANICS (TRPH) | | MG/KG | 1700 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32-C-B-02 | NORMAL | 8/23/2000 | 0 | 10 | DIESEL RANGE ORGANICS (TRPH) | | MG/KG | 2400 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32-C-EW | NORMAL | 8/23/2000 | 0 | 8 | DIESEL RANGE ORGANICS (TRPH) | | MG/KG | 350 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32-C-NW | NORMAL | 8/23/2000 | 0 | 8 | DIESEL RANGE ORGANICS (TRPH) | | MG/KG | 1200 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32-C-SW | NORMAL | 8/23/2000 | 0 | 8 | DIESEL RANGE ORGANICS (TRPH) | | MG/KG | 960 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32-C-B-01 | NORMAL | 8/23/2000 | 0 | 10 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 1700 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32-C-B-02 | NORMAL | 8/23/2000 | 0 | 10 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 2400 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32SB3-0-2 | ORIG | 1/12/1993 | 0 | 2 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 401 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32SB3-0-2-AVG | AVG | 1/12/1993 | 0 | 2 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 592.5 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32SB3-0-2-D | DUP | 1/12/1993 | 0 | 2 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 784 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32SB6-0-2 | NORMAL | 1/12/1993 | 0 | 2 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 12300 | 340 | | 2500 | | Yes | Screening Value Not Available | Yes | Screening Value Not Available | **Yes** |
| 32SB7-0-2 | NORMAL | 1/20/1993 | 0 | 2 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 7180 | 340 | | 2500 | | Yes | Screening Value Not Available | Yes | Screening Value Not Available | **Yes** |
| 32SB7-15-17 | NORMAL | 1/20/1993 | 15 | 17 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 2580 | 340 | | 2500 | | Yes | Screening Value Not Available | Yes | Screening Value Not Available | **Yes** |
| 32SB7-30-32 | NORMAL | 1/21/1993 | 30 | 32 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 2650 | 340 | | 2500 | | Yes | Screening Value Not Available | Yes | Screening Value Not Available | **Yes** |
| 32SB7-5-7 | NORMAL | 1/20/1993 | 5 | 7 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 2310 | 340 | | 2500 | | Yes | Screening Value Not Available | No | Screening Value Not Available | **Yes** |
| 32SBB0212 | NORMAL | 6/28/2001 | 10 | 12 | TOTAL PETROLEUM HYDROCARBONS (TRPH) | | MG/KG | 3040 | 340 | | 2500 | | Yes | Screening Value Not Available | Yes | Screening Value Not Available | **Yes** |

# APPENDIX D

# ORIGINAL FS (TtNUS, 2001a)

# TABLES 6-8 AND 6-9

**Table 6-8**
**SITE 32 SOIL ALTERNATIVES**
**NAS WHITING FIELD, MILTON, FLORIDA**

| Alternative Number | Alternative Type | Representative Process Options Combined Into Alternatives | Alternative Description |
|---|---|---|---|
| Alternative S32-1 | No Action | None | • Five-year Reviews. |
| Alternative S32-2 Surface Soil (exceeding PRGs) Removal and LUCs | Containment/Limited Action – No or Limited Treatment | LUCs, Excavation, Disposal, Soil Cover | • LUCs including LUCAP and LUCIP.<br>• Delineation/confirmatory sampling of surface soil adjacent to 32SB06 and 32SB07.<br>• Excavation/disposal of surface soil (0-2 feet bgs) exceeding PRGs at 32SB06 and 32SB07.<br>• Backfill excavation with clean fill.<br>• Establish vegetative cover.<br>• Posting of warning signs.<br>• Five-Year site reviews. |
| Alternative S32-3 Soil Venting and LUCs | Containment/Limited/Treatment Action – Treatment | LUCs, In Situ Soil Venting | • LUCs including LUCAP and LUCIP.<br>• Delineation/confirmatory sampling of surface soil adjacent to 32SB06 and 32SB07.<br>• Install and operate an in situ soil venting system at location 32SB06 and 32SB07.<br>• Posting of warning signs.<br>• Five-Year site reviews. |
| Alternative S32-4 Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs | Treatment/Bulk Removal – Eliminates or Minimizes Long-Term Management | LUCs, Bulk Excavation, Disposal | • LUCs including LUCAP and LUCIP.<br>• Delineation/confirmatory sampling of surface and subsurface soil adjacent to 32SB06 and 32SB07.<br>• Demolition and removal/disposal of asphalt and concrete pavement.<br>• Excavation/disposal of surface and subsurface soil exceeding PRGs at 32SB06 and 32SB07.<br>• Backfill excavation with clean fill.<br>• Replacement of asphalt or concrete pavement.<br>• Establish vegetative cover.<br>• Posting of warning signs.<br>• Five-Year site reviews. |

Site 32 alternatives S32-1, S32-2, and S32-4 contain the same RPOs as Site 3 alternatives S3-1, S3-2, and S3-3, respectively. Alternative S32-3 contains the same RPOs as for Site 4 alternative S4-3. Refer to the discussion in Sections 2.3.4 and 3.3.4 for a brief description of these alternatives.

## 6.4 DETAILED ANALYSES OF SOIL ALTERNATIVES

The objective of the individual detailed analyses is to provide adequate information for each alternative to facilitate the selection of soil remedial actions at NAS Whiting Field. During detailed analysis of alternatives, soil remedial alternatives are assessed against the nine evaluation criteria outlined in USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988). The evaluation criteria, widely used in CERCLA investigations, are beneficial in selecting and reducing the number of remedial alternatives. Uncertainties associated with specific alternatives are included in the evaluation when changes in assumptions or unknown conditions could affect the analyses.

# Table 6-9
## SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 32
## NAS WHITING FIELD, MILTON, FLORIDA
## PAGE 1 OF 4

| Criteria | Alternative S4-1<br>No Action | Alternative S4-2<br>Surface Soil (exceeding PRGs) Removal and LUCs | Alternative S4-3<br>Soil Venting and LUCs | Alternative S4-4<br>Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs |
|---|---|---|---|---|
| **THRESHOLD CRITERIA** | | | | |
| **Overall Protection of Human Health and the Environment** | | | | |
| Human Health Protection | No reduction in risk. | Provides a high level of protection. LUCs reduce risk from residuals. Excavation, disposal, and a soil cover reduce risk of potential exposure. | Provides a high level of protection. LUCs and treatment reduce risk from residuals. | Provides highest level of protection. LUCs reduce risk from residuals. Excavation and disposal reduce risk of potential exposure. |
| Environmental Protection | Allows potential environmental impacts from fugitive dust. | Excavation and a soil cover stop fugitive dust. Natural attenuation reduces constituent concentrations of deeper impacted soils over time. | Natural attenuation and soil venting reduce constituent concentrations of impacted soils over time. | Excavation and disposal will eliminate or reduce all concentration levels in a short period of time. |
| **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)** | | | | |
| Compliance with Chemical-Specific ARARs | Does not meet ARARs. | Meets ARARs in greater than 30 years. | Meets ARARs for organics in 2 years. | Meets ARARs within 1 year. |
| Compliance with Action-Specific ARARs | Not applicable | Meets ARARs if proper PPE used during excavation, disposal, and construction of a soil cover. | Meets ARARs if proper PPE used during construction of in situ venting system. | Meets ARARs if proper PPE used during excavation and disposal. |
| Compliance with Location-Specific ARARs | Not applicable | Not applicable | Not applicable | Not applicable |
| Compliance with Other Criteria | Not applicable | Meets NAS Whiting Field requirements | Meets NAS Whiting Field requirements | Meets NAS Whiting Field requirements |
| **BALANCING CRITERIA** | | | | |
| **Long-Term Effectiveness and Permanence** | | | | |
| Reduction in Residual Risk | Natural attenuation decreases risk, however, risk is significant for >30 years. | Provides high level of long-term residual risk reduction. Risk reduced by excavation and disposal of surface-impacted soil. Natural attenuation decreases remaining risk; however, risk due to subsurface impacted soil is significant for an estimated 30 years. | Provides medium level of long-term residual risk reduction. Risk reduced by soil venting of the impacted soil. Any residual concentrations will be reduced over time through natural attenuation. | Provides highest level of long-term residual risk reduction. Risk eliminated or reduced by excavation and off-site disposal. |

