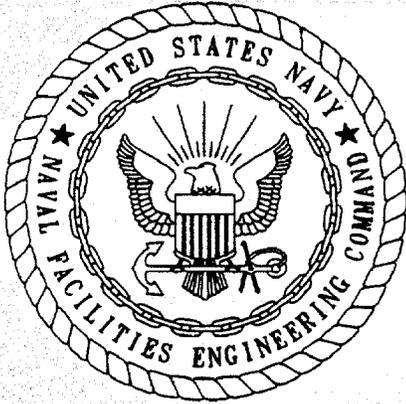


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REMEDIAL INVESTIGATION REPORT SITE 1 NORTHWEST DISPOSAL AREA WITH
TRANSMITTAL NAS WHITING FIELD FL
6/1/1998
HARDING LAWSON ASSOCIATES



**REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST DISPOSAL AREA**

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

**UNIT IDENTIFICATION CODE: N60508
CONTRACT NO.: N62467-89-D-0317/116**

JUNE 1998



**SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA
29418**

File 7541
1000239

Harding Lawson Associates



2534

August 24, 1998

Commanding Officer
Attn: Linda Martin CODE 1859
SouthNavFacEngCom
2155 Eagle Drive
North Charleston, SC 29419

SUBJECT: Page Inserts for Final Remedial Investigation Report Site 1, Northwest Disposal Area,
Naval Air Station Whiting Field Milton, Florida Contract No. N62467-89-D-0317

Dear Linda:

Enclosed please find two copies of page inserts for the Final Remedial Investigation Report, Site 1 Northwest Disposal Area for Naval Air Station Whiting Field, Milton, Florida. These inserts reflect your additional comments on the final report.

Additional copies of these page inserts have been forwarded to the list below on behalf of Southern Division, Naval Facilities Engineering Command for Naval Air Station Whiting Field.

Sincerely,

Harding Lawson Associates

A handwritten signature in black ink, appearing to read "T. Hansen", is written over a horizontal line.

Terry Hansen, P.G.
Project Manager

Enclosure (2 copies)

cc: Jim Holland, NAS Whiting Field PWD (2 copies)
Jim Cason, FDEP (2 copies)
Craig Benedikt, USEPA (1 copy)
Tom Conrad, Bechtel Environmental (1 copy)
Phillip Ottinger, Tetra Tech NUS (1 copy)



**SOUTHDIV - Review Comments for
Remedial Investigation Report for Site 1, Northwest Disposal Area
Linda Martin**

Comment: The document should be written in a more positive and conclusive tone not in a non-conclusive tone. In most case in the executive summary, chapters 6, 7, & 9 phrases like "thought to be, easily, primarily ect," should be taken out. Another example of this is the whole paragraph on 8-8 stating "It is important.....an actual transport route. Also do a word search for "that' and "which" and delete them from your sentences.

Response: The document is written in a tone that expresses the inconclusive nature of any and all Remedial Investigations. Phrases such as "thought to be, easily, primarily ect," express the fact that although the site conditions indicated are believed to be accurate other conditions may be present and contributing to interpretations. Without unlimited funds and time all conditions can not be fully explored nor should be explored.

The referenced paragraph on page 8-8 will be deleted. ABB-ES editors will perform a word search for the occurrence of "that" and "which" and evaluate the appropriate usage of each occurrence. If the appropriateness of the occurrence is questionable, the word will be deleted and the sentence will be reworded.

Comment: Change section 7.1: Site Characterization to reflect the information in the Nature Conservancy Report 1997.

Response: The Nature Conservancy Report (1997), includes the results of a survey of rare species and natural communities at NAS Whiting Field, does not contain information specific to the site characterization of Site 1. Therefore, it is not appropriate

Comment: The 1993 groundwater data should not be used in any data set including risk assessment. In some places in the document you say the data is not used and in other places you say it is used.

Response: Agreed. The data was not used in the risk assessment and any references to such in the text will be deleted.

**REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST DISPOSAL AREA**

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

Unit Identification Code: N60508

Contract No.: N62467-89-D-0317/116

Prepared by:

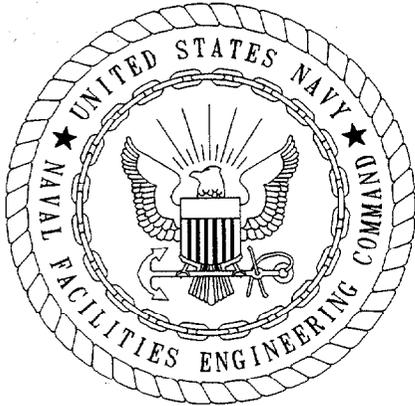
**Harding Lawson Associates
2590 Executive Center Circle, East
Tallahassee, Florida 32301**

Prepared for:

**Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29418**

Linda Martin, Code 1859, Engineer-in-Charge

June 1998



CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

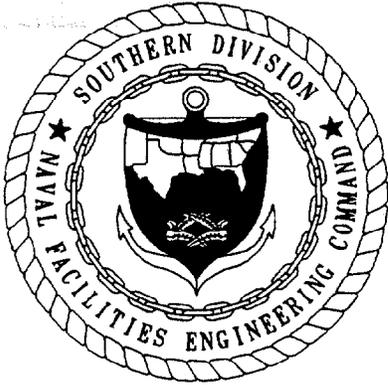
The Contractor, Harding Lawson Associates (formerly ABB Environmental Services, Inc.), hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/116 are complete and accurate and comply with all requirements of this contract.

DATE: June 9, 1998

NAME AND TITLE OF CERTIFYING OFFICIAL: Terry Hansen, P.G.
Task Order Manager

NAME AND TITLE OF CERTIFYING OFFICIAL: Gerald Walker, P.G.
Project Technical Lead

(DFAR 252.227-7036)



FOREWORD

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

One of these programs is the Installation Restoration (IR) program. This program complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), the Resource Conservation and Recovery Act (RCRA), and the Hazardous and Solid Waste Amendments (HSWA) of 1984. These acts establish the means to assess and clean up hazardous waste sites for both private-sector and Federal facilities. The CERCLA and SARA acts form the basis for what is commonly known as the Superfund program.

Originally, the Navy's part of this program was called the Naval Assessment and Control of Installation Pollutants (NACIP) program. Early reports reflect the NACIP process and terminology. The Navy eventually adopted the program structure and terminology of the standard IR program.

The IR program is conducted in several stages as follows:

- preliminary assessment (PA),
- site inspection (SI) (formerly the PA and SI steps were called the initial assessment study under the NACIP program),
- remedial investigation and feasibility study (RI/FS), and
- remedial design and remedial action (RD/RA).

The Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) manages and the U.S. Environmental Protection Agency (USEPA) and the Florida Department of Environmental Protection (formerly Florida Department of Environmental Regulation) oversee the Navy environmental program at Naval Air Station (NAS) Whiting Field. All aspects of the program are conducted in compliance with State and Federal regulations, as ensured by the participation of these regulatory agencies.

Questions regarding the CERCLA program at NAS Whiting Field should be addressed to Ms. Linda Martin, Code 1859, at (803) 743-5574.

EXECUTIVE SUMMARY

A remedial investigation and feasibility study (RI/FS) is being conducted at Naval Air Station (NAS) Whiting Field in Milton, Florida, by Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) as part of the Department of Defense Installation Restoration (IR) program. The IR program was designed to identify and abate or control contaminant migration resulting from past operations at naval installations.

A phased approach was implemented to conduct the RI. Phase I was completed in May 1992. The subsequent phases of the RI were designated as Phase IIA and Phase IIB. Fieldwork for Phase IIA was completed in March 1994. RI Phase IIB was completed in November 1996.

This RI report contains the results of assessment activities used to characterize site-specific chemicals detected in environmental media (soil gas, soil, and groundwater) at Site 1, Northwest Disposal Area at NAS Whiting Field. Data obtained from these activities were used to evaluate the nature and extent of contamination at the site and support feasibility studies (if required) and baseline risk assessments. Human health and ecological baseline risk assessments are included with the RI report.

The fieldwork conducted during the RI included the following tasks:

- soil gas survey,
- geophysical survey,
- test pit investigations,
- subsurface soil sampling,
- surface soil sampling,
- monitoring well installation,
- groundwater sampling, and
- hydrogeologic investigations.

