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FINAL FEASIBILITY STUDY ADDENDUM FOR SITE 33 NAS WHITING FIELD FL
9/17/2004
TETRA TECH NUS



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0904-E120

September 17, 2004

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Reference: CLEAN Contract No. N62467-94-D-0888
Contract Task Order No. 0028

Subject: Final Feasibility Study Addendum, Site 33 (Revision 1)
Naval Air Station, Whiting Field, Milton, Florida

Dear Ms. Martin:

Enclosed is the Final Feasibility Study Addendum for Site 33 Surface and Subsurface Soils (Revision 2) in hardcopy format. An electronic version is also being submitted to you and the individuals indicated below. A formal response to EPA comments (dated September 10th, 2004) and FDEP comments (dated September 9th, 2004) will be submitted under separate cover.

If you have any questions, please contact me at (850) 385-9899.

Sincerely,

A handwritten signature in black ink, appearing to read 'Terry Hansen'.

Terry Hansen
Task Order Manager

TH:tko

Enclosure

- c: Mr. Craig Benedikt, USEPA Region 4 (hardcopy and electronic copy)
- Mr. Jim Cason, FDEP (2 hardcopies and electronic copy)
- Ms. Lisa Campbell, Tetra Tech NUS (hardcopy and electronic copy)
- Mr. Ron Joyner, NAS Whiting Field (hardcopy and electronic copy)
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Feasibility Study Addendum
for
**Site 33, Midfield 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 33, MIDFIELD MAINTENANCE HANGAR
SURFACE AND SUBSURFACE SOIL**

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

USEPA ID No. FL2170023244

Submitted to:

**Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
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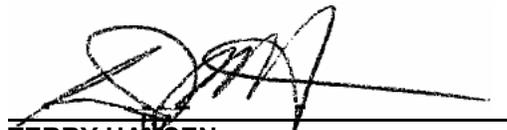
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SEPTEMBER 2004

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PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify this document, *Feasibility Study Addendum for Site 33, Midfield Maintenance Hangar, 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

| | |
|-----------------|---|
| ABB-ES | ABB Environmental Services |
| ARAR | applicable or relevant and appropriate requirement |
| 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 |
| CTE | central tendency exposure |
| EC | Engineering Control |
| ELCR | excess lifetime cancer risk |
| F.A.C. | Florida Administrative Code |
| FL PRO | Florida Petroleum Range Organics |
| EPC | exposure point concentration |
| FDEP | Florida Department of Environmental Protection |
| FS | Feasibility Study |
| FSA | Feasibility Study Addendum |
| ft ² | square feet |
| GIR | General Information Report |
| HHRA | Human Health Risk Assessment |
| HI | Hazard Index |
| HQ | Hazard Quotient |
| IRA | Interim Remedial Action |
| LUC | land use control |
| mg/kg | milligrams per kilogram |
| NAS | Naval Air Station |
| NPW | net present worth |
| PRG | Preliminary Remedial Goal |
| RAO | Remedial Action Objective |
| RBC | risk-based concentration |
| RfD | reference dose |
| RI | Remedial Investigation |
| RME | Reasonable Maximum Exposure |
| SCTL | soil cleanup target level |
| TBC | to be considered |

| | |
|-------|---|
| TRPH | total recoverable petroleum hydrocarbons |
| TtNUS | Tetra Tech NUS, Inc. |
| 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 33, Midfield Maintenance Hangar, Building 1454, since submittal of the original FS in March 2001 (TtNUS, 2001a). The original FS included six sites at Naval Air Station (NAS) Whiting Field: Sites 3, 4, 6, 30, 32 and 33. Section 7.0 of the FS addressed surface and subsurface soil at Site 33.

The changes at Site 33 addressed in this FSA include the following activities undertaken and determinations made after the submittal of the FS:

- **Underground Storage Tank (UST) Removal** - In August 2000, the UST at Site 33 was removed along with a small amount of soil [CH2M HILL Constructors Inc. (CCI), 2001]. Confirmation soil samples identified no constituents exceeding regulatory screening levels.
- **Arsenic**, originally identified as a constituent of concern (COC), was determined to be naturally occurring at Site 33. 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]. 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 COC and remediation of arsenic in surface and subsurface soil is not required at Site 33.
- **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, 2002). Therefore, analytical results are now compared to the USEPA Region IX PRGs and FDEP soil cleanup target levels (SCTLs) for commercial/industrial exposure (FDEP, 1999).
- The individual metal constituents aluminum, iron, manganese and vanadium have no direct evidence of site-related use at Site 33 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 33 surface and subsurface soils.

1.1 PURPOSE

The purpose of this FSA is to evaluate the impact of the changes discussed above on the surface and subsurface soils at Site 33. The specific items to be evaluated include:

- Removal of the abandoned UST including the excavation and removal of petroleum-contaminated soil.
- Soil screening criteria changed to USEPA Region IX PRGs.
- Revised Human Health Risk Assessment (HHRA).

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 (RAOs) including Cleanup Goals (CGs) and areas and volumes of soil requiring remedial action. 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 for Site 33
- Appendix C Tables 7-8 and 7-9 From Original FS (TtNUS, 2001a)
- Appendix D Remedial Alternatives Cost Estimate

2.0 ENVIRONMENTAL CONDITIONS

Site 33 is located at the Midfield Maintenance Hangar, Building 1454 (Figure 2-1). The site consists of Building 1454 and the adjacent area where the former waste oil tank UST was located.

Environmental conditions at Site 33 are described in detail in the RI Report (TtNUS, 1999) and the FS (TtNUS, 2001a). Only the UST removal activities and the associated revised HHRA are discussed in the following sections.

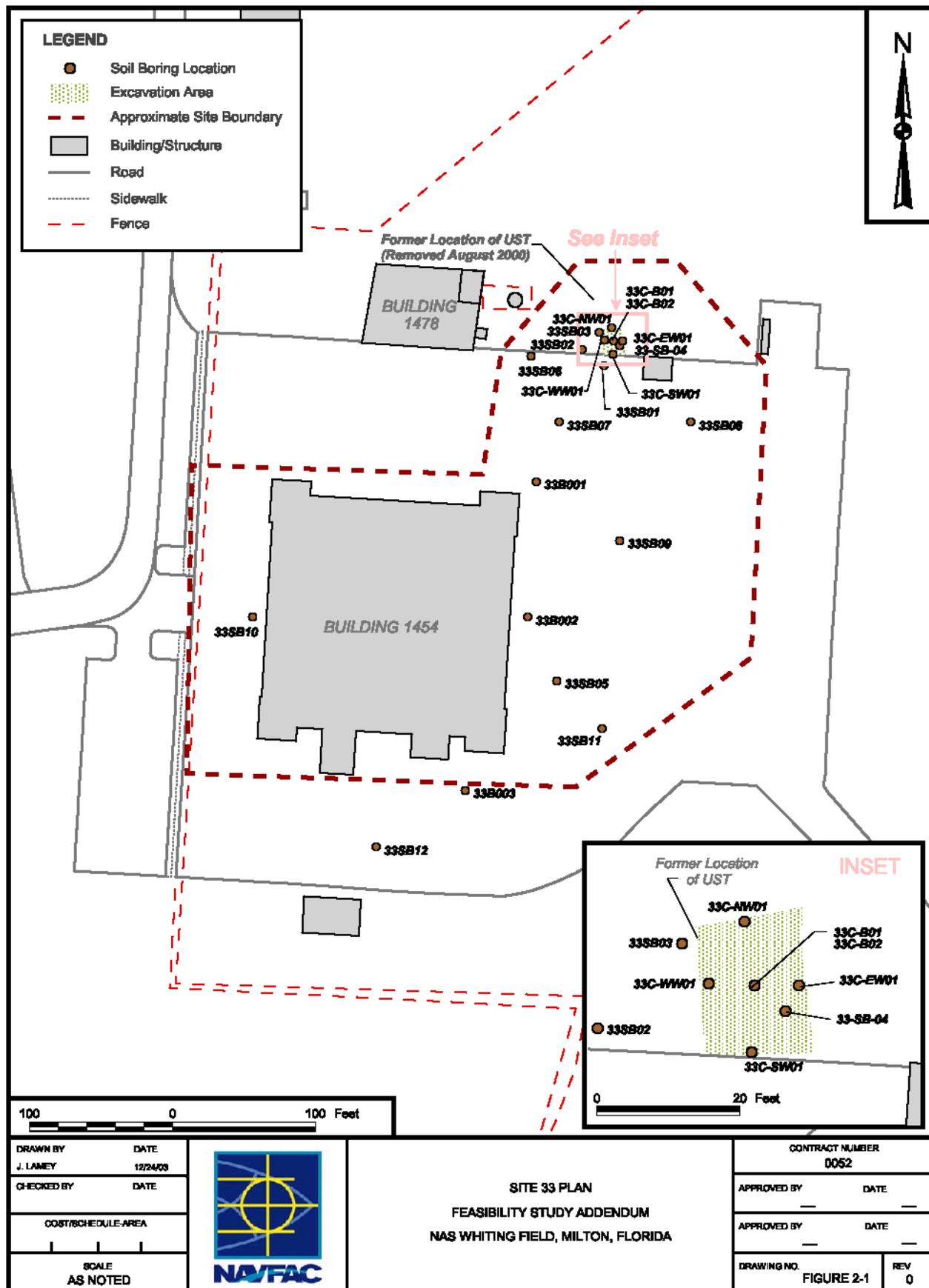
2.1 UST REMOVAL ACTIVITIES

In August 2000, the UST at Site 33 was 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 the previously abandoned UST, transportation and disposal of petroleum-contaminated soil, collection and analysis of confirmatory soil samples, placement and compaction of clean backfill soil in the excavation area, and site restoration. The intent of the limited excavation was to remove contaminated soil surrounding the UST, thereby eliminating the potential contamination source and to obtain clean closure, if possible.

The 846-gallon UST was reportedly in operation from 1943 through 1986. The tank was reportedly abandoned in place and filled with sand in 1986. Upon inspection in August 2000, the tank was determined to be either partially or totally full of liquids with minor amounts of sand. Waste disposal profile samples were collected from the tank, and all solid and liquid wastes were disposed of in accordance with state and local regulations.

Soil at the Site 33 UST area was excavated to an average depth of 10 feet below land surface (bls). After receiving the initial excavation confirmation sampling results, further excavation of the eastern edge was required and conducted to achieve clean closure. Approximately 80 cubic yards of contaminated soil were removed and disposed of as nonhazardous waste. The excavation measured approximately 17 by 20 feet and was approximately 10 feet deep. The areal extent of the excavation and confirmation sample data are included in Appendix A.

Post-excavation confirmation sampling included collection of six 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 at 10 feet bls. The confirmation samples exhibited no soil concentrations above FDEP SCTLs or USEPA Region IX PRGs other than arsenic, now determined to be naturally occurring at NAS Whiting Field (FDEP, 2001). Analytical results are summarized in Appendix A.



Site restoration included backfilling the excavated area with clean soil from an off site source and covering the soil with sod.

2.2 SUMMARY OF REVISED HHRA

The revised HHRA conservatively estimates the potential risk to human health using historic analytical data and recent UST removal analytical data for surface and subsurface soils from 0 to 15 feet bls. The original HHRA was included in the RI Report (TtNUS, 1999). Details of the revised HHRA are presented in Appendix B. A summary of the revised HHRA is provided below.

There were no carcinogenic COPCs identified in surface or subsurface soils at Site 33. Therefore, there is no cancer risk associated with exposure to surface or subsurface soils. Total recoverable petroleum hydrocarbons (TRPH) was selected as the only COPC for surface and subsurface soils at Site 33.

For the current land use condition, risks for the construction worker were evaluated for exposure to subsurface soil. The concentration of TRPH in subsurface soil at Site 33 [7,790 milligram per kilogram (mg/kg)] exceeded the FDEP SCTL industrial criteria. For the construction worker, the reasonable maximum exposure (RME) Hazard Index (HI) from exposure to TRPH in subsurface soil (0.17) is less than the USEPA and FDEP target benchmark of 1.0 for all receptors.

There are no current complete exposure pathways for surface soil at Site 33 since most of the site is covered with concrete and asphalt concrete pavement (see Figure 2-1). The only boring location with TRPH concentrations exceeding the FDEP SCTL (residential) in surface soil is 33SB5 (see Appendix B-1) and this location is covered with concrete. Although it is unlikely the concrete will be removed from Site 33 in the future, exposure to surface soils under this scenario was evaluated. Based on this scenario, TRPH is a RME HI risk driver for the child resident at Site 33. The RME HI for the child receptor is 1.1 at Site 33. For all other receptors at Site 33, the TRPH HI is less than unity. However, due to the uncertainty associated with the TRPH reference dose (RfD), the calculated HI is likely to be overestimated.

3.0 REMEDIAL ACTION OBJECTIVES

The RAOs in for Site 33 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:

- Although there are no human health risks associated with the current and anticipated future commercial/industrial use of this site, unacceptable human health risk exists for direct exposure to surface or subsurface soil based on a future hypothetical residential use of the site.
- FDEP SCTLs (commercial/industrial land use).
- USEPA Region IX PRG values (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 in direct contact with the soil.

3.1 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 TBC criteria, chemicals and media of interest, and exposure pathways. The CGs for this site are now formulated based on the following criteria: FDEP SCTLs [Chapter 62-777, Florida Administrative Code (F.A.C.)] for direct commercial/industrial exposure, and USEPA Region IX PRGs. The current and anticipated 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 surface and subsurface soils CGs for Site 33.

**TABLE 3-1
DETERMINATION OF CLEANUP GOALS AT SITE 33
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 |
|---|-------|--|--|-------------|--------------------------|--------------------------------------|-----------------|---|--------------------|
| TRPH | mg/kg | 2,500 | NA | 2,500 | NA | NA | 2,500 | NA | 2,500 |

¹Combined list of all COPCs for Site 33 (surface and subsurface soil).

²Table 2, Soil Cleanup Target Levels, Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C. (May 1999).

³USEPA Region IX Preliminary Remedial Goal Table, October 2002.

⁴Soil Basis Codes: N = Noncarcinogen, C = Carcinogen

⁵Table 3-18, GIR, Remedial Investigation and Feasibility Study, ABB-ES, 1998. Background screening value for inorganics is two times the mean detected concentration.

mg/kg – milligrams per kilogram

NA – Not Applicable

CG – Cleanup Goal

3.2 CONSTITUENTS OF CONCERN

The original FS identified arsenic and TRPH in subsurface soil as the only COCs for Site 33. Because arsenic has been determined to be naturally occurring, it is no longer retained as a COC. The revised COCs for Site 33 have been determined by comparing the soil CG value against the COPC's site-specific representative concentration. The site specific representative concentration for TRPH in subsurface soil, the only COPC identified for Site 33, is 7,790 mg/kg. This maximum detected concentration exceeds the CG of 2,500 mg/kg. Any COPC with a site-specific representative concentration exceeding the CG becomes a COC. In summary, TRPH is the only COC in subsurface soil. The estimated area impacted by this COC in subsurface soil is shown on Figure 3-1.

3.3 AREA AND VOLUME OF SOIL REQUIRING REMEDIAL ACTION

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

The estimated volume of impacted soil calculated for the location exceeding the CG is based on Table 5-4 of the original FS. The rationale for estimating the area and vertical extent of impacted soil is presented in the following paragraphs.

The area around sample 33SB09 is not included in the revised calculations for volume of impacted soil because arsenic at Site 33 is naturally occurring and is no longer considered a COC.

The area excavated during the UST removal project is shown on Figure 3-1 and in Appendix A. The depth of excavation was approximately 10 feet. Confirmation soil samples from the bottom and sidewalls of the excavation identified no constituent concentrations above risk-based screening levels.