## Table 6-9

## SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 32

## NAS WHITING FIELD, MILTON, FLORIDA



| Criteria | Alternative S4-1<br>No Action | Alternative S4-2<br>Surface Soil (exceeding PRGs) Removal and LUCs | Alternative S4-3<br>Soil Venting and LUCs | Alternative S4-4<br>Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs |
|---|---|---|---|---|
| Long-Term Reliability of Controls | Not applicable | Provides a high level of reliability if soil cover is maintained. | Provides a high level of reliability because of proven technology, and if the soil cover is maintained. | Provides highest level of reliability. Controls are adequate and reliable. |
| Need for 5-Year Review | Required | Required | Required | Required |
| Prevention of Exposure to Residuals | All constituents remain. Direct contact and incidental ingestion are not controlled. | Direct excavation and disposal of surface-impacted soil reduce exposure to residuals. Exposure risk reduced by LUCs and a soil cover. | Direct excavation and disposal of surface-impacted soil reduce exposure to residuals. Exposure risk reduced by LUCs. | Exposure to residuals is eliminated or reduced by excavation and disposal as well as enforced LUCs. |
| Potential Need for Replacement of Technical Components after Remedial Objectives Are Achieved | Not applicable | Soil cover may require replacement or repair. | No technical components required. | No technical components required. |
| Long-Term Management | Not applicable | Management required for estimated 30 years. | Management required for estimated 30 years. | Minimum management required for estimated 30 year. |
| **Reduction of Mobility, Toxicity, or Volume through Treatment** | | | | |
| Amount Destroyed or Treated | None | Excavated surface soil is disposed of off site. Remaining soil will naturally attenuate over time. A soil cover is for containment only. | Organic compound removal is about 90%. | All impacted soil exceeding PRGs is excavated and disposed. Removal efficiency estimated >95%. |
| Reduction in Mobility, Toxicity, or Volume | Toxicity may be reduced through natural attenuation. | Mobility reduced by excavation and a soil cover. Toxicity of excavated soils may be reduced in an off-site TSDF. Toxicity of remaining soils may be reduced through natural attenuation. | Toxicity is reduced by treatment and natural attenuation. | Mobility reduced by excavation and disposal. Toxicity of excavated soils may be reduced in an off-site TSDF. |
| Irreversibility of Treatment | Natural attenuation is an irreversible process. | Off-site TSDF treatment and natural attenuation are irreversible processes. | Off-site TSDF treatment, soil venting and natural attenuation are irreversible processes. | Off-site TSDF treatment is an irreversible process. |
| Type and Quantity of Residuals Remaining after Treatment | All residuals of organics left from natural attenuation. | Minor organic residuals remain above industrial action levels. | No residuals remain above industrial action levels. | No residuals remain above industrial action levels. |

## Table 6-9

## SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 32

## NAS WHITING FIELD, MILTON, FLORIDA



| Criteria | Alternative S4-1<br>No Action | Alternative S4-2<br>Surface Soil (exceeding PRGs) Removal and LUCs | Alternative S4-3<br>Soil Venting and LUCs | Alternative S4-4<br>Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs |
|---|---|---|---|---|
| Long-Term Reliability of Controls | Not applicable | Provides a high level of reliability if soil cover is maintained. | Provides a high level of reliability because of proven technology, and if the soil cover is maintained. | Provides highest level of reliability. Controls are adequate and reliable. |
| Need for 5-Year Review | Required | Required | Required | Required |
| Prevention of Exposure to Residuals | All constituents remain. Direct contact and incidental ingestion are not controlled. | Direct excavation and disposal of surface-impacted soil reduce exposure to residuals. Exposure risk reduced by LUCs and a soil cover. | Direct excavation and disposal of surface-impacted soil reduce exposure to residuals. Exposure risk reduced by LUCs. | Exposure to residuals is eliminated or reduced by excavation and disposal as well as enforced LUCs. |
| Potential Need for Replacement of Technical Components after Remedial Objectives Are Achieved | Not applicable | Soil cover may require replacement or repair. | No technical components required. | No technical components required. |
| Long-Term Management | Not applicable | Management required for estimated 30 years. | Management required for estimated 30 years. | Minimum management required for estimated 30 year. |
| **Reduction of Mobility, Toxicity, or Volume through Treatment** | | | | |
| Amount Destroyed or Treated | None | Excavated surface soil is disposed of off site. Remaining soil will naturally attenuate over time. A soil cover is for containment only. | Organic compound removal is about 90%. | All impacted soil exceeding PRGs is excavated and disposed. Removal efficiency estimated >95%. |
| Reduction in Mobility, Toxicity, or Volume | Toxicity may be reduced through natural attenuation. | Mobility reduced by excavation and a soil cover. Toxicity of excavated soils may be reduced in an off-site TSDF. Toxicity of remaining soils may be reduced through natural attenuation. | Toxicity is reduced by treatment and natural attenuation. | Mobility reduced by excavation and disposal. Toxicity of excavated soils may be reduced in an off-site TSDF. |
| Irreversibility of Treatment | Natural attenuation is an irreversible process. | Off-site TSDF treatment and natural attenuation are irreversible processes. | Off-site TSDF treatment, soil venting and natural attenuation are irreversible processes. | Off-site TSDF treatment is an irreversible process. |
| Type and Quantity of Residuals Remaining after Treatment | All residuals of organics left from natural attenuation. | Minor organic residuals remain above industrial action levels. | No residuals remain above industrial action levels. | No residuals remain above industrial action levels. |

## Table 6-9
## SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 32
## NAS WHITING FIELD, MILTON, FLORIDA
## PAGE 4 OF 4

| Criteria | Alternative S4-1 No Action | Alternative S4-2 Surface Soil (exceeding PRGs) Removal and LUCs | Alternative S4-3 Soil Venting and LUCs | Alternative S4-4 Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs |
|---|---|---|---|---|
| Ability to Monitor Effectiveness | Not applicable | Monitoring gives notice of potential presence of contaminants in subsurface strata; monitoring also indicates excavation effectiveness. | Monitoring gives notice of treatment efficiency and progress of remediation. | Monitoring indicates excavation effectiveness and removal of contaminated areas. |
| Permitting Requirements | Not applicable | Transportation and Disposal Permit will be required. | Transportation and Disposal Permit will be required. Permit for air emissions may be required. | Transportation and Disposal Permit will be required. |
| Coordination with Other Agencies | Not applicable | All permits and/or permit modifications are obtainable. | All permits and/or permit modifications are obtainable. | All permits and/or permit modifications are obtainable. |
| Availability of Services and Capabilities | Not applicable | Readily available | Available | Readily Available |
| Availability of Equipment, Specialists, and Materials | Not applicable | Readily available | Available | Readily Available |
| **Cost**[b] | | | | |
| Capital Cost | $0 | $16,196 | $66,975 | $353,656 |
| Short-Term O&M | $0 | $0 | $24,525 | $0 |
| Long-Term O&M | | | | |
| 5-Year Review | $7,375 | $7,375 | $7,375 | $7,375 |
| Land-Use Controls | $0 | $3,092 | $2,839 | $2,839 |
| Total Project Present Worth Cost | $18,008 | $73,286 | $189,620 | $410,746 |

[a] Does not include testing or treatability studies.