Soil gas samples were analyzed for methane and other volatile organic compounds (VOCs). Soil and groundwater samples were analyzed for target compound list organic analytes, and target analyte list inorganic analytes.

The following conclusions are based on results of the RI investigation activities at Site 1, Northwest Disposal Area, NAS Whiting Field.

- Geophysical survey results do not conclusively support any evidence of landfilling.
- The test pit sampling results do not conclusively support any evidence of landfilling.
- Neither methane nor VOCs were detected during the soil gas survey.
- Neither semivolatile organic compounds (SVOCs) nor polychlorinated biphenyls (PCBs) were detected in surface soil samples at concentrations exceeding their respective detection limits. One VOC (xylenes) was detected at a concentration below the Florida residential soil cleanup goal in two surface soil samples. One

pesticide compound (dieldrin) was detected at a concentration below the Florida residential soil cleanup goal in one surface soil sample. Twenty inorganic analytes were detected in the surface soil samples. Eleven inorganic analytes exceeded the background screening values (Harding Lawson Associates [HLA], 1998). Detected concentrations of arsenic exceeded the USEPA Region III RBC for residential and industrial use and Florida soil cleanup goals for residential soil. However, none of the concentrations exceeded the FDEP-approved site-specific arsenic soil cleanup goal of 4.62 mg/kg.

- Neither SVOCs, pesticides, nor PCBs were detected at concentrations exceeding detection limits in the subsurface soil sample collected at Site 1. One VOC (acetone) was detected in the sample; however, acetone is a common field or laboratory derived contaminant. Sixteen inorganic analytes were detected in the subsurface soil sample. Only mercury slightly exceeded the background screening value. No inorganic analytes detected in the subsurface soil sample exceeded the Florida industrial use soil cleanup goal.
- VOCs, SVOCs, or PCBs were not detected in groundwater samples at concentrations exceeding Federal or State maximum contaminant levels (MCLs). One pesticide compound (beta-benzene hexachloride [BHC]) was detected in two groundwater samples collected in 1993; however, no applicable standard currently exists.
- Two inorganic analytes, aluminum and iron, were detected in the shallow monitoring well groundwater samples, collected by low-flow methods, at concentrations exceeding Federal and Florida MCLs. None of the inorganic analytes detected in the groundwater samples collected using low-flow methods from the intermediate monitoring well exceeded Federal or State MCLs.
- The pH values of groundwater samples collected from monitoring wells were below the lower range for Federal and Florida Secondary MCLs; however, these values were within the range observed in background groundwater samples collected at NAS Whiting Field (HLA, 1998).
- The groundwater flow direction is to the south-southwest and discharges at Clear Creek; the creek is located approximately 5,000 feet southwest of the site.
- The Human Health Risk Assessment determined soil and groundwater at Site 1 are not likely to pose an unacceptable carcinogenic risk or noncancer hazard to a current or hypothetical future receptors at the site based on USEPA guidelines and target risk levels.
- The total excess lifetime cancer risk associated with ingestion of soil by a hypothetical future resident (1×10^{-5}) and occupational worker (1×10^{-6}) did exceed FDEP's target level of concern (1×10^{-6}) due to arsenic.
- The noncancer hazards associated with ingestion and direct contact of soil by a hypothetical future child resident slightly exceeded

U.S. Environmental Protection Agency target hazard index (HI) of 1; however, no individual analyte exceeded 1.

- Noncancer risk in surface soil is primarily from iron. Iron was detected in surface soil samples at concentrations of an order of magnitude less than acceptable essential nutrient levels.
- The results of the Ecological Risk Assessment suggest risks are not predicted for ecological receptors at Site 1.

Based on the interpretation of findings from the remedial investigation activities, a focused feasibility study is proposed for Site 1, Northwest Disposal Area.