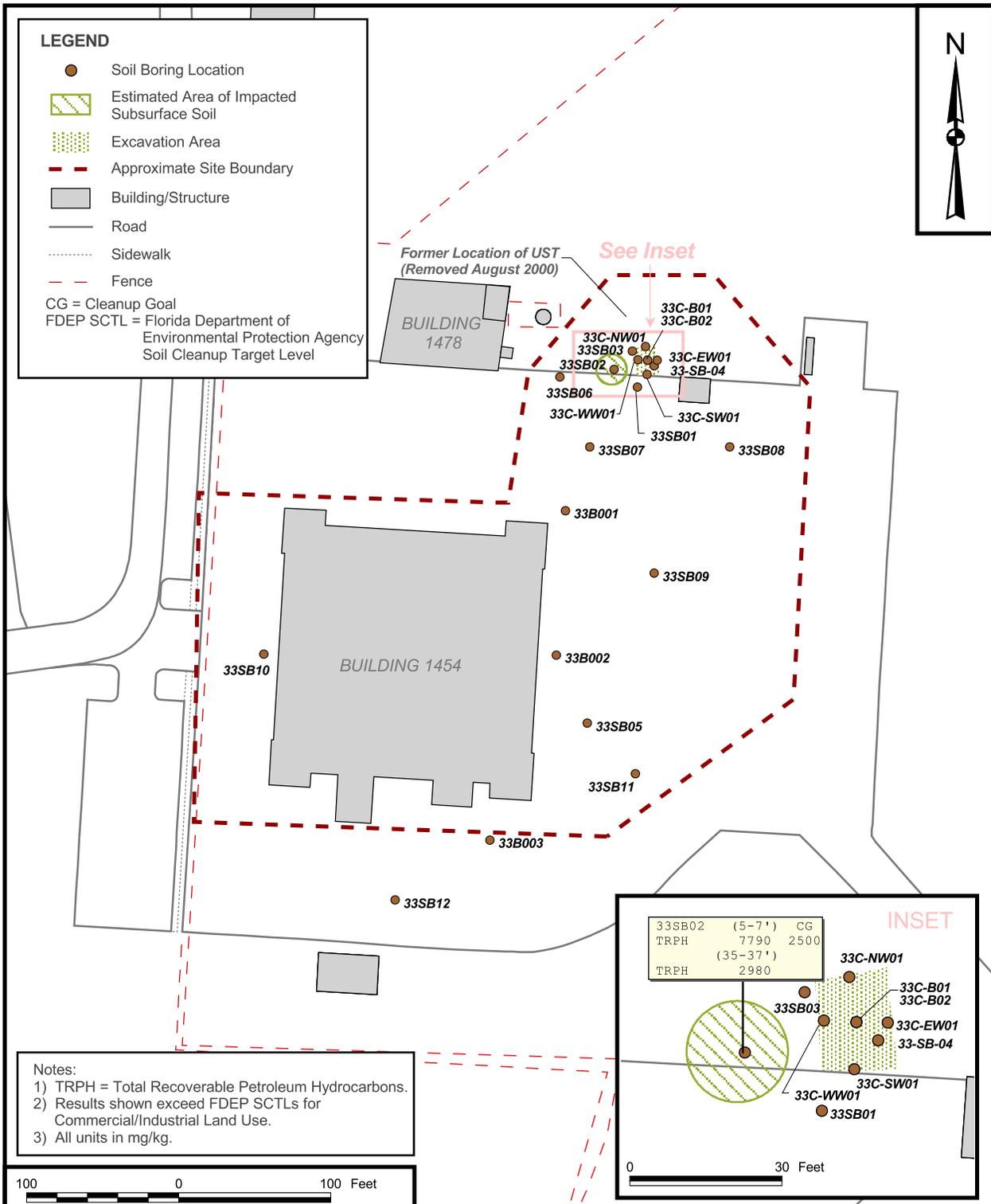
The sample location 33SB02 is considered a localized area of impact (10 foot radius). TRPH was detected at a concentration of 7,790 mg/kg at 5 to 7 feet bls, but the samples collected at 10 to 12 feet and 15 to 17 feet bls did not have TRPH concentrations above the CG. The impacted area was estimated to extend to 9 feet bls (Figure 3-1). In addition, TRPH was detected above the CG in the sample collected at 35 to 37 feet bls. The deeper samples, starting at 60 feet bls, did not have impact above the CG; therefore, the impact was estimated to extend to 50 feet bls. Based on a localized area, the total estimated volume of impact at 33SB02 is 560 cubic yards.

The estimated area [approximately 310 square feet (ft²)] and volume (560 cubic yards) impacted by TRPH associated with boring location 33SB02 remains unchanged from the original FS.

LEGEND

- Soil Boring Location
- ▨ Estimated Area of Impacted Subsurface Soil
- ▤ Excavation Area
- - - Approximate Site Boundary
- Building/Structure
- Road
- ⋯ Sidewalk
- - - Fence

CG = Cleanup Goal
 FDEP SCTL = Florida Department of Environmental Protection Agency Soil Cleanup Target Level



Notes:
 1) TRPH = Total Recoverable Petroleum Hydrocarbons.
 2) Results shown exceed FDEP SCTLs for Commercial/Industrial Land Use.
 3) All units in mg/kg.



| | |
|----------------------|-----------------|
| DRAWN BY J. LAMEY | DATE 7/22/04 |
| CHECKED BY | DATE |
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SITE 33 ESTIMATED AREA IMPACTED BY
 CONSTITUENTS OF CONCERN
 IN SURFACE AND SUBSURFACE SOILS
 RECORD OF DECISION
 NAS WHITING FIELD, MILTON, FLORIDA

| | |
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| CONTRACT NUMBER 0052 | |
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| DRAWING NO. FIGURE 2-2 | REV 0 |

4.0 AMENDED DESCRIPTION AND EVALUATION OF REMEDIAL ALTERNATIVES

4.1 AMENDED DESCRIPTION OF ALTERNATIVES

Identification and screening appropriate technologies for remedial alternatives addressing the RAOs developed for Site 33 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 C contains a copy of the original FS description (Table 7-8) and evaluation of remedial alternatives for Site 33 (Table 7-9). This section of the FSA presents a revised description of the four original remedial alternatives eliminating the UST removal component, as well as the subsurface soil removal component for soil containing arsenic. Table 4-1 shows a comparison 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 UST removal and changes in soil COCs (deletion of arsenic) upon the evaluation of the four above 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. The changes in COCs only impact the overall protectiveness of Alternatives 2 and 3. These two alternatives are also slightly more protective because arsenic is no longer considered a COC.

4.2.2 Compliance with ARARs

The changes in COCs only impact the compliance of Alternatives 2 and 3 with chemical-specific ARARs. Compliance with the ARARs for the persistent arsenic is no longer required. There is no change in the compliance of Alternatives 1 and 4 with chemical-specific ARARs and with the compliance of Alternatives 1, 2, 3, and 4 and with location- and action-specific-ARARs.

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**TABLE 4-1
COMPARISON OF ORIGINAL FS AND FSA DESCRIPTION OF SOIL REMEDIAL ALTERNATIVES
SITE 33
NAS WHITING FIELD
MILTON, FLORIDA**

| Alternative Number | | Alternative Type | | Representative Process Options Combined into Alternatives | | Alternative Description | |
|--|---|--|---|---|------------------------------------|--|---|
| FS (March 2001) | FS Addendum (August 2004) | FS (March 2001) | FS Addendum (August 2004) | FS (March 2001) | FS Addendum (August 2004) | FS (March 2001) | FS Addendum (August 2004) |
| Alternative S33-1 No Action | Alternative 1 No Action | No Action | None | None | None | <ul style="list-style-type: none"> Five - year Reviews. | <ul style="list-style-type: none"> No Action (<i>Five-year review will be part of LUC Remedial Design.</i>) |
| Alternative S33-2 UST Removal and LUCs | Alternative 2 ECs and LUCs | Source Removal / Containment /Limited Action – No or Minimal Treatment | Limited Action – No or Minimal Treatment | LUCs, Remove UST | ECs and LUCs | <ul style="list-style-type: none"> LUCs including LUCAP and LUCIP. Excavate and remove UST.* Posting of warning signs. Five-year site reviews. | <ul style="list-style-type: none"> ECs and LUCs (<i>LUC Remedial Design will establish LUCIP.</i>) (<i>UST removed, August 2000.</i>) Posting of warning signs (<i>Five-year review will be part of LUC Remedial Design.</i>) |
| Alternative S33-3 UST Removal, Soil Venting, and LUCs | Alternative 3 Soil Venting and LUCs | Source Removal / Containment / Limited Action – Minimal Treatment | Limited Action – Minimal Treatment | LUCs, Remove UST, In Situ Soil Venting | LUCs and Soil Venting | <ul style="list-style-type: none"> LUCs including LUCAP and LUCIP. Delineation/confirmatory sampling of subsurface soil adjacent to 33SB02. Excavate and remove UST.* Install and operate an in situ soil venting system for subsurface soil at location 33SB02. Posting of warning signs. Five-year site reviews. | <ul style="list-style-type: none"> LUCs (<i>LUC Remedial Design will establish LUCIP.</i>) (<i>No delineation sampling, no surface soil excavation planned.</i>) (<i>UST's removed, August 2000.</i>) Install, operate, and monitor a soil venting system for subsurface soil at locations 33SB02. Posting of warning signs. (<i>Five-year review will be part of LUC remedial design.</i>) |
| Alternative S33-4 UST Removal, Subsurface Soil (exceeding PRGs) Removal, and LUCs | Alternative 4 Subsurface Soil (exceeding CGs) Removal and LUCs | Treatment / Bulk Removal – Minimizes Long-Term Management | Treatment/Bulk Removal – Minimizes Long-Term Management | LUCs, Remove UST, Bulk Excavation, Disposal | LUCs, Bulk Excavation, Disposal | <ul style="list-style-type: none"> LUCs including LUCAP and LUCIP. Delineation/confirmatory sampling of subsurface soil adjacent to 33SB02 and 33SB09. Excavate and remove UST.* Demolition and removal/disposal of asphalt and concrete pavement. Excavation/disposal of subsurface soil exceeding PRGs at 33SB02 and 33SB09. Backfill excavations with clean fill. Replace asphalt or concrete pavement. Establish vegetative cover. Posting of warning signs. Five-year site reviews. | <ul style="list-style-type: none"> LUCs (<i>LUC Remedial Design will establish LUCIP.</i>) Delineation/confirmatory sampling of surface and subsurface soil adjacent to 33SB02 (Arsenic no longer a COC; remediation of soil at 33SB09 not required). (<i>UST removed, August 2000.</i>) Demolition and removal/disposal of asphalt and concrete pavement. Excavation/disposal of surface and subsurface soil containing TRPH exceeding CGs at 33SB02. Backfill excavations with clean fill. Replace asphalt or concrete pavement. Establish vegetative cover. Posting of warning signs. (<i>Five-year review will be part of LUC Remedial Design.</i>) |

COC = constituent of concern
 ECs = Engineering Controls
 LUCs = Land Use Controls
 LUCAP = LUC Assurance Plan
 LUCIP = LUC Implementation Plan
 PRG = Preliminary Remedial Goal
 TPH = Total Petroleum Hydrocarbons
 TRPH = Total Recoverable Petroleum Hydrocarbons (FS refers to TPH; FS Addendum refers to TRPH)
 UST = Underground Storage Tank

Reference: Table 7-8, FS (TtNUS, 2001)

*The Project Completion Report, UST Removal at Sites 30, 32, and 33 (CCI, 2001) documenting the August 2000 removal of the UST at Site 33 was finalized in August 2001. The FS (TtNUS, 2001a) was finalized in March 2001 and did not incorporate the UST removal activities.

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TABLE 4-2

**SUMMARY OF COMPARATIVE IMPACT OF CHANGES IN COCS ON EVALUATION OF REMEDIAL ALTERNATIVES
SITE 33
NAS WHITING FIELD
MILTON, FLORIDA**

PAGE 1 OF 2

| Criteria | <u>Alternative 1</u> No Action | <u>Alternative 2</u> ECs and LUCs | <u>Alternative 3</u> Soil Venting and LUCs | <u>Alternative 4</u> 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 | More protection because of elimination of arsenic as a COC | More protection because of elimination of arsenic as a COC | No change |
| Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) | | | | |
| Compliance with Chemical-Specific ARARs | No change | Compliance with ARAR for persistent arsenic no longer required. | Compliance with ARAR for persistent arsenic no longer required. | 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 | Decreased residual risk because of elimination of arsenic as a COC | Decreased residual risk because of elimination of arsenic as a COC | 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 | Less amount of COCs required to be destroyed/treated; arsenic no longer a COC. | Less amount of COCs required to be destroyed/treated; arsenic no longer a COC. | Less amount of COCs required to be destroyed/treated; arsenic no longer a COC. |
| Reduction in Mobility, Toxicity, or Volume | No change | No change of reduction in mobility and toxicity. More reduction of volume. | No change of reduction in mobility and toxicity. More reduction of volume. | No change |
| 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 33
NAS WHITING FIELD
MILTON, FLORIDA**

PAGE 2 OF 2

| Criteria | Alternative 1 No Action | Alternative 2 ECs and LUCs | Alternative 3 Soil Venting and LUCs | Alternative 4 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 construction required: UST removed during the removal action in August 2000. | No change | Less construction time due to less soil to be excavated/disposed (less than 6 months). |
| Time Until RAOs and CGs are Achieved | No change | No change for time to meet RAOs. Less time will be required to meet CG because of elimination of arsenic as a COC. | No change for time to meet RAOs. Less time will be required to meet CG because of elimination of arsenic as a COC. | No change in time to meet RAOs. Less time will be required to meet CG because of elimination of arsenic as a COC. |
| 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 | \$24,613 (decrease) | \$16,206 (decrease) | \$150,502 (decrease) |
| Short-Term O&M | No change | No change | No change | 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 \$0 (Total) b | \$21,130 (decrease) \$82,186 (Total) | \$16,206 (decrease) \$186,934 (Total) | \$150,502 (decrease) \$243,457 (Total) |

NOTES:

ARAR Applicable or relevant and appropriate requirement
CG Cleanup Goal
COC Constituent of concern
EC Engineering Control
LUC Land use control
O&M Operation & Maintenance
RAO Remedial Action Objective

a Values shown represent the amount of decrease or increase in cost from original FS estimate. Present worth cost details are provided in Appendix C.

b The original FS included costs for 5-year reviews; however, no 5 year-reviews are included for the No Action alternative in this re-evaluation.

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 are reduced because of the elimination of persistent arsenic as a COC.

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. The changes in COCs do not impact the reduction of mobility or toxicity provided by Alternatives 2, 3, and 4. However, the estimated volume of soil to be treated is approximately 560 cubic yards less than the estimate presented in the original FS due to the elimination of arsenic as a COC.

4.2.5 Short-Term Effectiveness

The changes in COCs have a slight impact on the short-term effectiveness of Alternatives 2, 3, and 4. Alternative 2 requires no construction time because the UST has been removed. Alternative 2, 3, and 4 may achieve the CG sooner because arsenic is no longer a COC. Alternative 4 construction time would be reduced because arsenic is no longer a COC and less soil would be required to be excavated.

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 a small impact on the cost of Alternatives 2, 3, and 4. The removal of arsenic as a COC reduces the cost of Alternative 4 due to the elimination of the subsurface soil removal associated with boring location 33SB09 (arsenic in the 14-16 foot bls interval). The UST removal (CCI, 2001) also reduces the cost of Alternatives 2, 3, and 4 due to the elimination of this component from these three alternatives. The estimated net present worth (NPW) for Alternative 2 (\$82,186), has decreased by \$21,130 from the cost presented in the FS. The estimated NPW for Alternative 3 (\$186,934) and Alternative 4 (\$243,457) decreased by \$16, 206, and \$150, 502, respectively, from the FS estimate. Table 4-2 shows the amount of decreased in cost for Alternatives 2, 3, and 4 as well as the overall total present worth cost for each alternative. The NPW costs are detailed in Appendix D.