[b] Includes capital costs, short- and long-term O&M present worth, and contingency.

# APPENDIX E

# REMEDIAL ALTERNATIVES COST ESTIMATE

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE 2: ENGINEERING CONTROLS AND LAND USE CONTROLS
CAPITAL COSTS

| Cost Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING** | | | | | | | | | | | |
| 1.1 Prepare Remedial Action Plan | 40 | hr | | | $33.79 | | $0 | $0 | $1,352 | $0 | $1,352 |
| 1.2 Project Scheduling and Procurement | 8 | hr | | | $33.79 | | $0 | $0 | $270 | $0 | $270 |
| **2 MOBILIZATION/DEMOBILIZATION** | | | | | | | | | | | |
| 2.1 Equipment Mob/Demob (Exc. & Dozier) | 0 | ea | | | $200.00 | $250.00 | $0 | $0 | $0 | $0 | $0 |
| 2.2 Mobilize/Demobilize Personnel (2-persons) | 0 | ea | | $375.00 | $300.00 | | $0 | $0 | $0 | $0 | $0 |
| **3 DECONTAMINATION** | | | | | | | | | | | |
| 3.1 Temporary Decon Pad | 0 | ls | | $250.00 | $200.00 | $75.00 | $0 | $0 | $0 | $0 | $0 |
| 3.2 Decon Water Disposal | 0 | drum | $125.00 | | | | $0 | $0 | $0 | $0 | $0 |
| 3.3 Decon Water Storage Drums | 0 | ea | | $45.00 | | | $0 | $0 | $0 | $0 | $0 |
| 3.4 PPE (2 p * 2 days) | 0 | m-day | | $30.00 | | | $0 | $0 | $0 | $0 | $0 |
| 3.5 Decontaminate Equipment (Pressure Washer) | 0 | ea | | | $134.45 | $50.00 | $0 | $0 | $0 | $0 | $0 |
| **4 SITE PREPARATION** | | | | | | | | | | | |
| 4.1 Erosion Control Fencing | 0 | lf | | $0.23 | $1.17 | | $0 | $0 | $0 | $0 | $0 |
| 4.2 Collect/Analyze Delineation Samples (TPH) | 0 | ea | $200.00 | $10.00 | $23.52 | | $0 | $0 | $0 | $0 | $0 |
| 4.3 Construction Surveys (2-man crew) | 0 | day | $648.36 | | | | $0 | $0 | $0 | $0 | $0 |
| 4.4 Utility Location and Site Delineation/Layout | 0 | hrs | | | $33.23 | | $0 | $0 | $0 | $0 | $0 |
| **5 EXCAVATION/BACKFILL** | | | | | | | | | | | |
| 5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator) | 0.00 | cy | | | $1.27 | $2.23 | $0 | $0 | $0 | $0 | $0 |
| 5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavator | 0 | hrs | | | | $20.50 | $0 | $0 | $0 | $0 | $0 |
| 5.3 Health & Safety Monitoring with OVA during Excavation | 0 | day | | | $188.16 | $100.00 | $0 | $0 | $0 | $0 | $0 |
| 5.4 Collect/Analyze Confirmatory Samples | 0 | ea | $200.00 | $10.00 | $23.52 | | $0 | $0 | $0 | $0 | $0 |
| 5.5 Import (Offsite) Place, Compact Clean Fill Material | 0.00 | cy | | $7.82 | $0.85 | $1.81 | $0 | $0 | $0 | $0 | $0 |
| 5.6 UST Removal | 0 | ea | | $340.72 | $485.04 | $1,638.12 | $0 | $0 | $0 | $0 | $0 |
| **6 OFF-SITE TRANSPORTATION/DISPOSAL** | | | | | | | | | | | |
| 6.1 Waste Profile | 0 | ls | $750.00 | | | | $0 | $0 | $0 | $0 | $0 |
| 6.2 Transport and Dispose of Soil (Non-hazard.) in Landfill | 0.00 | ton | $45.00 | | | | $0 | $0 | $0 | $0 | $0 |
| 6.3 Prepare Shipment Manifests | 0 | hrs | | | $33.23 | | $0 | $0 | $0 | $0 | $0 |
| **7 SITE RESTORATION** | | | | | | | | | | | |
| 7.1 Import Vegetative Cover Material (Topsoil) | 0.00 | cy | | $15.00 | | | $0 | $0 | $0 | $0 | $0 |
| 7.2 Place/Grade Topsoil (6") | 0 | day | | | $227.20 | $435.00 | $0 | $0 | $0 | $0 | $0 |
| 7.3 Sod Disturbed Area | 0.0000 | acre | $20,859.00 | | | | $0 | $0 | $0 | $0 | $0 |
| **8 LAND USE CONTROLS** | | | | | | | | | | | |
| 8.1 Site Survey (2-man crew) | 2 | days | $648.36 | | | | $1,297 | $0 | $0 | $0 | $1,297 |
| 8.2 Prepare Land Use Plan | 100 | hours | | | $33.79 | | $0 | $0 | $3,379 | $0 | $3,379 |
| 8.3 Modify Master Plan and Prepare Deed Restrictions | 80 | hours | | | $33.79 | | $0 | $0 | $2,703 | $0 | $2,703 |
| **Subtotal Direct Capital Costs less Subcontract** | | | | | | | | $0 | $7,704 | $0 | $7,704 |
| **Local Area Adjustment** | | | | | | | | 84% | 84% | 84% | |
| | | | | | | | | $0 | $6,471 | $0 | $6,471 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $1,941 | | $1,941 |
| G & A on Labor Cost @ 10% | | | | | | | | | $647 | | $647 |
| G & A on Material Cost @ 10% | | | | | | | | $0 | | | $0 |
| **Total Direct Capital Cost** | | | | | | | | $0 | $9,060 | $0 | $9,060 |

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE 2: ENGINEERING CONTROLS AND LAND USE CONTROLS
CAPITAL COSTS

| Cost Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Indirects on Total Direct Labor Cost @ 75% | | | | | | | | | $6,795 | | $6,795 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $906 |
| **Subtotal** | | | | | | | | | | | $16,761 |
| Health & Safety Monitoring @ 3% | | (Includes Subcontractor cost) | | | | | | | | | $542 |
| **Total Field Cost** | | | | | | | | | | | **$17,303** |
| Subtotal Subcontractor Cost | | | | | | | $1,297 | | | | $1,297 |
| G & A on Subcontract Cost @ 10% | | | | | | | $130 | | | | $130 |
| Profit on Subcontractor Cost @ 5% | | | | | | | | | | | $65 |
| **Subcontractor Cost** | | | | | | | | | | | **$1,491** |
| Contingency on Total Field and Subcontractor Costs @ 10% | | | | | | | | | | | **$1,879** |
| Engineering on Total Field and Subcontractor Costs @ 5% | | | | | | | | | | | **$940** |
| **TOTAL Capital COST** | | | | | | | | | | | **$21,613** |