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
ARAR	applicable or relevant and appropriate requirement
BAF	bioaccumulation factor
BAT	Bengt-Arne-Torstensson
bls	below land surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
cm/sec	centimeters per second
CPC	chemical of potential concern
CRDL	contract-required detection limit
%D	percent Difference
DQO	data quality objective
ECPC	ecological contaminant of potential concern
Eh	redox potential
ELCR	excess lifetime cancer risk
EM	electromagnetic
EPC	exposure point concentration
ERA	ecological risk assessment
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FS	feasibility study
ft/day	feet per day
ft/ft	feet per foot
ft/yr	feet per year
GIR	General Information Report
HHPCP	human health chemical of potential concern
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
HRS	Hazard Ranking System
IAS	initial assessment study
IDL	instrument detection limit
IR	Installation Restoration
LD ₅₀	lethal dose to 50 percent of test population
LOEC	lowest observed effects concentrations
LOAEL	lowest observed adverse effects level
MAG	magnetometry
MCL	maximum contaminant level

GLOSSARY (Continued)

mg/kg	milligrams per kilogram
MS/MSD	matrix spike and matrix spike duplicate
µg/kg	micrograms per kilogram
µg/l	micrograms per liter
µmho/cm	micromhos per centimeter
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NFA	no further action
NOAEL	no observable adverse effects level
NPL	National Priority List
NTU	nephelometric turbidity unit
PA	Preliminary Assessment
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyl
PCPT	piezocone penetrometer test
PDE	potential dietary exposure
QA	quality assurance
QC	quality control
QAPP	Quality Assurance Program Plan
RBC	risk-based concentration
RG0	remedial goal option
%RSD	percent Relative Standard Deviation
RI	remedial investigation
RME	reasonable maximum exposure
RPD	relative percent difference
SARA	Superfund Amendments and Reauthorization Act
SDG	sample delivery group
SFF	site foraging frequency
SOUTHNAV- FACENCOM	Southern Division, Naval Facilities Engineering Command
SQL	sample quantitation limit
SU	standard unit
SVOC	semivolatile organic compound
TAL	target analyte list
TCL	target compound list
TRV	toxicity reference value
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

1.0 INTRODUCTION

Harding Lawson Associates (HLA) (formerly ABB Environmental Services, Inc. [ABB-ES]), under contract to the Department of Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) is submitting the Remedial Investigation (RI) Report for Site 1, Northwest Disposal Area, at Naval Air Station (NAS) Whiting Field located in Milton, Florida. The RI Report for Site 1 is one in a series of site-specific reports being completed in conjunction with the NAS Whiting Field General Information Report (GIR) (ABB-ES, 1998) to summarize the previous investigations and to present the results of the RI.

The Remedial Investigation and Feasibility Study (RI/FS) is being conducted on behalf of the Navy at NAS Whiting Field under contract No. N62467-89-D-0317. The RI was conducted in three phases. The Phase I RI field program was completed in May 1992. The Phase IIA RI field program was conducted between May 1992 and March 1994. The Phase IIB RI field program was completed in November 1996.