4.3 SUMMARY

As discussed in Sections 4.1 and 4.2 and as further illustrated on Tables 4-1 and 4-2, recent developments at Site 33 have had very little impact on the findings of the original FS. There are 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 report.

REFERENCES

ABB-ES (ABB Environmental Services, 1998). Remedial Investigation and Feasibility Study, General Information Report, Naval Air Station Whiting Field, Milton, Florida. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina.

CCI (CH2M HILL Constructors, Inc.), 2001. *Project Completion Report, UST Removal at Sites 30, 32, 33, Naval Air Station Whiting Field, Milton, Florida*. August.

FDEP (Florida Department of Environmental Protection), 1999. Technical Report: Development of Soil Cleanup Target Levels for Chapter F.A.C. 62-777. Final Report. May 26.

FDEP, 2001. Letter from James Cason, FDEP, to James Holland, Whiting Field, April 11.

TtNUS (Tetra Tech NUS, Inc.), 1999. *Remedial Investigation for Surface and Subsurface Soil at Sites 3, 4, 6, 30, 32, and 33, Naval Air Station Whiting Field, Milton, Florida*. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina. September.

TtNUS, 2001a. *Feasibility Study for Surface and Subsurface Soil at Sites 3, 4, 6, 30, 32, and 33, Naval Air Station Whiting Field, Milton, Florida*. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina. March.

TtNUS, 2001b. *Proposed Plan for Site 33, Midfield Maintenance Hangar Naval Air Station Whiting Field, Milton, Florida*. Prepared for NAVFAC EFD SOUTH, North Charleston, South Carolina. June.

United States Environmental Protection Agency (USEPA), 1999. Region III Risk-Based Concentration (RBC) Table. April 12.

USEPA, 2002. Region IX Preliminary Remediation Goals (PRGs) Table 2002 Update. USEPA Region IX, San Francisco, CA. October 1

APPENDIX A
UST REMOVAL DATA

Legend

▲ Soil Sample Location

Notes:

1. All units are mg/kg.
2. The applicable residential/industrial soil criteria for Site 33 are:

| | 62-777 FAC Direct Exposure Residential | 62-777 FAC Direct Exposure Industrial | 62-777 FAC Leachability |
|----------|--|---|-------------------------------|
| Arsenic* | 0.8 | 3.7 | 29 |

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

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

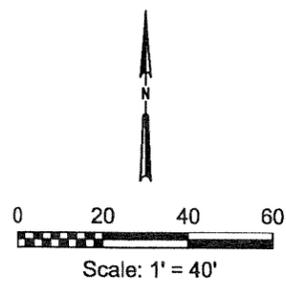
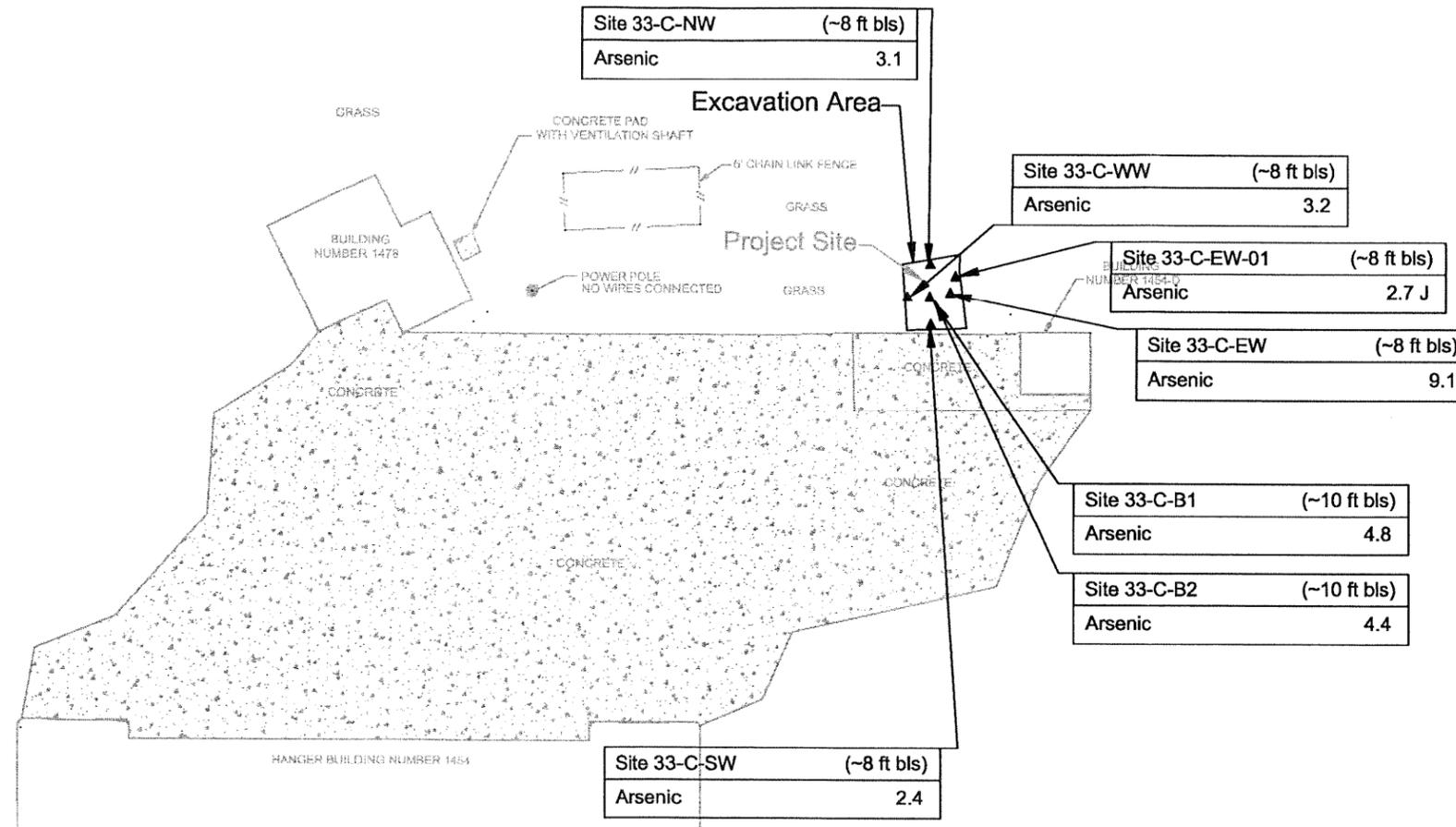


FIGURE 3-4
Excavation Area and Soil Sample
Locations for Site 33
Project Completion Report, NAS Whiting Field

TABLE 3-5
Analytical Summary Results for Site 33
Project Completion Report, NAS Whiting Field

| Sample ID No. | Site 33-C-B1 Bottom | Site 33-C-B2 Bottom | Site 33-C-SW South Wall | Site 33-C-EW East Wall | Site 33-C-WW West Wall | Site 33-C-NW North Wall | Site 33-C-EW-01 East Wall | 62-777 | 62-777 | 62-777 | |
|-----------------------------|---------------------------|---------------------------|-------------------------------|------------------------------|------------------------------|-------------------------------|---------------------------------|---------------------------|---------------------------|--------------|---------------------|
| | | | | | | | | FAC Direct Exposure | FAC Direct Exposure | | FAC Leachability |
| Laboratory ID No. | 08205-1 | 08205-2 | 08205-3 | 08205-4 | 08205-5 | 08205-6 | 08335-1 | Residential | Industrial | Leachability | |
| Depth | 10 ft bls | 10 ft bls | 8 ft bls | 8 ft bls | 8 ft bls | 8 ft bls | 8 ft bls | | | | |
| LABORATORY ANALYSES | Units | Soil | Soil | Soil | Soil | Soil | Soil | | | | |
| 1,1,2-Trichloroethane | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 1.3 | 1.8 | 0.03 |
| Tetrachloroethene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 8.9 | 17 | 0.03 |
| 1,3-Dichloropropane | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | | | |
| Dibromochloromethane | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 1.4 | 2.1 | 0.003 |
| 1,2-Dibromoethane | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 0.01 | 0.04 | 0.0001 |
| Chlorobenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 30 | 200 | 1.3 |
| 1,1,1,2-Tetrachloroethane | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 4 | 5.7 | 0.01 |
| Ethylbenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 1100 | 8400 | 0.6 |
| Total Xylenes | mg/kg | 0.016 U | 0.015 U | 0.017 U | 0.016 U | 0.015 U | 0.019 U | --- | 5900 | 40000 | 0.2 |
| Styrene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 2700 | 21000 | 3.6 |
| Bromoform | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 48 | 84 | 0.03 |
| 1-Methylethylbenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | | | |
| Bromobenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | | | |
| 1,1,2,2-Tetrachloroethane | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 0.7 | 1.1 | 0.002 |
| 1,2,3-Trichloropropane | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 0.01 | 0.02 | 0.001 |
| n-Propylbenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | | | |
| 2-Chlorotoluene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 120 | 850 | 2.8 |
| 4-Chlorotoluene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 100 | 730 | 2.5 |
| 1,3,5-Trimethylbenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 11 | 74 | 0.3 |
| tert-Butylbenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | | | |
| 1,2,4-Trimethylbenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 13 | 88 | 0.3 |
| sec-Butylbenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | | | |
| 1,3-Dichlorobenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 27 | 180 | 0.3 |
| 1,4-Dichlorobenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 6 | 9 | 2.2 |
| Isopropylbenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 160 | 1100 | 0.2 |
| p-Isopropyltoluene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | | | |
| n-Butylbenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | | | |
| 1,2-Dichlorobenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 650 | 4600 | 17 |
| 1,2-Dibromo-3-chloropropane | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 0.8 | 2.7 | 0.001 |
| 1,2,4-Trichlorobenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 560 | 7500 | 5.3 |
| Hexachlorobutadiene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 6.3 | 12 | 1.1 |

TABLE 3-5

Analytical Summary Results for Site 33
Project Completion Report, NAS Whiting Field

| Sample ID No. | Units | Site | Site | Site | Site | Site | Site | Site | 62-777 | 62-777 | 62-777 FAC Leachability |
|--|-------|----------------------|----------------------|-----------------------|----------------------|----------------------|-----------------------|-------------------------|---------------------------|---------------------------|-------------------------------|
| | | 33-C-B1 Bottom | 33-C-B2 Bottom | 33-C-SW South Wall | 33-C-EW East Wall | 33-C-WW West Wall | 33-C-NW North Wall | 33-C-EW-01 East Wall | FAC Direct Exposure | FAC Direct Exposure | |
| Laboratory ID No. | Depth | 08205-1 10 ft bls | 08205-2 10 ft bls | 08205-3 8 ft bls | 08205-4 8 ft bls | 08205-5 8 ft bls | 08205-6 8 ft bls | 08335-1 8 ft bls | Residential | Industrial | |
| LABORATORY ANALYSES | | Soil | Soil | Soil | Soil | Soil | Soil | Soil | | | |
| Naphthalene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 40 | 270 | 1.7 |
| 1,2,3-Trichlorobenzene | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.0052 U | 0.0065 U | --- | 560 | 7400 | 4.6 |
| Methyl-tert-butyl-ether | mg/kg | 0.0054 U | 0.0049 U | 0.0056 U | 0.0054 U | 0.011 | 0.0065 U | --- | 3200 | 22000 | 0.2 |
| Total Recoverable Petroleum Hydrocarbons (FL-PRO) | | | | | | | | | | | |
| TRPH | mg/kg | 52 | 40 | 20 | 3.5 | 10 | 53 | --- | 340 | 2500 | 340 |
| Metals (6010) | | | | | | | | | | | |
| Arsenic | mg/kg | 4.8 | 4.4 | 2.4 | 9.1 | 3.2 | 3.1 | 2.7 J | 0.8 | 3.7 | 29 |
| Chromium | mg/kg | 18 | 18 | 8.3 | 36 | 13 | 9.9 | --- | 210 | 420 | 38 |
| Cadmium | mg/kg | 0.10 U | 0.10 U | 0.10 U | 0.11 U | 0.10 U | 0.10 U | --- | 75 | 1300 | 8 |
| Lead | mg/kg | 8.1 | 7.5 | 5 | 8.6 | 12 | 8.4 | --- | 400 | 920 | |
| Polycyclic Aromatic Hydrocarbons (8310) | | | | | | | | | | | |
| Naphthalene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 40 | 270 | 1.7 |
| Acenaphthylene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 1100 | 11000 | 27 |
| 1-Methyl naphthalene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 68 | 470 | 2.2 |
| 2-Methyl naphthalene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 80 | 560 | 6.1 |
| Acenaphthene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 1900 | 18000 | 2.1 |
| Fluorene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 2200 | 28000 | 160 |
| Phenanthrene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 2000 | 30000 | 250 |
| Anthracene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 18000 | 260000 | 2500 |
| Fluoranthene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 2900 | 48000 | 1200 |
| Pyrene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 2200 | 37000 | 880 |
| Benzo(a)anthracene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 1.4 | 5 | 3.2 |
| Chrysene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 140 | 450 | 77 |
| Benzo(b)fluoranthene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 1.4 | 4.8 | 10 |
| Benzo(k)fluoranthene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 15 | 52 | 25 |
| Benzo(a)pyrene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 0.1 | 0.5 | 8 |
| Dibenz(a,h)anthracene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 0.1 | 0.5 | 30 |
| Benzo(g,h,i)perylene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 2300 | 41000 | 32000 |
| Ideno(1,2,3-cd)pyrene | mg/kg | 0.37 U | 0.36 U | 0.36 U | 0.39 U | 0.38 U | 0.37 U | --- | 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 33
MIDFIELD MAINTENANCE HANGAR**

SURFACE AND SUBSURFACE SOILS

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

AUGUST 2004

ACRONYMS

| | |
|--------|--|
| ABB-ES | ABB Environmental Services |
| bls | below land surface |
| COPC | constituent of potential concern |
| CTE | central tendency exposure |
| ELCR | excess lifetime cancer risk |
| FL PRO | Florida Petroleum Range Organics |
| 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 |
| mg/kg | milligrams per kilogram |
| PRG | Preliminary Remedial Goal |
| RfD | reference dose |
| RI | Remedial Investigation |
| RME | Reasonable Maximum Exposure |
| SCTL | soil cleanup target level |
| TRPH | total recoverable petroleum hydrocarbon |
| 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 NAS Whiting Field Site 33 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 (August 2000), and arsenic, aluminum, iron, manganese, and vanadium being present at naturally occurring concentrations at Site 33. 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 33 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 33 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, 2002) 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

All soil samples collected from 0 to 15 feet below land surface (bls) at Site 33 were evaluated for COPC selection. Only those chemicals detected in at least one sample were screened against the lesser of the USEPA Region IX PRG or the FDEP SCTL for the commercial/industrial 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 chemicals associated with non-cancer toxicity. For carcinogenic chemicals, 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 chemicals in soil via incidental ingestion, dermal contact, inhalation of volatiles, and inhalation of particulate dusts. To account for possible additivity of noncarcinogenic 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 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.

As shown in Table 1-1, total recoverable petroleum hydrocarbons (TRPH) was the only constituent identified as a COPC for surface soil and subsurface soils at Site 33. Appendix B-1 provides a summary of the TRPH detections for all soil samples taken during the RI and the UST removal project.

1.2 Exposure Assessment

The exposure assessment for this revised HHRA remains unchanged from the baseline HHRA presentation in the RI.

Surface Soil

There is no surface soil exposure at Site 33 for the current land use scenario as an industrial area with concrete and asphalt pavement covering most of the ground surface. For completeness purposes, the hypothetical future case assuming concrete removal was evaluated. Receptor exposure to TRPH through ingestion and dermal contact was evaluated.