**NAVAL AIR STATION WHITING FIELD**
**MILTON, FLORIDA**
**SITE 32**
**SOIL ALTERNATIVE 2: ENGINEERING CONTROLS AND LAND USE CONTROLS**
**Operation and Maintenance Costs per Year**

| | Item | Qty | Unit | Unit Cost | Subtotal Cost | Notes |
|---|---|---|---|---|---|---|
| 1 | Energy - Electric | | kWh | $0.06 | $0 | |
| 2 | Maintenance | | ls | | $0 | 5% of Installation Cost |
| 3 | Carbon Unit Changeout/Regeneration of Spent Carbon | | pound | $3.00 | $0 | once a year |
| 4 | Labor, Mobilization/Demobilization, Per Diem, Supplies | | wk | $925.00 | $0 | 1 visit per week - 1 day |
| 5 | Labor, Mobilization/Demobilization, Per Diem, Supplies | | mo | $1,950.00 | $0 | 1 visit per quarter - 2 laborers, 2 days |
| 6 | Analysis of Off-gas samples | | ea | $250.00 | $0 | 1 per month, VOCs |
| 7 | Quarterly Reports | | ea | $4,000.00 | $0 | |
| | Total Cost for One Year Operation | | | | $0 | |

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE 2: ENGINEERING CONTROLS AND LAND USE CONTROLS
ANNUAL COSTS

| Cost Item | Quantity | Unit | Unit Cost | Labor Overhead[a] | Total Cost |
|---|---|---|---|---|---|
| **1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)** | | | | | |
| 1.1 Site Review Meeting (2-persons for 2-days) | | | | | |
| Project Manager | 16 | hr | $38.00 | $38.00 | $1,216 |
| Staff Engineer | 16 | hr | $26.02 | $26.02 | $833 |
| ODCs (travel, etc.) | 1 | ls | $800.00 | | $800 |
| 1.2 Five Year Review Report | | | | | |
| Project Manager | 16 | hr | $38.00 | $38.00 | $1,216 |
| Staff Engineer | 32 | hr | $26.02 | $26.02 | $1,665 |
| ODCs (photocopies, telephone, etc.) | 1 | ls | $100.00 | | $100 |
| Subtotal Five Year Review Cost | | | | | $5,830 |
| G&A and Profit @ 15% | | | | | $874 |
| Subtotal | | | | | $6,704 |
| Contingency @ 10% | | | | | $670.44 |
| **Total Five Year Review Cost** | | | | | **$7,375** |
| **2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)** | | | | | |
| 2.1 Quarterly Site Inspections | | | | | |
| Project Manager (2 hrs for each Inspection) | 8 | hr | $38.00 | $38.00 | $608 |
| 2.2 Annual Review and Report | | | | | |
| Project Manager | 12 | hr | $38.00 | $38.00 | $912 |
| Staff Engineer | 12 | hr | $26.02 | $26.02 | $624 |
| ODCs (photocopies, telephone, etc.) | 1 | ls | $100.00 | | $100 |
| 2.3 Asphalt/Concrete Cover Maintenance | 1 | ls | $200.00 | | $200 |
| Subtotal Land Use Control Monitoring | | | | | $2,444 |
| G&A and Profit @ 15% | | | | | $367 |
| Subtotal | | | | | $2,811 |
| Contingency @ 10% | | | | | $281.12 |
| **Total Land Use Control Monitoring Cost** | | | | | **$3,092** |

[a] Overhead on professional labor @ 100%.

**NAVAL AIR STATION WHITING FIELD**
**MILTON, FLORIDA**
**SITE 32**
**SOIL ALTERNATIVE 2: ENGINEERING CONTROLS AND LAND USE CONTROLS**
**PRESENT WORTH ANALYSIS**

| Year | Capital Cost | Operation and Maintenance Cost | Annual Cost | Total Yearly Cost | Present-Worth Factor (i = 6%) | Present Worth |
|---|---|---|---|---|---|---|
| 0 | $21,613 | | | $21,613 | 1.000 | $21,613 |
| 1 | | $0 | $3,092 | $3,092 | 0.943 | $2,917 |
| 2 | | $0 | $3,092 | $3,092 | 0.890 | $2,752 |
| 3 | | $0 | $3,092 | $3,092 | 0.840 | $2,596 |
| 4 | | $0 | $3,092 | $3,092 | 0.792 | $2,449 |
| 5 | | $0 | $10,467 | $10,467 | 0.747 | $7,822 |
| 6 | | $0 | $3,092 | $3,092 | 0.705 | $2,180 |
| 7 | | $0 | $3,092 | $3,092 | 0.665 | $2,057 |
| 8 | | $0 | $3,092 | $3,092 | 0.627 | $1,940 |
| 9 | | $0 | $3,092 | $3,092 | 0.592 | $1,830 |
| 10 | | $0 | $10,467 | $10,467 | 0.558 | $5,845 |
| 11 | | $0 | $3,092 | $3,092 | 0.527 | $1,629 |
| 12 | | $0 | $3,092 | $3,092 | 0.497 | $1,537 |
| 13 | | $0 | $3,092 | $3,092 | 0.469 | $1,450 |
| 14 | | $0 | $3,092 | $3,092 | 0.442 | $1,368 |
| 15 | | $0 | $10,467 | $10,467 | 0.417 | $4,368 |
| 16 | | $0 | $3,092 | $3,092 | 0.394 | $1,217 |
| 17 | | $0 | $3,092 | $3,092 | 0.371 | $1,148 |
| 18 | | $0 | $3,092 | $3,092 | 0.350 | $1,083 |
| 19 | | $0 | $3,092 | $3,092 | 0.331 | $1,022 |
| 20 | | $0 | $10,467 | $10,467 | 0.312 | $3,264 |
| 21 | | $0 | $3,092 | $3,092 | 0.294 | $910 |
| 22 | | $0 | $3,092 | $3,092 | 0.278 | $858 |
| 23 | | $0 | $3,092 | $3,092 | 0.262 | $810 |
| 24 | | $0 | $3,092 | $3,092 | 0.247 | $764 |
| 25 | | $0 | $10,467 | $10,467 | 0.233 | $2,439 |
| 26 | | $0 | $3,092 | $3,092 | 0.220 | $680 |
| 27 | | $0 | $3,092 | $3,092 | 0.207 | $641 |
| 28 | | $0 | $3,092 | $3,092 | 0.196 | $605 |
| 29 | | $0 | $3,092 | $3,092 | 0.185 | $571 |
| 30 | | $0 | $10,467 | $10,467 | 0.174 | $1,822 |
| | | | | **TOTAL PRESENT WORTH** | | **$82,186** |

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE 3: IN SITU SOIL VENTING AND LAND USE CONTROLS
CAPITAL COSTS

| Cost Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING** | | | | | | | | | | | |
| 1.1 Prepare Remedial Action Plan | 225 | hr | | | $33.79 | | $0 | $0 | $7,603 | $0 | $7,603 |
| 1.2 Project Scheduling and Procurement | 45 | hr | | | $33.79 | | $0 | $0 | $1,521 | $0 | $1,521 |
| **2 MOBILIZATION/DEMOBILIZATION** | | | | | | | | | | | |
| 2.1 Portable Toilet | 0.5 | mo | $74.18 | | | | $37 | $0 | $0 | $0 | $37 |
| 2.2 Storage Trailer (28' x 10') | 0.5 | mo | $98.33 | | | | $49 | $0 | $0 | $0 | $49 |
| **3 DECONTAMINATION** | | | | | | | | | | | |
| 3.1 Temporary Decon Pad | 1 | ls | | $250.00 | $200.00 | $75.00 | $0 | $250 | $200 | $75 | $525 |
| 3.2 Decon Water Disposal | 1 | drum | $125.00 | | | | $125 | $0 | $0 | $0 | $125 |
| 3.3 Decon Water Storage Drums | 1 | ea | | $45.00 | | | $0 | $45 | $0 | $0 | $45 |
| 3.4 PPE (2 p * 3 days * 1 Weeks) | 6 | m-day | | $30.00 | | | $0 | $180 | $0 | $0 | $180 |
| 3.5 Decontaminate Equipment (Pressure Washer) | 1 | ea | | | $134.45 | $50.00 | $0 | $0 | $134 | $50 | $184 |
| **4 SITE PREPARATION** | | | | | | | | | | | |
| 4.1 Erosion Control Fencing | 0 | lf | | $0.23 | $1.17 | | $0 | $0 | $0 | $0 | $0 |
| 4.2 Collect/Analyze Delineation Samples (TPH) | 0 | ea | $200.00 | $10.00 | $23.52 | | $0 | $0 | $0 | $0 | $0 |
| 4.3 Construction Surveys (2-man crew) | 1 | day | $648.36 | | | | $648 | $0 | $0 | $0 | $648 |
| 4.4 Utility Location/Site Layout | 8 | hrs | | | $33.23 | | $0 | $0 | $266 | $0 | $266 |
| **5 EXCAVATION/BACKFILL** | | | | | | | | | | | |
| 5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator) | 0 | cy | | | $1.27 | $2.23 | $0 | $0 | $0 | $0 | $0 |
| 5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavator | 0 | hrs | | | | $20.50 | $0 | $0 | $0 | $0 | $0 |
| 5.3 Health & Safety Monitoring with OVA during Excavation | 0 | day | | | $188.16 | $100.00 | $0 | $0 | $0 | $0 | $0 |
| 5.4 Collect/Analyze Confirmatory Samples | 0 | ea | $305.00 | $10.00 | $23.52 | | $0 | $0 | $0 | $0 | $0 |
| 5.5 Import (Offsite) Place, Compact Clean Fill Material | 0 | cy | | $7.82 | $0.85 | $1.81 | $0 | $0 | $0 | $0 | $0 |
| 5.6 UST Removal | 0 | ea | | $340.72 | $485.04 | $1,638.12 | $0 | $0 | $0 | $0 | $0 |
| **6 OFF-SITE TRANSPORTATION/DISPOSAL** | | | | | | | | | | | |
| 6.1 Waste Profile | 1 | ls | $750.00 | | | | $750 | $0 | $0 | $0 | $750 |
| 6.2 Transport/Dispose of Soil Cuttings (Non-Haz) in Landfill | 10 | ton | $45.00 | | | | $450 | $0 | $0 | $0 | $450 |
| 6.3 Prepare Shipment Manifests | 4 | hrs | | | $33.23 | | $0 | $0 | $133 | $0 | $133 |
| **7 SOIL VAPOR EXTRACTION (SUBSURFACE SOIL)** | | | | | | | | | | | |
| 7.1 Soil Vapor Extraction (SVE) System Layout (30' radius) | 12 | hrs | | | $33.23 | | $0 | $0 | $399 | $0 | $399 |
| 7.2 Mobilize/Demobilize Drill Rig and Trenching Equipment | 1 | ls | $2,000.00 | | | | $2,000 | $0 | $0 | $0 | $2,000 |
| 7.3 SVE Well Install, 11" H. S. Auger ( 4 wells, various depth) | 92 | lf | $27.01 | | | | $2,485 | $0 | $0 | $0 | $2,485 |
| 7.4 PVC Well Screen, 4" dia | 70 | lf | $17.84 | | | | $1,249 | $0 | $0 | $0 | $1,249 |
| 7.5 PVC Well Riser, 4" dia. | 22 | lf | $13.39 | | | | $295 | $0 | $0 | $0 | $295 |
| 7.6 Well Box and Surface Completion | 4 | well | $250.00 | | | | $1,000 | $0 | $0 | $0 | $1,000 |
| 7.7 PVC Piping, Schedule 40, 4" | 80 | lf | | $1.62 | $4.60 | | $0 | $130 | $368 | $0 | $498 |
| 7.8 Install SVE Piping and System Equipment | 1 | ls | $1,000.00 | | | | $1,000 | $0 | $0 | $0 | $1,000 |
| 7.9 Piping Values, fittings, etc. | 1 | ls | $100.00 | | | | $100 | $0 | $0 | $0 | $100 |
| 7.10 Electrical System Installation | 1 | ls | $2,000.00 | | | | $2,000 | $0 | $0 | $0 | $2,000 |
| 7.11 QA/QC Inspection of System Installation | 60 | hrs | | | $31.08 | | $0 | $0 | $1,865 | $0 | $1,865 |
| 7.12 Vapor Recovery System, 127 SCFM, 1.5 Hp | 2 | ea | $4,615.00 | | | | $9,230 | $0 | $0 | $0 | $9,230 |
| 7.13 Portable Building for Treatment System | 1 | ea | $1,000.00 | | | | $1,000 | $0 | $0 | $0 | $1,000 |
| 7.14 Off Gas Treatment, Dual GAC Units (400#), 250 CFM | 2 | ea | $2,520.00 | | | | $5,040 | $0 | $0 | $0 | $5,040 |
| **8 SITE RESTORATION** | | | | | | | | | | | |
| 8.1 Import Vegetative Cover Material (Topsoil) | 0.00 | cy | | $15.00 | | | $0 | $0 | $0 | $0 | $0 |
| 8.2 Place/Grade Topsoil (6") | 0 | day | | | $227.20 | $435.00 | $0 | $0 | $0 | $0 | $0 |
| 8.1 Sod Disturbed Area | 0.0000 | acre | $20,859.00 | | | | $0 | $0 | $0 | $0 | $0 |
| **9 LAND USE CONTROLS** | | | | | | | | | | | |
| 9.1 Site Survey (2-man crew) | 2 | days | $648.36 | | | | $1,297 | $0 | $0 | $0 | $1,297 |
| 9.2 Prepare Land Use Plan | 100 | hours | | | $33.79 | | $0 | $0 | $3,379 | $0 | $3,379 |
| 9.3 Modify Master Plan and Prepare Deed Restrictions | 80 | hours | | | $33.79 | | $0 | $0 | $2,703 | $0 | $2,703 |
| **Subtotal Direct Capital Costs less Subcontract** | | | | | | | | $605 | $18,570 | $125 | $19,300 |

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE 3: IN SITU SOIL VENTING AND LAND USE CONTROLS
CAPITAL COSTS

| Cost Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Local Area Adjustment** | | | | | | | | 84% | 84% | 84% | |
| | | | | | | | | $508 | $15,599 | $105 | $16,212 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $4,680 | | $4,680 |
| G & A on Labor Cost @ 10% | | | | | | | | | $1,560 | | $1,560 |
| G & A on Material Cost @ 10% | | | | | | | | $51 | | | $51 |
| **Total Direct Capital Cost** | | | | | | | | $559 | $21,839 | $105 | $22,502 |
| Indirects on Total Direct Labor Cost @ 75% | | | | | | | | | $16,379 | | $16,379 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $2,250 |
| **Subtotal** | | | | | | | | | | | $41,131 |
| Health & Safety Monitoring @ 3% | | (Includes Subcontractor cost) | | | | | | | | | $2,097 |
| **Total Field Cost** | | | | | | | | | | | **$43,228** |
| Subtotal Subcontractor Cost | | | | | | | $28,755 | | | | $28,755 |
| G & A on Subcontract Cost @ 10% | | | | | | | $2,875 | | | | $2,875 |
| Profit on Subcontractor Cost @ 5% | | | | | | | | | | | $1,438 |
| **Subcontractor Cost** | | | | | | | | | | | **$33,068** |
| Contingency on Total Field and Subcontractor Costs @ 10% | | | | | | | | | | | **$7,630** |
| Engineering on Total Field and Subcontractor Costs @ 5% | | | | | | | | | | | **$3,815** |
| **TOTAL Capital COST** | | | | | | | | | | | **$87,740** |