Subsurface Soil

There are no current exposures to subsurface soil. However, construction activities in the future may expose construction workers to contaminants in subsurface soil. Incidental ingestion and dermal contact were evaluated for construction workers exposed to contaminants in subsurface soil.

Exposure Point Concentrations (EPCs) for TRPH in surface and subsurface soil were calculated according to Paragraph 2.5.3.3 of the GIR (ABB-ES, 1998). Appendix D-9 of the RI presents COPCs, EPCs, intake, and risk calculations for Site 33 assuming the concrete is removed from the site.

1.3 Toxicity Assessment

The toxicity assessment evaluates the available evidence on the potential adverse effects associated with exposure to each COPC. With this information, a relationship between the extent of exposure and the likelihood or severity of adverse human health effects is developed. The maximum detected concentration of TRPH was used as the EPC for risk screening.

TABLE 1-1
SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN
SITE 33
NAS WHITING FIELD, MILTON, FLORIDA

PAGE 1 OF 2

| | |
|----------------------|---------------------|
| Scenario Time Frame: | Current/Future |
| Medium: | Soil |
| Exposure Medium: | Soil (0 to 15 feet) |
| Exposure Point: | Site 33 |

| 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 Residential | | |
| Volatiles | | | | | | | | | | | | |
| 67641 | Acetone | 0.003 | 0.017 | mg/kg | 3/13 | 0.15 | NA | 160 | N | 78 | No | BSL |
| 100414 | Ethylbenzene | 1.5 | 1.5 | mg/kg | 1/13 | 1.5 | NA | 8.9 | C | 110 | No | BSL |
| 79016 | Trichloroethene | 0.029 | 0.048 | mg/kg | 2/13 | 0.0385 | NA | 0.053 | C | 6 | No | BSL |
| 1330207 | Xylenes, Total | 0.011 | 4.8 | mg/kg | 3/13 | 4.8 | NA | 27 | N | 590 | No | BSL |
| Semivolatiles | | | | | | | | | | | | |
| 91576 | 2-Methylnaphthalene | 2.1 | 2.5 | mg/kg | 3/13 | 2.5 | NA | 5.6 ⁽⁶⁾ | N | 8 | No | BSL |
| 117817 | Bis(2ethylhexyl)Phthalate | 0.061 | 0.41 | mg/kg | 2/13 | 0.41 | NA | 35 | C | 76 | No | BSL |
| 86737 | Fluorene | 0.068 | 0.15 | mg/kg | 2/13 | 0.15 | NA | 275 | N | 220 | No | BSL |
| 91203 | Naphthalene | 0.27 | 0.61 | mg/kg | 4/13 | 0.61 | NA | 5.6 | N | 4 | No | BSL |
| 85018 | Phenanthrene | 0.069 | 0.24 | mg/kg | 2/13 | 0.24 | NA | 5.6 ⁽⁶⁾ | N | 200 | No | BSL |
| 129000 | Pyrene | 0.04 | 0.04 | mg/kg | 1/13 | 0.04 | NA | 230 | N | 220 | No | BSL |
| Pesticides/PCBs | | | | | | | | | | | | |
| 5103719 | Gamma-chlordane | 0.0047 | 0.0047 | mg/kg | 1/12 | 0.0047 | NA | 1.6 ⁽⁷⁾ | C | 3.1 | No | BSL |
| Inorganics | | | | | | | | | | | | |
| 7429905 | Aluminum | 5610 | 47800 | mg/kg | 13/13 | 47800 | 15848 | 7600 | N | 7200 | No | NOIC |
| 7440382 | Arsenic | 0.7 | 11.5 | mg/kg | 13/13 | 11.5 | 3.2 | 0.39 | C | 0.8 | No | NOIC |
| 7440393 | Barium | 3.3 | 18.1 | mg/kg | 13/13 | 18.1 | 23.2 | 540 | N | 110 | No | BSL |
| 7440417 | Beryllium | 0.13 | 0.13 | mg/kg | 1/13 | 0.13 | 0.36 | 15 | N | 12 | No | BSL |
| 7440439 | Cadmium | 0.39 | 1 | mg/kg | 13/13 | 1 | 0.58 | 3.7 | N | 75 | No | BSL |
| 7440702 | Calcium | 56 | 795 | mg/kg | 13/13 | 795 | 396 | NA | | | No | NUT |
| 7440473 | Chromium | 6.9 | 34.7 | mg/kg | 13/13 | 34.7 | 11 | 210 ⁽⁸⁾ | C | 210 ⁽⁹⁾ | No | BSL |
| 7440484 | Cobalt | 1.3 | 1.8 | mg/kg | 7/13 | 1.8 | 3 | 140 | N | 470 | No | BSL |
| 7440508 | Copper | 2.9 | 11.1 | mg/kg | 13/13 | 11.1 | 9.4 | 310 | N | 110 | No | BSL |
| 7439896 | Iron | 5880 | 22300 | mg/kg | 13/13 | 22300 | 8832 | 2300 | N | 2300 | No | NOIC |
| 7439921 | Lead | 2.7 | 24.3 | mg/kg | 13/13 | 24.3 | 11.4 | 400 ⁽¹⁰⁾ | | 400 | No | BSL |
| 7439954 | Magnesium | 40.6 | 204 | mg/kg | 13/13 | 204 | 268 | NA | | NA | No | NUT |
| 7439965 | Manganese | 24.3 | 169 | mg/kg | 13/13 | 169 | 392 | 180 | N | 160 | No | BSL |
| 7439976 | Mercury | 0.03 | 0.17 | mg/kg | 9/13 | 0.17 | 0.12 | 2.3 ⁽¹¹⁾ | N | 3.4 | No | BSL |

TABLE 1-1
 SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN
 SITE 33
 NAS WHITING FIELD, MILTON, FLORIDA

PAGE 2 OF 2

| 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 Residential | | |
| Inorganics (Continued) | | | | | | | | | | | | |
| 7440020 | Nickel | 2.7 | 3.8 | mg/kg | 5/13 | 3.8 | 7.2 | 160 | N | 110 | No | BSL |
| 7440097 | Potassium | 60 | 205 | mg/kg | 13/13 | 205 | 177 | NA | | NA | No | NUT |
| 7782492 | Selenium | 0.22 | 0.64 | mg/kg | 5/13 | 0.64 | 0.46 | 39 | N | 39 | No | BSL |
| 7440235 | Sodium | 156 | 249 | mg/kg | 13/13 | 249 | 406 | NA | | NA | No | NUT |
| 7440622 | Vanadium | 14.4 | 61.5 | mg/kg | 13/13 | 61.5 | 21.8 | 55 | N | 15 | No | NOIC |
| 7440666 | Zinc | 5.2 | 19.3 | mg/kg | 13/13 | 19.3 | 15.4 | 2300 | N | 2300 | No | BSL |
| Petroleum Hydrocarbons | | | | | | | | | | | | |
| | Total Petroleum Hydrocarbons | 3.5 | 7790 | mg/kg | 18/18 | 7790 | NA | NA | | 340 ⁽¹²⁾ | 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 PRG Table, 2002 (note: 1/10th PRG value used for non-carcinogens).

(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. 1/10th SCTL value used for non-carcinogens. Values for vanadium are based on acute toxicity; therefore, vanadium screening values are not adjusted to 1/10th.

(4) Rationale codes: Selection or Deletion Reason: Above Screening Level (ASL)
 Essential Nutrient (NUT)
 Below Screening Level (BSL)
 Naturally Occurring Inorganic Chemical (NOIC)

(5) Soil basis codes: N noncarcinogen
 C carcinogen

(6) Value is for naphthalene

(7) Value is for chlordane

(8) Value is for total chromium. Hexavalent chromium is not known to have been used at NASWF.

(9) Value is for hexavalent chromium, only SCTL given for chromium.

(10) Screening level for lead, "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities", OSWER Directive #9355.412.

(11) Value is for mercuric chloride.

(12) Value is for Total Recoverable Petroleum Hydrocarbons.

Constituents exceeding criteria are bolded.

COPC Constituent of Potential Concern

mg/kg milligram per kilogram

NA not applicable

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. For Site 33, quantitative estimates of non-carcinogenic risks are made for TRPH, the only COPC identified for the site, for each complete exposure pathway identified in the exposure assessment. The risk characterization methodology is described in Subsection 2.5.5 of the GIR (ABB-ES, 1998).

In the RI, TRPH was addressed separately from other COPCs due to a high level of uncertainty associated with the risks attributed to TRPH. Subsection 6.6 of the RI summarizes the estimated risks due to TRPH at Site 33. This revised HHRA presents the previously calculated risks for TRPH, the only COPC, identified for Site 33.

1.5 Results

TRPH data (1992, 1993, 1998, and 2000) from Site 33 were re-evaluated to determine the revised COPCs for the site based on changed screening criteria and additional soil analytical data from the UST removal project. The 1998 and 2000 data were collected following the Florida Petroleum Range Organics (FL-PRO) methodology. The FL-PRO methodology analyzes the c8 to c40 chains. The 1998 samples were “step-out” samples collected to evaluate the nature and extent of contamination. Therefore, these samples were collected at locations away from the highest previous concentrations. The 2000 data were soil confirmation samples collected from the UST removal project. These concentrations would be underestimates of risk if used in the risk assessment. The historical biased samples were analyzed for TRPH using USEPA Method SW418.1.

The FDEP criteria for direct contact with soils is 340 milligrams per kilogram (mg/kg) for residential land use and 2,500 mg/kg for industrial land use (FDEP, 1999). Concentrations detected in site surface and subsurface soil samples were compared to the residential criteria and the industrial criteria. The oral reference dose (RfD) for TRPH was taken from the most conservative TRPH RfD presented in Table 2-9 of the GIR (ABB-ES, 1998). This RfD of 0.03 multiplied by the gastrointestinal absorption efficiency value of 0.5 (GIR, ABB-ES, 1998) converts the oral RfD to a dermal RfD of 0.02. Hazard Indices (HIs) were determined using these values. Carcinogenic risk could not be evaluated for any receptor since there is no cancer slope factor for TRPH.

Current Land-use Conditions

The concentrations of TRPH in surface soils at Site 33 (2,340 mg/kg) were more than the FDEP SCTL residential criteria. These concentrations were not detected in “step-out” samples, but in the biased

samples collected near suspected source areas. Since concrete covered the surface soil at Site 33, there were no current complete exposure pathways.

The concentration of TRPH in subsurface soils at Site 33 (7,790 mg/kg) was more than the industrial criteria. The risks for the construction worker were evaluated at this site. The Reasonable Maximum Exposure (RME) HI for the construction worker (0.17) is less than unity. Appendix B-2 contains copies of the risk estimate presented in Appendix D-3 of the RI.

Hypothetical Future Land-use Conditions Assuming Concrete Removal at Site 33

Although it is unlikely the concrete will be removed in the future from Site 33, TRPH exposures are quantified in the RI, Appendix D-9, assuming future concrete removal. Copies of these risk calculations are contained in Appendix B-3 for reference. The RME HIs for the adult trespasser, older child trespasser, site maintenance worker, occupational worker, and construction worker are all less than 1.0 at Site 33. The RME HI for the child resident is 1.1 at Site 33; the Central Tendency Exposure (CTE) risk for this receptor is 0.38 at Site 33. The RME HI for the adult resident is less than 1.0 at Site 33.

1.6 Uncertainty Analysis

General uncertainties associated with the risk estimation process and site-specific uncertainties are discussed or referenced in the RI.

There is a high level of uncertainty associated with the risks attributed to TRPH. Estimated TRPH risks are uncertain for the following reasons:

- Recent data from the suspected source area are not represented in the risk assessment, causing possible overestimation of risk, assuming the concentrations of TRPH decreased over time through processes such as biodegradation.
- The most conservative TRPH RfD was used. It is unlikely the most conservative RfD is applicable to all detected TRPH; therefore, the HI is likely to be over estimated.

APPENDIX B-1
TRPH DETECTIONS IN SOILS
SITE 33
NAS WHITING FIELD, MILTON, FLORIDA

TABLE B1-1

**TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
DETECTIONS IN SURFACE AND SUBSURFACE SOILS
SITE 33, MIDFIELD MAINTENANCE HANGAR
NAS WHITING FIELD, MILTON, FLORIDA**

| SAMPLE ID | SAMPLE DATE | SAMPLE INTERVAL (ft bls) | PARAMETER | CONCENTRATION (mg/kg) | FDEP SCTL (Residential) | FDEP SCTL (Industrial) | EXCEEDS RESIDENTIAL SCTL | EXCEEDS INDUSTRIAL SCTL |
|-----------------|-------------|-----------------------------|-----------|--------------------------|----------------------------|---------------------------|--------------------------------|-------------------------------|
| 33B00201 | 6/6/1996 | 0-2 | TRPH | 13.8 | 340 | 2500 | No | No |
| 33B00202 | 6/6/1996 | 5-7 | TRPH | 18.8 | 340 | 2500 | No | No |
| 33B00303 | 6/6/1996 | 10-12 | TRPH | 274 | 340 | 2500 | No | No |
| 33B00304 | 6/6/1996 | 15-17 | TRPH | 109 | 340 | 2500 | No | No |
| 33B00305 | 6/6/1996 | 20-22 | TRPH | 2.1 | 340 | 2500 | No | No |
| 33-C-B1 | 8/23/2000 | 10* | TRPH | 52 | 340 | 2500 | No | No |
| 33-C-B2 | 8/23/2000 | 10* | TRPH | 40 | 340 | 2500 | No | No |
| 33-C-EW | 8/23/2000 | 8* | TRPH | 3.5 | 340 | 2500 | No | No |
| 33-C-NW | 8/23/2000 | 8* | TRPH | 53 | 340 | 2500 | No | No |
| 33-C-SW | 8/23/2000 | 8* | TRPH | 20 | 340 | 2500 | No | No |
| 33-C-WW | 8/23/2000 | 8* | TRPH | 10 | 340 | 2500 | No | No |
| 33SB1-10-12 | 12/3/1992 | 10-12 | TRPH | 9.2 | 340 | 2500 | No | No |
| 33SB1-25-27 | 12/3/1992 | 25-27 | TRPH | 10.2 | 340 | 2500 | No | No |
| 33SB2-10-12 | 12/1/1992 | 10-12 | TRPH | 1310 | 340 | 2500 | Yes | No |
| 33SB2-120-122 | 12/3/1992 | 120-122 | TRPH | 2.3 | 340 | 2500 | No | No |
| 33SB2-15-17 | 12/1/1992 | 15-17 | TRPH | 610 | 340 | 2500 | Yes | No |
| 33SB2-2-4 | 12/1/1992 | 2-4 | TRPH | 17.7 | 340 | 2500 | No | No |
| 33SB2-35-37 | 12/3/1992 | 35-37 | TRPH | 2110 | 340 | 2500 | Yes | No |
| 33SB2-35-37-AVG | 12/3/1992 | 35-37 | TRPH | 2545 | 340 | 2500 | Yes | Yes |
| 33SB2-35-37-D | 12/3/1992 | 35-37 | TRPH | 2980 | 340 | 2500 | Yes | Yes |
| 33SB2-5-7 | 12/1/1992 | 5-7 | TRPH | 7790 | 340 | 2500 | Yes | Yes |
| 33SB2-60-62 | 12/3/1992 | 60-62 | TRPH | 222 | 340 | 2500 | No | No |
| 33SB2-80-82 | 12/3/1992 | 80-82 | TRPH | 862 | 340 | 2500 | Yes | No |
| 33SB2-95-97 | 12/3/1992 | 95-97 | TRPH | 27.2 | 340 | 2500 | No | No |
| 33SB3-15-17 | 12/1/1992 | 15-17 | TRPH | 4.3 | 340 | 2500 | No | No |
| 33SB4-15-17 | 12/2/1992 | 15-17 | TRPH | 5.6 | 340 | 2500 | No | No |
| 33SB4-3-5 | 12/2/1992 | 3-5 | TRPH | 14.1 | 340 | 2500 | No | No |
| 33SB5-0-2 | 12/6/1992 | 0-2 | TRPH | 2340 | 340 | 2500 | Yes | No |
| 33SB5-0-2-AVG | 12/6/1992 | 0-2 | TRPH | 2300 | 340 | 2500 | Yes | No |
| 33SB5-0-2-D | 12/6/1992 | 0-2 | TRPH | 2260 | 340 | 2500 | Yes | No |
| 33SB5-10-12 | 12/6/1992 | 10-12 | TRPH | 4.8 | 340 | 2500 | No | No |
| 33SB5-5-7 | 12/6/1992 | 5-7 | TRPH | 18.2 | 340 | 2500 | No | No |
| W33SB00601 | 3/18/1998 | 0-2 | TRPH | 10.7 | 340 | 2500 | No | No |
| W33SB00603 | 3/18/1998 | 28-30 | TRPH | 9.34 | 340 | 2500 | No | No |

Samples exceeding FDEP SCTL criteria are highlighted.