**NAVAL AIR STATION WHITING FIELD**
**MILTON, FLORIDA**
**SITE 32**
**SOIL ALTERNATIVE 3: IN SITU SOIL VENTING AND LAND USE CONTROLS**
**ANNUAL OPERATION AND MAINTENANCE COSTS**

| | Item | Qty | Unit | Unit Cost | Subtotal Cost | Notes |
|---|---|---|---|---|---|---|
| 1 | Energy - Soil Venting System | 19,600 | kWh | $0.06 | $1,176 | Electrical Load is approx. 3 Hp. |
| 2 | Maintenance | 1 | ls | $500.00 | $500 | 3% of Installation Cost |
| 3 | Carbon Unit Changeout/Regeneration of Spent Carbon | 400 | pound | $3.00 | $1,200 | once a year |
| 4 | Labor, Mobilization/Demobilization, Per Diem, Supplies | 12 | mo | $500.00 | $6,000 | Monthly O&M Site Visit (1 person , 1 days) |
| 6 | Analysis of Off-gas samples | 12 | ea | $300.00 | $3,600 | 1 per month, VOCs |
| 7 | Geoprobe Mob/Demob. & 1-day Operation | 1 | ea | $650.00 | $650 | |
| 8 | Soil Samples (TPH, TCE, BAP, Trimethylbenzenes)) | 24 | ea | $400.00 | $9,600 | Samples collected annually to confirm cleanup. |
| 9 | Quarterly Reports | 4 | ea | $3,000.00 | $12,000 | |
| | **Total Cost for One Year Operation** | | | | **$34,726** | |

**NAVAL AIR STATION WHITING FIELD**
**MILTON, FLORIDA**
**SITE 32**
**SOIL ALTERNATIVE 3: IN SITU SOIL VENTING AND LAND USE CONTROLS**
**ANNUAL COSTS**

| Cost Item | Quantity | Unit | Unit Cost | Labor Overhead[a] | Total Cost |
|---|---|---|---|---|---|
| **1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)** | | | | | |
| 1.1 Site Review Meeting (2-persons for 2-days) | | | | | |
| Project Manager | 16 | hr | $38.00 | $38.00 | $1,216 |
| Staff Engineer | 16 | hr | $26.02 | $26.02 | $833 |
| ODCs (travel, etc.) | 1 | ls | $800.00 | | $800 |
| 1.2 Five Year Review Report | | | | | |
| Project Manager | 16 | hr | $38.00 | $38.00 | $1,216 |
| Staff Engineer | 32 | hr | $26.02 | $26.02 | $1,665 |
| ODCs (photocopies, telephone, etc.) | 1 | ls | $100.00 | | $100 |
| Subtotal Five Year Review Cost | | | | | $5,830 |
| G&A and Profit @ 15% | | | | | $874 |
| Subtotal | | | | | $6,704 |
| Contingency @ 10% | | | | | $670.44 |
| **Total Five Year Review Cost** | | | | | **$7,375** |
| **2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)** | | | | | |
| 2.1 Quarterly Site Inspections | | | | | |
| Project Manager (2 hrs for each Inspection) | 8 | hr | $38.00 | $38.00 | $608 |
| 2.2 Annual Review and Report | | | | | |
| Project Manager | 12 | hr | $38.00 | $38.00 | $912 |
| Staff Engineer | 12 | hr | $26.02 | $26.02 | $624 |
| ODCs (photocopies, telephone, etc.) | 1 | ls | $100.00 | | $100 |
| Subtotal Land Use Control Monitoring | | | | | $2,244 |
| G&A and Profit @ 15% | | | | | $337 |
| Subtotal | | | | | $2,581 |
| Contingency @ 10% | | | | | $258.12 |
| **Total Land Use Control Monitoring Cost** | | | | | **$2,839** |

[a] Overhead on professional labor @ 100%.

**NAVAL AIR STATION WHITING FIELD**
**MILTON, FLORIDA**
**SITE 32**
**SOIL ALTERNATIVE 3: IN SITU SOIL VENTING AND LAND USE CONTROLS**
**PRESENT WORTH ANALYSIS**

| Year | Capital Cost | Operation and Maintenance Cost | Annual Cost | Total Yearly Cost | Present-Worth Factor (i = 6%) | Present Worth |
|---|---|---|---|---|---|---|
| 0 | $87,740 | | | $87,740 | 1.000 | $87,740 |
| 1 | | $34,726 | $2,839 | $37,565 | 0.943 | $35,439 |
| 2 | | $34,726 | $2,839 | $37,565 | 0.890 | $33,433 |
| 3 | | $34,726 | $2,839 | $37,565 | 0.840 | $31,541 |
| 4 | | | $2,839 | $2,839 | 0.792 | $2,249 |
| 5 | | | $10,214 | $10,214 | 0.747 | $7,633 |
| 6 | | | $2,839 | $2,839 | 0.705 | $2,002 |
| 7 | | | $2,839 | $2,839 | 0.665 | $1,888 |
| 8 | | | $2,839 | $2,839 | 0.627 | $1,781 |
| 9 | | | $2,839 | $2,839 | 0.592 | $1,681 |
| 10 | | | $10,214 | $10,214 | 0.558 | $5,704 |
| 11 | | | $2,839 | $2,839 | 0.527 | $1,496 |
| 12 | | | $2,839 | $2,839 | 0.497 | $1,411 |
| 13 | | | $2,839 | $2,839 | 0.469 | $1,331 |
| 14 | | | $2,839 | $2,839 | 0.442 | $1,256 |
| 15 | | | $10,214 | $10,214 | 0.417 | $4,262 |
| 16 | | | $2,839 | $2,839 | 0.394 | $1,118 |
| 17 | | | $2,839 | $2,839 | 0.371 | $1,054 |
| 18 | | | $2,839 | $2,839 | 0.350 | $995 |
| 19 | | | $2,839 | $2,839 | 0.331 | $938 |
| 20 | | | $10,214 | $10,214 | 0.312 | $3,185 |
| 21 | | | $2,839 | $2,839 | 0.294 | $835 |
| 22 | | | $2,839 | $2,839 | 0.278 | $788 |
| 23 | | | $2,839 | $2,839 | 0.262 | $743 |
| 24 | | | $2,839 | $2,839 | 0.247 | $701 |
| 25 | | | $10,214 | $10,214 | 0.233 | $2,380 |
| 26 | | | $2,839 | $2,839 | 0.220 | $624 |
| 27 | | | $2,839 | $2,839 | 0.207 | $589 |
| 28 | | | $2,839 | $2,839 | 0.196 | $555 |
| 29 | | | $2,839 | $2,839 | 0.185 | $524 |
| 30 | | | $10,214 | $10,214 | 0.174 | $1,778 |
| | | | | **TOTAL PRESENT WORTH** | | **$237,653** |