* sample taken from excavation area

AVG = average of original and duplicate samples

APPENDIX B-2

**RISK CALCULATIONS – TRPH IN SUBSURFACE SOIL
(CURRENT LAND-USE CONDITIONS)**

RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: CONSTRUCTION WORKER - REASONABLE MAXIMUM EXPOSURES
MEDIA: SUBSURFACE SOIL
DATE: SEPTEMBER 9, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH INCIDENTAL INGESTION OF SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION:
$$\text{Intake} = (C \times IR \times CF \times FI \times EF \times ED) / (BW \times AT)$$

WHERE:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| IR = : | 480 Soil Ingestion Rate (mg/day) |
| CF = : | 1.0E-06 Conversion Factor (kg/mg) |
| FI = : | 1 Fraction from contaminated source (unitless) |
| EF = : | 30 Exposure Frequency (days/year) |
| ED = : | 1 Exposure Duration (years) |
| BW = : | 70 Body Weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 365 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = : 8.1E-09 kg-soil/kg-wt/day
 Chronic Daily Intake = : 5.6E-07 kg-soil/kg-wt/day

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| RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL (PAGE TWO) | | | | | | | | | |
|---|---------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33 LOCATION: MILTON, FLORIDA EXPOSURE SCENARIO: CONSTRUCTION WORKER - REASONABLE MAXIMUM EXPOSURES MEDIA: SUBSURFACE SOIL DATE: SEPTEMBER 9, 1998 | | | | | | | | | |
| CHEMICAL | Cs (mg/kg) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
| TPH | 7790 | 6.3E-05 | 4.4E-03 | NA | 3.00E-02 | NA | NA | 1.5E-01 | 100.0% |
| | | | | | Total | NA | NA | 1.5E-01 | 100.0% |

B-2-4

D3-444

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CTO-0028

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09/17/04
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09/27/99

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D3-445

CTO-0028

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: CONSTRUCTION WORKER - REASONABLE MAXIMUM EXPOSURES
MEDIA: SUBSURFACE SOIL
DATE: SEPTEMBER 9, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH DERMAL CONTACT WITH SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION: Absorbed Dose = $(C_s \times C_F \times S_A \times A_F \times A_{BS} \times E_F \times E_D) / (B_W \times A_T)$

Where:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| CF = : | 1.0E-06 Conversion factor (kg/mg) |
| SA = : | 5,750 Skin surface available for contact (cm ² /event) |
| AF = : | 1.0 Soil to skin adherence factor (mg/cm ²) |
| | Chemical |
| ABS = : | Specific Absorption factor (unitless) |
| EF = : | 30 Exposure frequency (events/year) |
| ED = : | 1 Exposure duration (years) |
| BW = : | 70 Body weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 365 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = 9.6E-08 kg-soil/kg-wt/day
 Chronic Daily Intake = : 5.8E-06 kg-soil/kg-wt/day

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RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL (PAGE TWO)

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: CONSTRUCTION WORKER - REASONABLE MAXIMUM EXPOSURES
MEDIA: SUBSURFACE SOIL
DATE: SEPTEMBER 9, 1998

| CHEMICAL | Cs (mg/kg) | ABS (unitless) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
|----------|---------------|-------------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| TPH | 7790 | 0.01 | 7.51E-06 | 5.26E-04 | NA | 2.00E-02 | NA | NA | 2.6E-02 | 100.0% |
| | | | | | | Total | NA | NA | 2.6E-02 | 100.0% |

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09/17/04
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09/27/99

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| RISK ASSESSMENT SPREADSHEET - SUMMARY | | | | | | | | |
|---|----------------------|----------------|------------|--------------|----------------------|----------------|----------|------------|
| SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33 LOCATION: MILTON, FLORIDA EXPOSURE SCENARIO: CONSTRUCTION WORKER - REASONABLE MAXIMUM EXPOSURES MEDIA: SUBSURFACE SOIL DATE: SEPTEMBER 9, 1998 | | | | | | | | |
| Chemical | Lifetime Cancer Risk | | | | Hazard Index | | | |
| | Incidental Ingestion | Dermal Contact | Total Risk | Percent Risk | Incidental Ingestion | Dermal Contact | Total HI | Percent HI |
| TPH | NA | NA | NA | NA | 1.5E-01 | 2.6E-02 | 1.7E-01 | 100.0% |
| Total | NA | NA | NA | NA | 1.5E-01 | 2.6E-02 | 1.7E-01 | 100.0% |

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D3-447

CTO 0028

CTO-0028

Rev. 1
09/27/99

Rev. 2
09/17/04

APPENDIX B-3

**RISK CALCULATIONS – TRPH IN SURFACE SOIL
(HYPOTHETICAL FUTURE CONDITIONS ASSUMING CONCRETE REMOVAL)**

RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: TRESPASSER - OLDER CHILD - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 8, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH INCIDENTAL INGESTION OF SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION: $\text{Intake} = (\text{C} \times \text{IR} \times \text{CF} \times \text{FI} \times \text{EF} \times \text{ED}) / (\text{BW} \times \text{AT})$

WHERE:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| IR = : | 100 Soil Ingestion Rate (mg/day) |
| CF = : | 1.0E-06 Conversion Factor (kg/mg) |
| FI = : | 1 Fraction from contaminated source (unitless) |
| EF = : | 45 Exposure Frequency (days/year) |
| ED = : | 10 Exposure Duration (years) |
| BW = : | 45 Body Weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 3,650 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = : 3.9E-08 kg-soil/kg-wt/day
 Chronic Daily Intake = : 2.7E-07 kg-soil/kg-wt/day

| RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL (PAGE TWO) | | | | | | | | | |
|---|---------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33 LOCATION: MILTON, FLORIDA EXPOSURE SCENARIO: TRESPASSER - OLDER CHILD - REASONABLE MAXIMUM EXPOSURES MEDIA: SURFACE SOIL WITHOUT CONCRETE DATE: JULY 8, 1998 | | | | | | | | | |
| CHEMICAL | Cs (mg/kg) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
| TPH | 2300 | 9.0E-05 | 6.3E-04 | NA | 3.00E-02 | NA | NA | 2.1E-02 | 100.0% |
| | | | | | Total | NA | NA | 2.1E-02 | 100.0% |

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B-3-4

D9-309

CTO 0028

CTO-0028

R4708989

D9-310

CTO-0028

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: TRESPASSER - OLDER CHILD - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 8, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH DERMAL CONTACT WITH SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION: $\text{Absorbed Dose} = (\text{Cs} \times \text{CF} \times \text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED}) / (\text{BW} \times \text{AT})$

Where:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| CF = : | 1.0E-06 Conversion factor (kg/mg) |
| SA = : | 1,013 Skin surface available for contact (cm ² /event) |
| AF = : | 1.0 Soil to skin adherence factor (mg/cm ²) |
| | Chemical |
| ABS = : | Specific Absorption factor (unitless) |
| EF = : | 45 Exposure frequency (events/year) |
| ED = : | Exposure duration (years) |
| BW = : | Body weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 3,650 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = 1.8E-06 kg-soil/kg-wt/day

Chronic Daily Intake = : 1.2E-05 kg-soil/kg-wt/day

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| RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL (PAGE TWO) | | | | | | | | | | |
|---|---------------|-------------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33 LOCATION: MILTON, FLORIDA EXPOSURE SCENARIO: TRESPASSER - OLDER CHILD - REASONABLE MAXIMUM EXPOSURES MEDIA: SURFACE SOIL WITHOUT CONCRETE DATE: JULY 8, 1998 | | | | | | | | | | |
| CHEMICAL | Cs (mg/kg) | ABS (unitless) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
| TPH | 2300 | 0.01 | 4.10E-05 | 2.87E-04 | NA | 2.00E-02 | NA | NA | 1.4E-02 | 100.0% |
| | | | | | | Total | NA | NA | 1.4E-02 | 100.0% |

B-3-6

D9-311

CTO-0028

CTO 0028

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RISK ASSESSMENT SPREADSHEET - SUMMARY

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
 LOCATION: MILTON, FLORIDA
 EXPOSURE SCENARIO: TRESPASSER - OLDER CHILD - REASONABLE MAXIMUM EXPOSURES
 MEDIA: SURFACE SOIL WITHOUT CONCRETE
 DATE: JULY 8, 1998

| Chemical | Lifetime Cancer Risk | | | | Hazard Index | | | |
|----------|----------------------|----------------|------------|--------------|----------------------|----------------|----------|------------|
| | Incidental Ingestion | Dermal Contact | Total Risk | Percent Risk | Incidental Ingestion | Dermal Contact | Total HI | Percent HI |
| TPH | NA | NA | NA | NA | 2.1E-02 | 1.4E-02 | 3.5E-02 | 100.0% |
| Total | NA | NA | NA | NA | 2.1E-02 | 1.4E-02 | 3.5E-02 | 100.0% |

RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
 LOCATION: MILTON, FLORIDA
 EXPOSURE SCENARIO: TRESPASSER - ADULT - REASONABLE MAXIMUM EXPOSURES
 MEDIA: SURFACE SOIL WITHOUT CONCRETE
 DATE: JULY 9, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH INCIDENTAL INGESTION OF SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION Intake = $(C \times IR \times CF \times FI \times EF \times ED) / (BW \times AT)$

WHERE:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| IR = : | 100 Soil Ingestion Rate (mg/day) |
| CF = : | 1.0E-06 Conversion Factor (kg/mg) |
| FI = : | 1 Fraction from contaminated source (unitless) |
| EF = : | 45 Exposure Frequency (days/year) |
| ED = : | 20 Exposure Duration (years) |
| BW = : | 70 Body Weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 7,300 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = : 5.0E-08 kg-soil/kg-wt/day
 Chronic Daily Intake = : 1.8E-07 kg-soil/kg-wt/day

| RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL (PAGE TWO) | | | | | | | | | |
|---|---------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33 LOCATION: MILTON, FLORIDA EXPOSURE SCENARIO: TRESPASSER - ADULT - REASONABLE MAXIMUM EXPOSURES MEDIA: SURFACE SOIL WITHOUT CONCRETE DATE: JULY 9, 1998 | | | | | | | | | |
| CHEMICAL | Cs (mg/kg) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
| TPH | 2300 | 1.2E-04 | 4.1E-04 | NA | 3.00E-02 | NA | NA | 1.4E-02 | 100.0% |
| | | | | | Total | NA | NA | 1.4E-02 | 100.0% |

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
 LOCATION: MILTON, FLORIDA
 EXPOSURE SCENARIO: TRESPASSER - ADULT - REASONABLE MAXIMUM EXPOSURES
 MEDIA: SURFACE SOIL WITHOUT CONCRETE
 DATE: JULY 9, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH DERMAL CONTACT WITH SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION: $\text{Absorbed Dose} = (\text{Cs} \times \text{CF} \times \text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED}) / (\text{BW} \times \text{AT})$

Where:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| CF = : | 1.0E-06 Conversion factor (kg/mg) |
| SA = : | 5,750 Skin surface available for contact (cm ² /event) |
| AF = : | 1.0 Soil to skin adherence factor (mg/cm ²) |
| | Chemical |
| ABS = : | Specific Absorption factor (unitless) |
| EF = : | 45 Exposure frequency (events/year) |
| ED = : | 20 Exposure duration (years) |
| BW = : | 70 Body weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 7,300 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = 2.9E-06 kg-soil/kg-wt/day
 Chronic Daily Intake = : 1.0E-05 kg-soil/kg-wt/day

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RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL (PAGE TWO)

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: TRESPASSER - ADULT - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 9, 1998

| CHEMICAL | Cs (mg/kg) | ABS (unitless) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
|----------|---------------|-------------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| TPH | 2300 | 0.01 | 6.66E-05 | 2.33E-04 | NA | 2.00E-02 | NA | NA | 1.2E-02 | 100.0% |
| | | | | | | Total | NA | NA | 1.2E-02 | 100.0% |

B-3-11

D9-331

CTO 0028

CTO-0028

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RISK ASSESSMENT SPREADSHEET - SUMMARY

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: TRESPASSER - ADULT - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 9, 1998

| Chemical | Lifetime Cancer Risk | | | | Hazard Index | | | |
|--------------|----------------------|----------------|------------|--------------|----------------------|----------------|----------------|---------------|
| | Incidental Ingestion | Dermal Contact | Total Risk | Percent Risk | Incidental Ingestion | Dermal Contact | Total HI | Percent HI |
| TPH | NA | NA | NA | NA | 1.4E-02 | 1.2E-02 | 2.5E-02 | 100.0% |
| Total | NA | NA | NA | NA | 1.4E-02 | 1.2E-02 | 2.5E-02 | 100.0% |

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D9-332

CTO 0028

CTO-0028

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RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: OCCUPATIONAL WORKER - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: AUGUST 20, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
EXPOSURES THROUGH INCIDENTAL INGESTION OF SOIL ARE CONSIDERED.
ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION. Intake = (C x IR x CF x FI x EF x ED)/(BW x AT)

WHERE: Cs = : Mean concentration in soil (mg/kg)
IR = : 50 Soil Ingestion Rate (mg/day)
CF = : 1.0E-06 Conversion Factor (kg/mg)
FI = : 1 Fraction from contaminated source (unitless)
EF = : 250 Exposure Frequency (days/year)
ED = : 25 Exposure Duration (years)
BW = : 70 Body Weight (kg)
ATc = : 25,550 Averaging time for carcinogenic exposures (days)
ATn = : 9,125 Averaging time for noncarcinogenic exposures (days)

Unit Dose
Lifetime Chronic Daily Intake = : 1.7E-07 kg-soil/kg-wt/day
Chronic Daily Intake = : 4.9E-07 kg-soil/kg-wt/day

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| RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL (PAGE TWO) | | | | | | | | | |
|---|---------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33 LOCATION: MILTON, FLORIDA EXPOSURE SCENARIO: OCCUPATIONAL WORKER - REASONABLE MAXIMUM EXPOSURES MEDIA: SURFACE SOIL WITHOUT CONCRETE DATE: AUGUST 20, 1998 | | | | | | | | | |
| CHEMICAL | Cs (mg/kg) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
| TPH | 2300 | 4.0E-04 | 1.1E-03 | NA | 3.00E-02 | NA | NA | 3.8E-02 | 100.0% |
| | | | | | Total | NA | NA | 3.8E-02 | 100.0% |

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D9-349

CTO 0028

CTO-0028

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D9-350

CTO-0028

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
 LOCATION: MILTON, FLORIDA
 EXPOSURE SCENARIO: OCCUPATIONAL WORKER - REASONABLE MAXIMUM EXPOSURES
 MEDIA: SURFACE SOIL WITHOUT CONCRETE
 DATE: AUGUST 20, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH DERMAL CONTACT WITH SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION Absorbed Dose = (Cs x CF x SA x AF x ABS x EF x ED)/(BW x AT)

Where

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| CF = : | 1.0E-06 Conversion factor (kg/mg) |
| SA = : | 2,300 Skin surface available for contact (cm ² /event) |
| AF = : | 1.0 Soil to skin adherence factor (mg/cm ²) |
| | Chemical |
| ABS = : | Specific Absorption factor (unitless) |
| EF = : | 250 Exposure frequency (events/year) |
| ED = : | 25 Exposure duration (years) |
| BW = : | 70 Body weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 9,125 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

| | |
|---------------------------------|---------------------------|
| Lifetime Chronic Daily Intake = | 8.0E-06 kg-soil/kg-wt/day |
| Chronic Daily Intake = : | 2.3E-05 kg-soil/kg-wt/day |

| RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL (PAGE TWO) | | | | | | | | | | |
|---|---------------|-------------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33 LOCATION: MILTON, FLORIDA EXPOSURE SCENARIO: OCCUPATIONAL WORKER - REASONABLE MAXIMUM EXPOSURES MEDIA: SURFACE SOIL WITHOUT CONCRETE DATE: AUGUST 20, 1998 | | | | | | | | | | |
| CHEMICAL | Cs (mg/kg) | ABS (unitless) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
| TPH | 2300 | 0.01 | 1.85E-04 | 5.18E-04 | NA | 2.00E-02 | NA | NA | 2.6E-02 | 100.0% |
| | | | | | | Total | NA | NA | 2.6E-02 | 100.0% |

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RISK ASSESSMENT SPREADSHEET - SUMMARY

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: OCCUPATIONAL WORKER - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: AUGUST 20, 1998

| Chemical | Lifetime Cancer Risk | | | | Hazard Index | | | |
|----------|----------------------|----------------|------------|--------------|----------------------|----------------|----------|------------|
| | Incidental Ingestion | Dermal Contact | Total Risk | Percent Risk | Incidental Ingestion | Dermal Contact | Total HI | Percent HI |
| TPH | NA | NA | NA | NA | 3.8E-02 | 2.6E-02 | 6.3E-02 | 100.0% |
| Total | NA | NA | NA | NA | 3.8E-02 | 2.6E-02 | 6.3E-02 | 100.0% |

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D9-352

CTO 0028

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| RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL (PAGE TWO) | | | | | | | | | |
|--|---------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33 LOCATION: MILTON, FLORIDA EXPOSURE SCENARIO: SITE MAINTENANCE WORKER - REASONABLE MAXIMUM EXPOSURES MEDIA: SURFACE SOIL WITHOUT CONCRETE DATE: JULY 8, 1998 | | | | | | | | | |
| CHEMICAL | Cs (mg/kg) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
| TPH | 2300 | 2.4E-05 | 6.8E-05 | NA | 3.00E-02 | NA | NA | 2.3E-03 | 100.0% |
| | | | | | Total | NA | NA | 2.3E-03 | 100.0% |

B-3-18

D9-369

CTO-0028

CTO 0028

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RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: SITE MAINTENANCE WORKER - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 8, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
EXPOSURES THROUGH DERMAL CONTACT WITH SOIL ARE CONSIDERED.
ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION: Absorbed Dose = (Cs x CF x SA x AF x ABS x EF x ED)/(BW x AT)

| | | |
|--------|---------|---|
| Where: | Cs = : | Mean concentration in soil (mg/kg) |
| | CF = : | 1.0E-06 Conversion factor (kg/mg) |
| | SA = : | 5,750 Skin surface available for contact (cm ² /event) |
| | AF = : | 0.6 Soil to skin adherence factor (mg/cm ³) |
| | ABS = : | Chemical Specific Absorption factor (unitless) |
| | EF = : | 30 Exposure frequency (events/year) |
| | ED = : | 25 Exposure duration (years) |
| | BW = : | 70 Body weight (kg) |
| | ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| | ATn = : | 9,125 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = 1.4E-06 kg-soil/kg-wt/day
Chronic Daily Intake = : 4.1E-06 kg-soil/kg-wt/day

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RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL (PAGE TWO)

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: SITE MAINTENANCE WORKER - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 8, 1998

| CHEMICAL | Cs (mg/kg) | ABS (unitless) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
|----------|---------------|-------------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| TPH | 2300 | 0.01 | 3.33E-05 | 9.32E-05 | NA | 2.00E-02 | NA | NA | 4.7E-03 | 100.0% |
| | | | | | | Total | NA | NA | 4.7E-03 | 100.0% |

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D9-371

CTO 0028

CTO-0028

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RISK ASSESSMENT SPREADSHEET - SUMMARY

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: SITE MAINTENANCE WORKER - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 8, 1998

| Chemical | Lifetime Cancer Risk | | | | Hazard Index | | | |
|----------|----------------------|----------------|------------|--------------|----------------------|----------------|----------|------------|
| | Incidental Ingestion | Dermal Contact | Total Risk | Percent Risk | Incidental Ingestion | Dermal Contact | Total HI | Percent HI |
| TPH | NA | NA | NA | NA | 2.3E-03 | 4.7E-03 | 6.9E-03 | 100.0% |
| Total | NA | NA | NA | NA | 2.3E-03 | 4.7E-03 | 6.9E-03 | 100.0% |

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D9-372

CTO 0028

CTO-0028

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RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: CONSTRUCTION WORKER - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 28, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH INCIDENTAL INGESTION OF SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION: $Intake = (C \times IR \times CF \times FI \times EF \times ED) / (BW \times AT)$

WHERE:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| IR = : | 480 Soil Ingestion Rate (mg/day) |
| CF = : | 1.0E-06 Conversion Factor (kg/mg) |
| FI = : | 1 Fraction from contaminated source (unitless) |
| EF = : | 30 Exposure Frequency (days/year) |
| ED = : | 1 Exposure Duration (years) |
| BW = : | 70 Body Weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 365 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = : 8.1E-09 kg-soil/kg-wt/day
 Chronic Daily Intake = : 5.6E-07 kg-soil/kg-wt/day

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| RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL (PAGE TWO) | | | | | | | | | |
|---|---------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33 LOCATION: MILTON, FLORIDA EXPOSURE SCENARIO: CONSTRUCTION WORKER - REASONABLE MAXIMUM EXPOSURES MEDIA: SURFACE SOIL WITHOUT CONCRETE DATE: JULY 28, 1998 | | | | | | | | | |
| CHEMICAL | Cs (mg/kg) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
| TPH | 2300 | 1.9E-05 | 1.3E-03 | NA | 3.00E-02 | NA | NA | 4.3E-02 | 100.0% |
| | | | | | Total | NA | NA | 4.3E-02 | 100.0% |

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D9-389

CTO-0028

CTO 0028

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RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
 LOCATION: MILTON, FLORIDA
 EXPOSURE SCENARIO: CONSTRUCTION WORKER - REASONABLE MAXIMUM EXPOSURES
 MEDIA: SURFACE SOIL WITHOUT CONCRETE
 DATE: JULY 28, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH DERMAL CONTACT WITH SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION Absorbed Dose = $(C_s \times CF \times SA \times AF \times ABS \times EF \times ED) / (BW \times AT)$

Where:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| CF = : | 1.0E-06 Conversion factor (kg/mg) |
| SA = : | 5,750 Skin surface available for contact (cm ² /event) |
| AF = : | 1.0 Soil to skin adherence factor (mg/cm ²) |
| | Chemical |
| ABS = : | Specific Absorption factor (unitless) |
| EF = : | 30 Exposure frequency (events/year) |
| ED = : | 1 Exposure duration (years) |
| BW = : | 70 Body weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 365 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = 9.6E-08 kg-soil/kg-wt/day
 Chronic Daily Intake = : 6.8E-06 kg-soil/kg-wt/day

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| RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL (PAGE TWO) | | | | | | | | | | |
|---|---------------|-------------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33 LOCATION: MILTON, FLORIDA EXPOSURE SCENARIO: CONSTRUCTION WORKER - REASONABLE MAXIMUM EXPOSURES MEDIA: SURFACE SOIL WITHOUT CONCRETE DATE: JULY 28, 1998 | | | | | | | | | | |
| CHEMICAL | Cs (mg/kg) | ABS (unitless) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
| TPH | 2300 | 0.01 | 2.22E-06 | 1.55E-04 | NA | 2.00E-02 | NA | NA | 7.8E-03 | 100.0% |
| | | | | | | Total | NA | NA | 7.8E-03 | 100.0% |

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D9-391

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RISK ASSESSMENT SPREADSHEET - SUMMARY

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: CONSTRUCTION WORKER - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 28, 1998

| Chemical | Lifetime Cancer Risk | | | | Hazard Index | | | |
|----------|----------------------|----------------|------------|--------------|----------------------|----------------|----------|------------|
| | Incidental Ingestion | Dermal Contact | Total Risk | Percent Risk | Incidental Ingestion | Dermal Contact | Total HI | Percent HI |
| TPH | NA | NA | NA | NA | 4.3E-02 | 7.8E-03 | 5.1E-02 | 100.0% |
| Total | NA | NA | NA | NA | 4.3E-02 | 7.8E-03 | 5.1E-02 | 100.0% |

B-3-26

D9-392

CTO 0028

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RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33

LOCATION: MILTON, FLORIDA

EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE ADULT RESIDENT - REASONABLE MAXIMUM EXPOSURES

MEDIA: SURFACE SOIL WITHOUT CONCRETE

DATE: JULY 28, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
EXPOSURES THROUGH INCIDENTAL INGESTION OF SOIL ARE CONSIDERED.
ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION:
$$\text{Intake} = \frac{\text{Cs} \times \text{IR} \times \text{CF} \times \text{FI} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

WHERE:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| IR = : | 100 Soil Ingestion Rate (mg/day) |
| CF = : | 1.0E-06 Conversion Factor (kg/mg) |
| FI = : | 1 Fraction from contaminated source (unitless) |
| EF = : | 350 Exposure Frequency (days/year) |
| ED = : | 24 Exposure Duration (years) |
| BW = : | 70 Body Weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 8,760 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = : 4.7E-07 kg-soil/kg-wt/day

Chronic Daily Intake = : 1.4E-06 kg-soil/kg-wt/day

471203005

R4708989

RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL (PAGE TWO)

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE ADULT RESIDENT - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 28, 1998

| CHEMICAL | Cs (mg/kg) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
|----------|---------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| TPH | 2300 | 1.1E-03 | 3.2E-03 | NA | 3.00E-02 | NA | NA | 1.1E-01 | 100.0% |
| | | | | | Total | NA | NA | 1.1E-01 | 100.0% |

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D9-404

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RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
 LOCATION: MILTON, FLORIDA
 EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE ADULT RESIDENT - REASONABLE MAXIMUM EXPOSURES
 MEDIA: SURFACE SOIL WITHOUT CONCRETE
 DATE: JULY 28, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH DERMAL CONTACT WITH SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW

RELEVANT EQUATION:
$$\text{Absorbed Dose} = \frac{\text{Cs} \times \text{CF} \times \text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

Where:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| CF = : | 1.0E-06 Conversion factor (kg/mg) |
| SA = : | 5,800 Skin surface available for contact (cm ² /event) |
| AF = : | 1.0 Soil to skin adherence factor (mg/cm ²) |
| ABS = : | Absorption factor (unitless) |
| EF = : | 350 Exposure frequency (events/year) |
| ED = : | 24 Exposure duration (years) |
| BW = : | 70 Body weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 8,760 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = 2.7E-05 kg-soil/kg-wt/day
 Chronic Daily Intake = : 7.9E-05 kg-soil/kg-wt/day

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R4708989

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL (PAGE TWO)

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE ADULT RESIDENT - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 28, 1998

| CHEMICAL | Cs (mg/kg) | ABS (unitless) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
|----------|---------------|-------------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| TPH | 2300 | 0.01 | 6.27E-04 | 1.83E-03 | NA | 2.00E-02 | NA | NA | 9.1E-02 | 100.0% |
| | | | | | | Total | NA | NA | 9.1E-02 | 100.0% |

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D9-406

CTO-0028

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RISK ASSESSMENT SPREADSHEET - SUMMARY

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
 LOCATION: MILTON, FLORIDA
 EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE ADULT RESIDENT - REASONABLE MAXIMUM EXPOSURES
 MEDIA: SURFACE SOIL WITHOUT CONCRETE
 DATE: JULY 28, 1998

| Chemical | Lifetime Cancer Risk | | | | Hazard Index | | | |
|----------|----------------------|----------------|------------|--------------|----------------------|----------------|----------|------------|
| | Incidental Ingestion | Dermal Contact | Total Risk | Percent Risk | Incidental Ingestion | Dermal Contact | Total HI | Percent HI |
| TPH | NA | NA | NA | NA | 1.1E-01 | 9.1E-02 | 2.0E-01 | 100.0% |
| Total | NA | NA | NA | NA | 1.1E-01 | 9.1E-02 | 2.0E-01 | 100.0% |

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D9-407

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RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE CHILD RESIDENT - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 28, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH INCIDENTAL INGESTION OF SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION:
$$\text{Intake} = \frac{Cs \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

WHERE:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| IR = : | 200 Soil Ingestion Rate (mg/day) |
| CF = : | 1.0E-06 Conversion Factor (kg/mg) |
| FI = : | 1 Fraction from contaminated source (unitless) |
| EF = : | 350 Exposure Frequency (days/year) |
| ED = : | 6 Exposure Duration (years) |
| BW = : | 15 Body Weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 2,190 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = : 1.1E-06 kg-soil/kg-wt/day
 Chronic Daily Intake = : 1.3E-05 kg-soil/kg-wt/day

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R4708989

| RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL (PAGE TWO) | | | | | | | | | |
|---|---------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33 LOCATION: MILTON, FLORIDA EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE CHILD RESIDENT - REASONABLE MAXIMUM EXPOSURES MEDIA: SURFACE SOIL WITHOUT CONCRETE DATE: JULY 28, 1998 | | | | | | | | | |
| CHEMICAL | Cs (mg/kg) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
| TPH | 2300 | 2.5E-03 | 2.9E-02 | NA | 3.00E-02 | NA | NA | 9.8E-01 | 100.0% |
| | | | | | Total | NA | NA | 9.8E-01 | 100.0% |

B-3-33

D9-424

CTO-0028

CTO 0028

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RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
 LOCATION: MILTON, FLORIDA
 EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE CHILD RESIDENT - REASONABLE MAXIMUM EXPOSURES
 MEDIA: SURFACE SOIL WITHOUT CONCRETE
 DATE: JULY 28, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH DERMAL CONTACT WITH SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION:
$$\text{Absorbed Dose} = \frac{Cs \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

Where:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| CF = : | 1.0E-06 Conversion factor (kg/mg) |
| SA = : | 766 Skin surface available for contact (cm ² /event) |
| AF = : | 1.0 Soil to skin adherence factor (mg/cm ²) |
| ABS = : | Absorption factor (unitless) |
| EF = : | 350 Exposure frequency (events/year) |
| ED = : | Exposure duration (years) |
| BW = : | Body weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 2,190 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = 1.0E-05 kg-soil/kg-wt/day
 Chronic Daily Intake = : 1.2E-04 kg-soil/kg-wt/day

471203005

R4708969

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL (PAGE TWO)

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33

LOCATION: MILTON, FLORIDA

EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE CHILD RESIDENT - REASONABLE MAXIMUM EXPOSURES

MEDIA: SURFACE SOIL WITHOUT CONCRETE

DATE: JULY 28, 1998

| CHEMICAL | Cs (mg/kg) | ABS (unitless) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
|----------|---------------|-------------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| TPH | 2300 | 0.01 | 2.41E-04 | 2.82E-03 | NA | 2.00E-02 | NA | NA | 1.4E-01 | 100.0% |
| | | | | | | Total | NA | NA | 1.4E-01 | 100.0% |