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE 4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING CGs), OFFSITE DISPOSAL, AND LUCs
CAPITAL COSTS

| Cost Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 PROJECT PLANNING** | | | | | | | | | | | |
| 1.1 Prepare Remedial Action Plan | 270 | hr | | | $33.79 | | $0 | $0 | $9,123 | $0 | $9,123 |
| 1.2 Project Scheduling and Procurement | 100 | hr | | | $33.79 | | $0 | $0 | $3,379 | $0 | $3,379 |
| **2 MOBILIZATION/DEMOBILIZATION** | | | | | | | | | | | |
| 2.1 Equipment Mob/Demob (Exc., Loader, & Dozier) | 3 | ea | | | $200.00 | $250.00 | $0 | $0 | $600 | $750 | $1,350 |
| 2.2 Mobilize/Demobilize Personnel (3-persons) | 3 | ea | | $375.00 | $300.00 | | $0 | $1,125 | $900 | $0 | $2,025 |
| 2.3 Portable Toilet | 2 | mo | $74.18 | | | | $148 | $0 | $0 | $0 | $148 |
| 2.4 Storage Trailer (28' x 10') | 2 | mo | $98.33 | | | | $197 | $0 | $0 | $0 | $197 |
| 2.5 Office Trailer (32' x 8') | 2 | mo | $221.49 | | | | $443 | $0 | $0 | $0 | $443 |
| 2.6 Site Utilities | 2 | mo | $1,000.00 | | | | $2,000 | $0 | $0 | $0 | $2,000 |
| **3 DECONTAMINATION** | | | | | | | | | | | |
| 3.1 Temporary Decon Pad | 1 | ls | | $450.00 | $400.00 | $155.00 | $0 | $450 | $400 | $155 | $1,005 |
| 3.2 Decon Water Disposal | 10 | drum | $125.00 | | | | $1,250 | $0 | $0 | $0 | $1,250 |
| 3.3 Decon Water Storage Drums | 10 | ea | | $45.00 | | | $0 | $450 | $0 | $0 | $450 |
| 3.4 PPE (3 p * 5 days * 8 Weeks) | 120 | m-day | | $30.00 | | | $0 | $3,600 | $0 | $0 | $3,600 |
| 3.5 Decontaminate Equipment (Pressure Washer) | 12 | ea | | | $134.45 | $50.00 | $0 | $0 | $1,613 | $600 | $2,213 |
| **4 SITE PREPARATION** | | | | | | | | | | | |
| 4.1 Erosion Control Fencing | 1000 | lf | | $0.23 | $1.17 | | $0 | $230 | $1,170 | $0 | $1,400 |
| 4.2 Collect/Analyze Delineation Samples (TPH & others) | 32 | ea | $200.00 | $10.00 | $23.52 | | $6,400 | $320 | $753 | $0 | $7,473 |
| 4.3 Construction Surveys (2-man crew) | 3 | day | $648.36 | | | | $1,945 | $0 | $0 | $0 | $1,945 |
| 4.4 Utility Location and Site Delineation/Layout | 36 | hrs | | | $33.23 | | $0 | $0 | $1,196 | $0 | $1,196 |
| 4.5 Concrete Demolition/Removal (6" reinforced) | 90 | cy | $45.58 | | | | $4,102 | $0 | $0 | $0 | $4,102 |
| 4.6 Concrete Debris Disposal | 90 | cy | $20.70 | | | | $1,863 | $0 | $0 | $0 | $1,863 |
| **5 EXCAVATION/BACKFILL** | | | | | | | | | | | |
| 5.1 Excavate/Load Contaminated Soil (2.0 cy Hyd. Exc.) | 17000 | cy | | | $0.68 | $1.71 | $0 | $0 | $11,560 | $29,070 | $40,630 |
| 5.2 Standby, Crawler Mounted 2.0 CY Hydraulic Excavator | 180 | hrs | | | | $37.54 | $0 | $0 | $0 | $6,757 | $6,757 |
| 5.3 Wheel Loader, 3 cy | 150 | hrs | | | $27.20 | $56.31 | $0 | $0 | $4,080 | $8,447 | $12,527 |
| 5.4 Standby, Wheel Loader, 3 cy | 60 | hrs | | | | $14.07 | $0 | $0 | $0 | $844 | $844 |
| 5.5 Health & Safety Monitoring with OVA during Excavation | 30 | day | | | $188.16 | $100.00 | $0 | $0 | $5,645 | $3,000 | $8,645 |
| 5.6 Collect/Analyze Confirmatory Samples | 20 | ea | $200.00 | $10.00 | $23.52 | | $4,000 | $200 | $470 | $0 | $4,670 |
| 5.7 Import (Offsite) Place, Compact Clean Fill Material | 2500 | cy | | $7.82 | $0.85 | $1.81 | $0 | $19,550 | $2,125 | $4,525 | $26,200 |
| 5.8 Backfill with Clean Excavated Material | 14500 | cy | | $0.28 | $2.02 | $0.76 | $0 | $4,060 | $29,290 | $11,020 | $44,370 |
| 5.9 UST Removal | 0 | ea | | $340.72 | $485.04 | $1,638.12 | $0 | $0 | $0 | $0 | $0 |
| **6 OFF-SITE TRANSPORTATION/DISPOSAL** | | | | | | | | | | | |
| 6.1 Waste Profile | 4 | ls | $750.00 | | | | $3,000 | $0 | $0 | $0 | $3,000 |
| 6.2 Transport and Dispose of Soil (Non-haz.) in Landfill | 3000 | ton | $45.00 | | | | $135,000 | $0 | $0 | $0 | $135,000 |
| 6.3 Prepare Shipment Manifests | 60 | hrs | | | $33.23 | | $0 | $0 | $1,994 | $0 | $1,994 |
| **7 SITE RESTORATION** | | | | | | | | | | | |
| 7.1 Concrete Slab (Reinforced) on Grade (6") | 4600 | sf | $4.03 | | | | $18,538 | $0 | $0 | $0 | $18,538 |
| **8 LAND USE CONTROLS** | | | | | | | | | | | |
| 8.1 Site Survey (2-man crew) | 2 | days | $648.36 | | | | $1,297 | $0 | $0 | $0 | $1,297 |
| 8.2 Prepare Land Use Plan | 100 | hours | | | $33.79 | | $0 | $0 | $3,379 | $0 | $3,379 |
| 8.3 Modify Master Plan and Prepare Deed Restrictions | 80 | hours | | | $33.79 | | $0 | $0 | $2,703 | $0 | $2,703 |
| **Subtotal Direct Capital Costs less Subcontract** | | | | | | | | $29,985 | $80,381 | $65,168 | $175,534 |