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D9-426

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R4708989

RISK ASSESSMENT SPREADSHEET - SUMMARY

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE CHILD RESIDENT - REASONABLE MAXIMUM EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 28, 1998

| Chemical | Lifetime Cancer Risk | | | | Hazard Index | | | |
|----------|----------------------|----------------|------------|--------------|----------------------|----------------|----------|------------|
| | Incidental Ingestion | Dermal Contact | Total Risk | Percent Risk | Incidental Ingestion | Dermal Contact | Total HI | Percent HI |
| TPH | NA | NA | NA | NA | 9.8E-01 | 1.4E-01 | 1.1E+00 | 100.0% |
| Total | NA | NA | NA | NA | 9.8E-01 | 1.4E-01 | 1.1E+00 | 100.0% |

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D9-427

CTO 0028

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RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
 LOCATION: MILTON, FLORIDA
 EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE CHILD RESIDENT - CENTRAL TENDENCY EXPOSURES
 MEDIA: SURFACE SOIL WITHOUT CONCRETE
 DATE: JULY 28, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH INCIDENTAL INGESTION OF SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION:
$$\text{Intake} = \frac{\text{Cs} \times \text{IR} \times \text{CF} \times \text{FI} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

WHERE:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| IR = : | 100 Soil Ingestion Rate (mg/day) |
| CF = : | 1.0E-06 Conversion Factor (kg/mg) |
| FI = : | 1 Fraction from contaminated source (unitless) |
| EF = : | 234 Exposure Frequency (days/year) |
| ED = : | 2 Exposure Duration (years) |
| BW = : | 15 Body Weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 730 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = : 1.2E-07 kg-soil/kg-wt/day

Chronic Daily Intake = : 4.3E-06 kg-soil/kg-wt/day

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RISK ASSESSMENT SPREADSHEET - INCIDENTAL INGESTION OF SOIL (PAGE TWO)

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
 LOCATION: MILTON, FLORIDA
 EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE CHILD RESIDENT - CENTRAL TENDENCY EXPOSURES
 MEDIA: SURFACE SOIL WITHOUT CONCRETE
 DATE: JULY 28, 1998

| CHEMICAL | Cs (mg/kg) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
|----------|---------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| TPH | 2300 | 2.8E-04 | 9.8E-03 | NA | 3.00E-02 | NA | NA | 3.3E-01 | 100.0% |
| | | | | | Total | NA | NA | 3.3E-01 | 100.0% |

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D9-439

CTO-0028

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RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
 LOCATION: MILTON, FLORIDA
 EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE CHILD RESIDENT - CENTRAL TENDENCY EXPOSURES
 MEDIA: SURFACE SOIL WITHOUT CONCRETE
 DATE: JULY 28, 1998

HAZARD INDICES AND INCREMENTAL CANCER RISKS ARE CALCULATED BY THIS SPREADSHEET.
 EXPOSURES THROUGH DERMAL CONTACT WITH SOIL ARE CONSIDERED.
 ASSUMPTIONS ARE OUTLINED BELOW.

RELEVANT EQUATION:
$$\text{Absorbed Dose} = \frac{Cs \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

Where:

| | |
|---------|---|
| Cs = : | Mean concentration in soil (mg/kg) |
| CF = : | 1.0E-06 Conversion factor (kg/mg) |
| SA = : | 663 Skin surface available for contact (cm ² /event) |
| AF = : | 0.2 Soil to skin adherence factor (mg/cm ²) |
| ABS = : | Absorption factor (unitless) |
| EF = : | 234 Exposure frequency (events/year) |
| ED = : | Exposure duration (years) |
| BW = : | Body weight (kg) |
| ATc = : | 25,550 Averaging time for carcinogenic exposures (days) |
| ATn = : | 730 Averaging time for noncarcinogenic exposures (days) |

Unit Dose

Lifetime Chronic Daily Intake = 6.1E-06 kg-soil/kg-wt/day
 Chronic Daily Intake = : 4.3E-05 kg-soil/kg-wt/day

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R4708989

RISK ASSESSMENT SPREADSHEET - DIRECT DERMAL CONTACT WITH SOIL (PAGE TWO)

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE CHILD RESIDENT - CENTRAL TENDENCY EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 28, 1998

| CHEMICAL | Cs (mg/kg) | ABS (unitless) | Lifetime Chronic Daily Intake (mg/kg/day) | Chronic Daily Intake (mg/kg/day) | Cancer Slope Factor (mg/kg/day) ⁻¹ | Reference Dose (mg/kg/day) | Lifetime Cancer Risk | Percent Cancer Risk | Hazard Quotient | Percent Hazard Quotient |
|----------|---------------|-------------------|--|--|--|----------------------------------|----------------------------|---------------------------|--------------------|-------------------------------|
| TPH | 2300 | 0.01 | 1.40E-04 | 9.78E-04 | NA | 2.00E-02 | NA | NA | 4.9E-02 | 100.0% |
| | | | | | | Total | NA | NA | 4.9E-02 | 100.0% |

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D9-441

CTO-0028

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471203005

R4708989

RISK ASSESSMENT SPREADSHEET - SUMMARY

SITE NAME: NAVAL AIR STATION WHITING FIELD - SITE 33
LOCATION: MILTON, FLORIDA
EXPOSURE SCENARIO: HYPOTHETICAL ON-SITE CHILD RESIDENT - CENTRAL TENDENCY EXPOSURES
MEDIA: SURFACE SOIL WITHOUT CONCRETE
DATE: JULY 28, 1998

| Chemical | Lifetime Cancer Risk | | | | Hazard Index | | | |
|----------|----------------------|----------------|------------|--------------|----------------------|----------------|----------|------------|
| | Incidental Ingestion | Dermal Contact | Total Risk | Percent Risk | Incidental Ingestion | Dermal Contact | Total HI | Percent HI |
| TPH | NA | NA | NA | NA | 3.3E-01 | 4.9E-02 | 3.8E-01 | 100.0% |
| Total | NA | NA | NA | NA | 3.3E-01 | 4.9E-02 | 3.8E-01 | 100.0% |

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D9-442

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APPENDIX C

TABLES 7-8 AND 7-9 FROM ORIGINAL FS (TtNUS, 2001a)

**TABLE 7-8
SITE 33 SOIL REMEDIAL ALTERNATIVES
NAS WHITING FIELD
MILTON, FLORIDA**

| Alternative Number | Alternative Type | Representative Process Options Combined Into Alternatives | Alternative Description |
|--|--|--|---|
| Alternative S33-1 No Action | No Action | None | <ul style="list-style-type: none"> • Five-year Reviews. |
| Alternative S33-2 UST Removal and LUCs | Source Removal, Containment/Limited Action – No or Limited Treatment | LUCs, Remove UST | <ul style="list-style-type: none"> • LUCs including LUCAP and LUCIP. • Excavate and remove UST. • Posting of warning signs. • Five-Year site reviews. |
| Alternative S33-3 UST Removal, Soil Venting, and LUCs | Source Removal, Containment/Limited /Treatment Action – Treatment | LUCs, Remove UST, In Situ Soil Venting | <ul style="list-style-type: none"> • LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of subsurface soil adjacent to 33SB02. • Excavate and remove UST. • Install and operate an in situ soil venting system for subsurface soil at location 33SB02. • Posting of warning signs. • Five-Year site reviews. |
| Alternative S33-4 UST Removal, Subsurface Soil (exceeding PRGs) Removal, and LUCs | Treatment/Bulk Removal – Minimizes Long-Term Management | LUCs, Remove UST, Bulk Excavation, Disposal | <ul style="list-style-type: none"> • LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of subsurface soil adjacent to 33SB02 and 33SB09. • Demolition and removal/disposal of asphalt and concrete pavement. • Excavate and remove UST. • Excavation/disposal of subsurface soil exceeding PRGs at 33SB02 and 33SB09. • Backfill excavation with clean fill. • Replacement of asphalt or concrete pavement. • Establish vegetative cover. • Posting of warning signs. • Five-Year site reviews. |

TABLE 7-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 33

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 1 OF 4

| Criteria | <u>Alternative S33-1</u> No Action | <u>Alternative S33-2</u> UST Removal and LUCs | <u>Alternative S33-3</u> UST Removal, Soil Venting, and LUCs | <u>Alternative S33-4</u> UST Removal, 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. UST removal reduces risk by removing potential source. LUCs reduce risk from residuals. | Provides a high level of protection. UST removal reduces risk by removing potential source. LUCs and treatment reduce risk from residuals. | Provides highest level of protection. LUCs reduce risk from residuals. UST removal and soil excavation and disposal reduce risk of potential exposure. |
| Environmental Protection | Allows potential environmental impacts from 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 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 using LUCs to minimize exposure pathways. | Meets ARARs for organics in 2 years and inorganics by minimizing exposure pathways. | Meets ARARs within 1 year. |
| Compliance with Action-Specific ARARs | Not applicable | Meets ARARs over time. | 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 may decrease risk; however, risk is significant for >30 years. | UST removal reduces risk by removing potential source. Natural attenuation may decrease 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 and UST removal. Any residual concentrations will be reduced over time through natural attenuation; however, risk due to subsurface impacted soil is significant for an estimated 30 years. | Provides highest level of long-term residual risk reduction. Risk eliminated or reduced by UST removal and soil excavation and off-site disposal. Any residual concentrations may be reduced over time through natural attenuation. |

TABLE 7-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 33

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 2 OF 4

| Criteria | <u>Alternative S33-1</u> No Action | <u>Alternative S33-2</u> UST Removal and LUCs | <u>Alternative S33-3</u> UST Removal, Soil Venting, and LUCs | <u>Alternative S33-4</u> UST Removal, Subsurface Soil (exceeding PRGs) Removal, and LUCs |
|---|--|--|--|--|
| Long-Term Reliability of Controls | Not applicable | Provides a high level of reliability if existing cover is maintained. | Provides a high level of reliability because of proven technology, and if the existing 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. | Exposure risk reduced by LUCs and the existing soil cover. | Exposure risk reduced by LUCs and the existing soil cover. | Exposure to residuals is reduced by excavation and disposal as well as enforced LUCs. |
| Potential Need for Replacement of Technical Components after Remedial Objectives Are Achieved | Not applicable | The existing soil cover may require replacement or repair. | The existing soil cover may require replacement or repair. | No technical components required. |
| Long-Term Management | Not applicable | Management required for estimated 30 years. | Management required for estimated 30 years. | Minimal management required for estimated 30 years. |
| Reduction of Mobility, Toxicity, or Volume through Treatment | | | | |
| Amount Destroyed or Treated | None | Remaining contaminants may naturally attenuate over time. The existing soil cover is for containment only. | Organic compound removal is about 90%. Inorganic compounds may naturally attenuate over time. The existing soil cover is for containment only. | All impacted soil exceeding Remediation Goals is excavated and disposed. Removal efficiency estimated >95%. |
| Reduction in Mobility, Toxicity, or Volume | Toxicity may be reduced through natural attenuation. | Mobility reduced by the existing soil cover. Toxicity of remaining soils may be reduced through natural attenuation. | Mobility reduced by the existing soil cover. 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. | Natural attenuation is an irreversible process. | 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 inorganics left from natural attenuation. | Minor inorganic and organic residuals remain above industrial action levels in subsurface soil. | Residuals of inorganics left from soil venting and natural attenuation remain above industrial action levels. | No inorganic residuals remain above action levels. |

TABLE 7-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 33

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 3 OF 4

| Criteria | <u>Alternative S33-1</u> No Action | <u>Alternative S33-2</u> UST Removal and LUCs | <u>Alternative S33-3</u> UST Removal, Soil Venting, and LUCs | <u>Alternative S33-4</u> UST Removal, Subsurface Soil (exceeding PRGs) Removal, and LUCs |
|---|---|---|--|---|
| Short-Term Effectiveness | | | | |
| Community Protection During Implementation | Not applicable | Not applicable | Temporary increase in dust emissions during installation of soil venting system can be controlled by proper construction techniques. | Temporary increases in dust emissions through excavation and disposal; controlled by proper construction techniques. |
| Worker Protection During Implementation | Not applicable | Not applicable | Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction. | Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction. |
| Environmental Impacts | No unacceptable impacts from existing conditions. | No unacceptable impacts from existing conditions. | Construction of treatment system can generate impacted soil, runoff, and fugitive dust. Off-gases may contain low concentrations of contaminants. | Excavation of impacted soils can generate runoff and fugitive dust. |
| Construction Time ^a | Not applicable | Less than 1 year | Less than 1 year | Less than 1 year |
| Time Until Remedial Response Objectives Are Achieved | Estimated at 30 years. | Estimated at 1 year. | Estimated at 3 years. | Estimated at 1 year. |
| Implementability | | | | |
| Ability to Construct and Operate the Technology | Not applicable | Many contractors available to remove USTs | Many contractors available to remove USTs and construct and operate soil venting system. | Many contractors available to remove USTs and provide excavation. Fewer contractors that accept impacted soil for disposal. |
| Reliability of Technology | Not applicable | LUCs are reliable for restricting soil access immediately after implementation. | LUCs are reliable for restricting soil access immediately after implementation. Soil venting is a reliable technology for treating organic contaminants. | LUCs are reliable for restricting soil access immediately after implementation. Excavation and disposal are reliable. |
| Ease of Undertaking Additional Remedial Action, if Required | Easily implementable | Implementable | Implementable | Implementable |

TABLE 7-9
SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 33

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 4 OF 4

| Criteria | <u>Alternative S33-1</u> No Action | <u>Alternative S33-2</u> UST Removal and LUCs | <u>Alternative S33-3</u> UST Removal, Soil Venting, and LUCs | <u>Alternative S33-4</u> UST Removal, 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 | None | 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^a | | | | |
| Capital Costs | \$0 | \$46,226 | \$80,495 | \$336,869 |
| 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 | \$2,839 | \$2,839 | \$2,839 |
| Total Project Present Worth Cost | \$18,008 | \$103,316 | \$203,140 | \$393,959 |

^a Does not include testing or treatability studies.

^b Includes capital costs, short- and long-term O&M present worth, and contingency. Present worth cost details are provided in Appendix E.