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE 4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING CGs), OFFSITE DISPOSAL, AND LUCs
CAPITAL COSTS

| Cost Item | Quantity | Unit | Unit Cost Subcontract | Unit Cost Material | Unit Cost Labor | Unit Cost Equipment | Extended Cost Subcontract | Extended Cost Material | Extended Cost Labor | Extended Cost Equipment | Subtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Local Area Adjustment** | | | | | | | | 84% | 84% | 84% | |
| | | | | | | | | $25,187 | $67,520 | $54,741 | $147,448 |
| Overhead on Labor Cost @ 30% | | | | | | | | | $20,256 | | $20,256 |
| G & A on Labor Cost @ 10% | | | | | | | | | $6,752 | | $6,752 |
| G & A on Material Cost @ 10% | | | | | | | | $2,519 | | | $2,519 |
| **Total Direct Capital Cost** | | | | | | | | $27,706 | $94,528 | $54,741 | $176,975 |
| Indirects on Total Direct Labor Cost @ 75% | | | | | | | | | $70,896 | | $70,896 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | $17,698 |
| **Subtotal** | | | | | | | | | | | $265,568 |
| Health & Safety Monitoring @ 3% | | (Includes Subcontractor cost) | | | | | | | | | $13,373 |
| **Total Field Cost** | | | | | | | | | | | **$278,941** |
| Subtotal Subcontractor Cost | | | | | | | $180,183 | | | | $180,183 |
| G & A on Subcontract Cost @ 10% | | | | | | | $18,018 | | | | $18,018 |
| Profit on Subcontractor Cost @ 5% | | | | | | | | | | | $9,009 |
| **Subcontractor Cost** | | | | | | | | | | | **$207,210** |
| Contingency on Total Field and Subcontractor Costs @ 10% | | | | | | | | | | | **$48,615** |
| Engineering on Total Field and Subcontractor Costs @ 5% | | | | | | | | | | | **$24,308** |
| **TOTAL Capital COST** | | | | | | | | | | | **$559,074** |

**NAVAL AIR STATION WHITING FIELD**
**MILTON, FLORIDA**
**SITE 32**
**SOIL ALTERNATIVE 4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING CGs), OFFSITE DISPOSAL, AND LUCs**
**Operation and Maintenance Costs per Year**

| | Item | Qty | Unit | Unit Cost | Subtotal Cost | Notes |
|---|---|---|---|---|---|---|
| 1 | Energy - Electric | | kWh | $0.06 | $0 | |
| 2 | Maintenance | | ls | | $0 | 5% of Installation Cost |
| 3 | Carbon Unit Changeout/Regeneration of Spent Carbon | | pound | $3.00 | $0 | once a year |
| 4 | Labor, Mobilization/Demobilization, Per Diem, Supplies | | wk | $925.00 | $0 | 1 visit per week - 1 day |
| 5 | Labor, Mobilization/Demobilization, Per Diem, Supplies | | mo | $1,950.00 | $0 | 1 visit per quarter - 2 laborers, 2 days |
| 6 | Analysis of Off-gas samples | | ea | $250.00 | $0 | 1 per month, VOCs |
| 7 | Quarterly Reports | | ea | $4,000.00 | $0 | |
| | Total Cost for One Year Operation | | | | $0 | |

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**ANNUAL COSTS**

| Cost Item | Quantity | Unit | Unit Cost | Labor Overhead[a] | Total Cost |
|---|---|---|---|---|---|
| **1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)** | | | | | |
| 1.1 Site Review Meeting (2-persons for 2-days) | | | | | |
| Project Manager | 16 | hr | $38.00 | $38.00 | $1,216 |
| Staff Engineer | 16 | hr | $26.02 | $26.02 | $833 |
| ODCs (travel, etc.) | 1 | ls | $800.00 | | $800 |
| 1.2 Five Year Review Report | | | | | |
| Project Manager | 16 | hr | $38.00 | $38.00 | $1,216 |
| Staff Engineer | 32 | hr | $26.02 | $26.02 | $1,665 |
| ODCs (photocopies, telephone, etc.) | 1 | ls | $100.00 | | $100 |
| Subtotal Five Year Review Cost | | | | | $5,830 |
| G&A and Profit @ 15% | | | | | $874 |
| Subtotal | | | | | $6,704 |
| Contingency @ 10% | | | | | $670.44 |
| **Total Five Year Review Cost** | | | | | **$7,375** |
| **2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)** | | | | | |
| 2.1 Quarterly Site Inspections | | | | | |
| Project Manager (2 hrs for each Inspection) | 8 | hr | $38.00 | $38.00 | $608 |
| 2.2 Annual Review and Report | | | | | |
| Project Manager | 12 | hr | $38.00 | $38.00 | $912 |
| Staff Engineer | 12 | hr | $26.02 | $26.02 | $624 |
| ODCs (photocopies, telephone, etc.) | 1 | ls | $100.00 | | $100 |
| Subtotal Land Use Control Monitoring | | | | | $2,244 |
| G&A and Profit @ 15% | | | | | $337 |
| Subtotal | | | | | $2,581 |
| Contingency @ 10% | | | | | $258.12 |
| **Total Land Use Control Monitoring Cost** | | | | | **$2,839** |

[a] Overhead on professional labor @ 100%.

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**PRESENT WORTH ANALYSIS**

| Year | Capital Cost | Operation and Maintenance Cost | Annual Cost | Total Yearly Cost | Present-Worth Factor (i = 6%) | Present Worth |
|---|---|---|---|---|---|---|
| 0 | $559,074 | | | $559,074 | 1.000 | $559,074 |
| 1 | | $0 | $2,839 | $2,839 | 0.943 | $2,679 |
| 2 | | $0 | $2,839 | $2,839 | 0.890 | $2,527 |
| 3 | | $0 | $2,839 | $2,839 | 0.840 | $2,384 |
| 4 | | $0 | $2,839 | $2,839 | 0.792 | $2,249 |
| 5 | | $0 | $10,214 | $10,214 | 0.747 | $7,633 |
| 6 | | $0 | $2,839 | $2,839 | 0.705 | $2,002 |
| 7 | | $0 | $2,839 | $2,839 | 0.665 | $1,888 |
| 8 | | $0 | $2,839 | $2,839 | 0.627 | $1,781 |
| 9 | | $0 | $2,839 | $2,839 | 0.592 | $1,681 |
| 10 | | $0 | $10,214 | $10,214 | 0.558 | $5,704 |
| 11 | | $0 | $2,839 | $2,839 | 0.527 | $1,496 |
| 12 | | $0 | $2,839 | $2,839 | 0.497 | $1,411 |
| 13 | | $0 | $2,839 | $2,839 | 0.469 | $1,331 |
| 14 | | $0 | $2,839 | $2,839 | 0.442 | $1,256 |
| 15 | | $0 | $10,214 | $10,214 | 0.417 | $4,262 |
| 16 | | $0 | $2,839 | $2,839 | 0.394 | $1,118 |
| 17 | | $0 | $2,839 | $2,839 | 0.371 | $1,054 |
| 18 | | $0 | $2,839 | $2,839 | 0.350 | $995 |
| 19 | | $0 | $2,839 | $2,839 | 0.331 | $938 |
| 20 | | $0 | $10,214 | $10,214 | 0.312 | $3,185 |
| 21 | | $0 | $2,839 | $2,839 | 0.294 | $835 |
| 22 | | $0 | $2,839 | $2,839 | 0.278 | $788 |
| 23 | | $0 | $2,839 | $2,839 | 0.262 | $743 |
| 24 | | $0 | $2,839 | $2,839 | 0.247 | $701 |
| 25 | | $0 | $10,214 | $10,214 | 0.233 | $2,380 |
| 26 | | $0 | $2,839 | $2,839 | 0.220 | $624 |
| 27 | | $0 | $2,839 | $2,839 | 0.207 | $589 |
| 28 | | $0 | $2,839 | $2,839 | 0.196 | $555 |
| 29 | | $0 | $2,839 | $2,839 | 0.185 | $524 |
| 30 | | $0 | $10,214 | $10,214 | 0.174 | $1,778 |
| | | | | | **TOTAL PRESENT WORTH** | **$616,164** |