APPENDIX D
REMEDIAL ALTERNATIVES COST ESTIMATE

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE 2: ECs AND LUCs
CAPITAL COSTS

| Cost Item | Quantity | Unit | Subcontract | Unit Cost | | | Extended Cost | | | Subtotal | |
|---|----------|-------|-------------|-----------|----------|------------|---------------|----------|---------|----------|-----------|
| | | | | Material | Labor | Equipment | Subcontract | Material | Labor | | Equipment |
| 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 |
| 3.2 Decon Water Disposal | 0 | drum | \$125.00 | | \$0 | \$0 | \$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 & inorganics) | 0 | ea | \$378.33 | | \$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 | \$378.33 | | \$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 |
| 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 | \$5,471 | \$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 |
| 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 |

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NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33

SOIL ALTERNATIVE 2: ECs 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 | |

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE 2: ECs AND LUCs
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 Concrete cover / asphalt 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 33
SOIL ALTERNATIVE 2: ECs AND LUCs
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 33
SOIL ALTERNATIVE 3: IN SITU SOIL VENTING AND LAND USE CONTROLS
CAPITAL COSTS

| Cost Item | Quantity | Unit | Subcontract | Unit Cost | | | Extended Cost | | | Subtotal | |
|--|----------|-------|-------------|-----------|----------|------------|---------------|----------|----------|----------|-----------|
| | | | | Material | Labor | Equipment | Subcontract | Material | Labor | | Equipment |
| 1 PROJECT PLANNING | | | | | | | | | | | |
| 1.1 Prepare Remedial Action Plan | 200 | hr | | | \$33.79 | | \$0 | \$0 | \$6,758 | \$0 | \$6,758 |
| 1.2 Project Scheduling and Procurement | 40 | hr | | | \$33.79 | | \$0 | \$0 | \$1,352 | \$0 | \$1,352 |
| 2 MOBILIZATION/DEMOBILIZATION | | | | | | | | | | | |
| 2.1 Equipment Mob/Demob (Exc. & Dozier) | 0 | ea | | | | \$200.00 | \$250.00 | \$0 | \$0 | \$0 | \$0 |
| 2.2 Mobilize/Demobilize Personnel (2-persons) | 0 | ea | | \$375.00 | | \$300.00 | | \$0 | \$0 | \$0 | \$0 |
| 2.3 Portable Toilet | 0 | mo | \$74.18 | | | | | \$0 | \$0 | \$0 | \$0 |
| 2.4 Storage Trailer (28' x 10') | 0 | mo | \$98.33 | | | | | \$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 * 1 Weeks) | 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 & inorganics) | 2 | ea | \$378.33 | \$10.00 | \$23.52 | | \$757 | \$20 | \$47 | \$0 | \$824 |
| 4.3 Construction Surveys (2-man crew) | 1 | day | \$648.36 | | | | \$648 | \$0 | \$0 | \$0 | \$648 |
| 4.4 Utility Location/Site Layout | 2 | hrs | | | \$33.23 | | \$0 | \$0 | \$66 | \$0 | \$66 |
| 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 | \$378.33 | \$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/Dispose of Soil Cuttings (Non-Haz) in Landfill | 0 | ton | \$45.00 | | | | \$0 | \$0 | \$0 | \$0 | \$0 |
| 6.3 Prepare Shipment Manifests | 0 | hrs | | | \$33.23 | | \$0 | \$0 | \$0 | \$0 | \$0 |
| 7 SOIL VAPOR EXTRACTION (SUBSURFACE SOIL) | | | | | | | | | | | |
| 7.1 Soil Vapor Extraction (SVE) System Layout (30' radius) | 4 | hrs | | | \$33.23 | | \$0 | \$0 | \$133 | \$0 | \$133 |
| 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 (1 wells x 27' depth) | 27 | lf | \$27.01 | | | | \$729 | \$0 | \$0 | \$0 | \$729 |
| 7.4 PVC Well Screen, 4" dia | 22 | lf | \$17.84 | | | | \$392 | \$0 | \$0 | \$0 | \$392 |
| 7.5 PVC Well Riser, 4" dia. | 5 | lf | \$13.39 | | | | \$67 | \$0 | \$0 | \$0 | \$67 |
| 7.6 Well Box and Surface Completion | 1 | well | \$250.00 | | | | \$250 | \$0 | \$0 | \$0 | \$250 |
| 7.7 PVC Piping, Schedule 40, 4" | 20 | lf | | \$1.62 | \$4.60 | | \$0 | \$32 | \$92 | \$0 | \$124 |
| 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 | 40 | hrs | | | \$31.08 | | \$0 | \$0 | \$1,243 | \$0 | \$1,243 |
| 7.12 Vapor Recovery System, 127 SCFM, 1.5 Hp | 1 | ea | \$4,615.00 | | | | \$4,615 | \$0 | \$0 | \$0 | \$4,615 |
| 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 | 1 | ea | \$2,520.00 | | | | \$2,520 | \$0 | \$0 | \$0 | \$2,520 |
| 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 |
| 8.3 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 | | | | | | | | \$52 | \$15,773 | \$0 | \$15,826 |

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NAVAL AIR STATION WHITING FIELD
 MILTON, FLORIDA
 SITE 33
 SOIL ALTERNATIVE 3: IN SITU SOIL VENTING AND LAND USE CONTROLS
 CAPITAL COSTS

| Cost Item | Quantity | Unit | Subcontract | Unit Cost | | | Subcontract | Extended Cost | | | Subtotal |
|--|----------|------|-------------|-----------|-------|-----------|-------------|---------------|----------|-----------|----------|
| | | | | Material | Labor | Equipment | | Material | Labor | Equipment | |
| Local Area Adjustment | | | | | | | | 84% | 84% | 84% | |
| | | | | | | | | \$44 | \$13,250 | \$0 | \$13,294 |
| Overhead on Labor Cost @ 30% | | | | | | | | | \$3,975 | | \$3,975 |
| G & A on Labor Cost @ 10% | | | | | | | | | \$1,325 | | \$1,325 |
| G & A on Material Cost @ 10% | | | | | | | | \$4 | | | \$4 |
| Total Direct Capital Cost | | | | | | | | \$48 | \$18,550 | \$0 | \$18,598 |
| Indirects on Total Direct Labor Cost @ 75% | | | | | | | | | \$13,912 | | \$13,912 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | \$1,860 |
| Subtotal | | | | | | | | | | | \$34,370 |
| Health & Safety Monitoring @ 3% | | | | | | | | | | | \$1,552 |
| Total Field Cost | | | | | | | | | | | \$35,922 |
| Subtotal Subcontractor Cost | | | | | | | \$17,375 | | | | \$17,375 |
| G & A on Subcontract Cost @ 10% | | | | | | | \$1,738 | | | | \$1,738 |
| Profit on Subcontractor Cost @ 5% | | | | | | | | | | | \$869 |
| Subcontractor Cost | | | | | | | | | | | \$19,982 |
| Contingency on Total Field and Subcontractor Costs @ 10% | | | | | | | | | | | \$5,590 |
| Engineering on Total Field and Subcontractor Costs @ 5% | | | | | | | | | | | \$2,795 |
| TOTAL Capital COST | | | | | | | | | | | \$64,290 |

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NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
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 | 9,800 | kWh | \$0.06 | \$588 | Electrical Load is approx. 1.5 Hp. |
| 2 Maintenance | 1 | ls | \$500.00 | \$500 | 3% of Installation Cost |
| 3 Carbon Unit Changeout/Regeneration of Spent Carbon | 200 | pound | \$3.00 | \$600 | 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 Sample Analysis | 8 | ea | \$73.33 | \$587 | Sampling performed annually to confirm cleanup. |
| 9 Quarterly Reports | 4 | ea | \$3,000.00 | \$12,000 | |
| Total Cost for One Year Operation | | | | \$24,525 | |

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
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%.

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NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
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 | \$64,290 | | | \$64,290 | 1.000 | \$64,290 |
| 1 | | \$24,525 | \$2,839 | \$27,364 | 0.943 | \$25,815 |
| 2 | | \$24,525 | \$2,839 | \$27,364 | 0.890 | \$24,354 |
| 3 | | \$24,525 | \$2,839 | \$27,364 | 0.840 | \$22,975 |
| 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 | | | | | | \$186,934 |

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE 4: EXCAVATION OF SUBSURFACE SOIL (EXCEEDING CGs), OFFSITE DISPOSAL, AND LUCs
CAPITAL COSTS

| Cost Item | Quantity | Unit | Subcontract | Unit Cost | | | Subcontract | Extended Cost | | | Subtotal |
|--|----------|-------|-------------|-----------|----------|------------|-------------|---------------|----------|-----------|----------|
| | | | | Material | Labor | Equipment | | Material | Labor | Equipment | |
| 1 PROJECT PLANNING | | | | | | | | | | | |
| 1.1 Prepare Remedial Action Plan | 200 | hr | | | \$33.79 | | \$0 | \$0 | \$6,758 | \$0 | \$6,758 |
| 1.2 Project Scheduling and Procurement | 80 | hr | | | \$33.79 | | \$0 | \$0 | \$2,703 | \$0 | \$2,703 |
| 2 MOBILIZATION/DEMobilIZATION | | | | | | | | | | | |
| 2.1 Equipment Mob/Demob (Exc., Loader, & Dozier) | 1 | ea | | | \$200.00 | \$250.00 | \$0 | \$0 | \$200 | \$250 | \$450 |
| 2.2 Mobilize/Demobilize Personnel (3-persons) | 1 | ea | | \$375.00 | \$300.00 | | \$0 | \$375 | \$300 | \$0 | \$675 |
| 2.3 Portable Toilet | 1 | mo | \$74.18 | | | | \$74 | \$0 | \$0 | \$0 | \$74 |
| 2.4 Storage Trailer (28' x 10') | 1 | mo | \$98.33 | | | | \$98 | \$0 | \$0 | \$0 | \$98 |
| 2.5 Office Trailer (32' x 8') | 1 | mo | \$221.49 | | | | \$221 | \$0 | \$0 | \$0 | \$221 |
| 2.6 Site Utilities | 1 | mo | \$1,000.00 | | | | \$1,000 | \$0 | \$0 | \$0 | \$1,000 |
| 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 | 3 | drum | \$125.00 | | | | \$375 | \$0 | \$0 | \$0 | \$375 |
| 3.3 Decon Water Storage Drums | 3 | ea | | \$45.00 | | | \$0 | \$135 | \$0 | \$0 | \$135 |
| 3.4 PPE (3 p * 5 days * 2 Weeks) | 15 | m-day | | \$30.00 | | | \$0 | \$450 | \$0 | \$0 | \$450 |
| 3.5 Decontaminate Equipment (Pressure Washer) | 3 | ea | | | \$134.45 | \$50.00 | \$0 | \$0 | \$403 | \$150 | \$553 |
| 4 SITE PREPARATION | | | | | | | | | | | |
| 4.1 Erosion Control Fencing | 300 | lf | | \$0.23 | \$1.17 | | \$0 | \$69 | \$351 | \$0 | \$420 |
| 4.2 Collect/Analyze Delineation Samples (inorganics & TPH) | 10 | ea | \$378.33 | \$10.00 | \$23.52 | | \$3,783 | \$100 | \$235 | \$0 | \$4,119 |
| 4.3 Construction Surveys (2-man crew) | 1 | day | \$648.36 | | | | \$648 | \$0 | \$0 | \$0 | \$648 |
| 4.4 Utility Location and Site Delineation/Layout | 12 | hrs | | | \$33.23 | | \$0 | \$0 | \$399 | \$0 | \$399 |
| 4.5 Concrete Demolition/Removal (6" reinforced) | 12 | cy | \$45.58 | | | | \$547 | \$0 | \$0 | \$0 | \$547 |
| 4.6 Concrete Debris Disposal | 12 | cy | \$20.70 | | | | \$248 | \$0 | \$0 | \$0 | \$248 |
| 5 EXCAVATION/BACKFILL | | | | | | | | | | | |
| 5.1 Excavate/Load Contaminated Soil (2.0 cy Hyd. Exc.) | 3600 | cy | | | \$0.68 | \$1.71 | \$0 | \$0 | \$2,448 | \$6,156 | \$8,604 |
| 5.2 Standby, Crawler Mounted 2.0 CY Hydraulic Excavator | 20 | hrs | | | | \$37.54 | \$0 | \$0 | \$0 | \$751 | \$751 |
| 5.3 Wheel Loader, 3 cy | 50 | hrs | | | \$27.20 | \$56.31 | \$0 | \$0 | \$1,360 | \$2,816 | \$4,176 |
| 5.4 Standby, Wheel Loader, 3 cy | 20 | hrs | | | | \$14.07 | \$0 | \$0 | \$0 | \$281 | \$281 |
| 5.5 Health & Safety Monitoring with OVA during Excavation | 10 | day | | | \$188.16 | \$100.00 | \$0 | \$0 | \$1,882 | \$1,000 | \$2,882 |
| 5.6 Collect/Analyze Confirmatory Samples | 5 | ea | \$378.33 | \$10.00 | \$23.52 | | \$1,892 | \$50 | \$118 | \$0 | \$2,059 |
| 5.7 Import (Offsite) Place, Compact Clean Fill Material | 650 | cy | | \$7.82 | \$0.85 | \$1.81 | \$0 | \$5,083 | \$553 | \$1,177 | \$6,813 |
| 5.8 Backfill with Clean Excavated Material | 3000 | cy | | \$0.28 | \$2.02 | \$0.76 | \$0 | \$840 | \$6,060 | \$2,280 | \$9,180 |
| 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 | 1 | ls | \$750.00 | | | | \$750 | \$0 | \$0 | \$0 | \$750 |
| 6.2 Transport and Dispose of Soil (Non-haz.) in Landfill | 1000 | ton | \$45.00 | | | | \$45,000 | \$0 | \$0 | \$0 | \$45,000 |
| 6.3 Prepare Shipment Manifests | 40 | hrs | | | \$33.23 | | \$0 | \$0 | \$1,329 | \$0 | \$1,329 |
| 7 SITE RESTORATION | | | | | | | | | | | |
| 7.1 Concrete Slab (Reinforced) on Grade (6") | 650 | sf | \$4.03 | | | | \$2,620 | \$0 | \$0 | \$0 | \$2,620 |
| 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 | | | | | | | | \$7,552 | \$31,581 | \$15,015 | \$54,148 |

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NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE 4: EXCAVATION OF SUBSURFACE SOIL (EXCEEDING CGs), OFFSITE DISPOSAL, AND LUCs
CAPITAL COSTS

| Cost Item | Quantity | Unit | Subcontract | Unit Cost | | | Subcontract | Extended Cost | | | Subtotal |
|--|----------|------|-------------------------------|-----------|-------|-----------|-------------|---------------|----------|-----------|-----------|
| | | | | Material | Labor | Equipment | | Material | Labor | Equipment | |
| Local Area Adjustment | | | | | | | | 84% | 84% | 84% | |
| | | | | | | | | \$6,344 | \$26,528 | \$12,613 | \$45,484 |
| Overhead on Labor Cost @ 30% | | | | | | | | | | | \$7,958 |
| G & A on Labor Cost @ 10% | | | | | | | | | | | \$2,653 |
| G & A on Material Cost @ 10% | | | | | | | | \$634 | | | \$634 |
| Total Direct Capital Cost | | | | | | | | \$6,978 | \$37,139 | \$12,613 | \$56,730 |
| Indirects on Total Direct Labor Cost @ 75% | | | | | | | | | | \$27,854 | \$27,854 |
| Profit on Total Direct Cost @ 10% | | | | | | | | | | | \$5,673 |
| Subtotal | | | | | | | | | | | \$90,257 |
| Health & Safety Monitoring @ 3% | | | (Includes Subcontractor cost) | | | | | | | | \$4,464 |
| Total Field Cost | | | | | | | | | | | \$94,721 |
| Subtotal Subcontractor Cost | | | | | | | \$58,554 | | | | \$58,554 |
| G & A on Subcontract Cost @ 10% | | | | | | | \$5,855 | | | | \$5,855 |
| Profit on Subcontractor Cost @ 5% | | | | | | | | | | | \$2,928 |
| Subcontractor Cost | | | | | | | | | | | \$67,337 |
| Contingency on Total Field and Subcontractor Costs @ 10% | | | | | | | | | | | \$16,206 |
| Engineering on Total Field and Subcontractor Costs @ 5% | | | | | | | | | | | \$8,103 |
| TOTAL Capital COST | | | | | | | | | | | \$186,367 |

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NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33

SOIL ALTERNATIVE 4: EXCAVATION OF 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 | |

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33

SOIL ALTERNATIVE 4: EXCAVATION OF SUBSURFACE SOIL (EXCEEDING CGs), OFFSITE DISPOSAL, AND LUCs
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 33

SOIL ALTERNATIVE 4: EXCAVATION OF SUBSURFACE SOIL (EXCEEDING CGs), OFFSITE DISPOSAL, AND LUCs
PRESENT WORTH ANALYSIS

| Year | Capital Cost | Operation and Maintenance Cost | Annual Cost | Total Yearly Cost | Present-Worth Factor (i = 6%) | Present Worth |
|----------------------------|--------------|--------------------------------|-------------|-------------------|-------------------------------|------------------|
| 0 | \$186,367 | | | \$186,367 | 1.000 | \$186,367 |
| 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 | | | | | | \$243,457 |