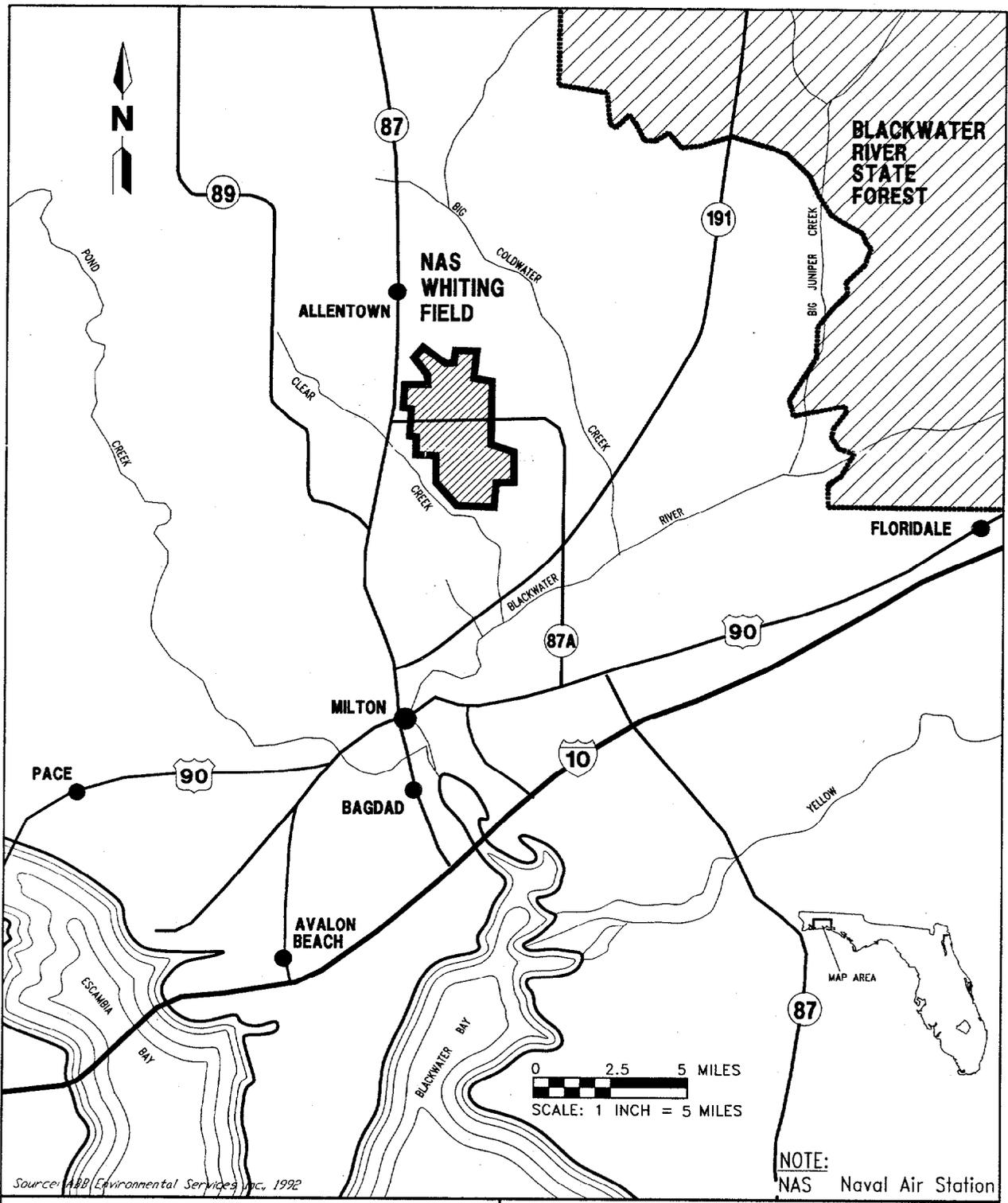
Installation Location and Description. NAS Whiting Field is located in Santa Rosa County, in Florida's northwest coastal area, approximately 5.5 miles north of Milton and 25 miles northeast of Pensacola (Figure 1-1). NAS Whiting Field presently consists of two air fields separated by an industrial area. The installation is approximately 3,842 acres. Figure 1-2 presents the installation layout and locations of RI/FS sites at NAS Whiting Field. A complete description of historic operations at the facility is presented in Section 1.3 and Appendix A of the NAS Whiting Field GIR (ABB-ES, 1998).

1.1 PURPOSE OF THE RI/FS. The purpose of the NAS Whiting Field RI is to identify and characterize the nature and extent of chemicals in environmental media and potential risks to human and ecological receptors that might be posed by toxic or hazardous chemicals present onsite. The chemicals were potentially released to the environment during past waste disposal practices or spills. The data collected during the RI field program will also be used in an FS (if necessary) to screen, evaluate, and select remedial alternatives to provide permanent, feasible solutions to environmental impacts that may be a result of past waste disposal practices or spills.

1.2 SITE DESCRIPTION. Site 1 is a 5-acre parcel located along the northwestern facility boundary near the North Air Field (Figure 1-2). The site is a surface depression that gently slopes toward a drainage outlet located along the southwestern site boundary.

The site is currently forested with pine trees that are approximately 20 feet in height. Large concrete pipes and culverts and some concrete rubble are present on the ground surface of the site. Buried wastes are not exposed at the land surface in erosional areas, nor are there indications (e.g., stained soil or stressed vegetation) of other past waste disposal practices.

According to the U.S. Department of Agriculture (USDA) (1980), the soil at Site 1 is classified as Troup Loamy Sand. There is no evidence of a clay soil cap over the site area. Because the soil at the site is predominantly silty sand, much of the onsite rainfall infiltrates directly into the soil. Surface water



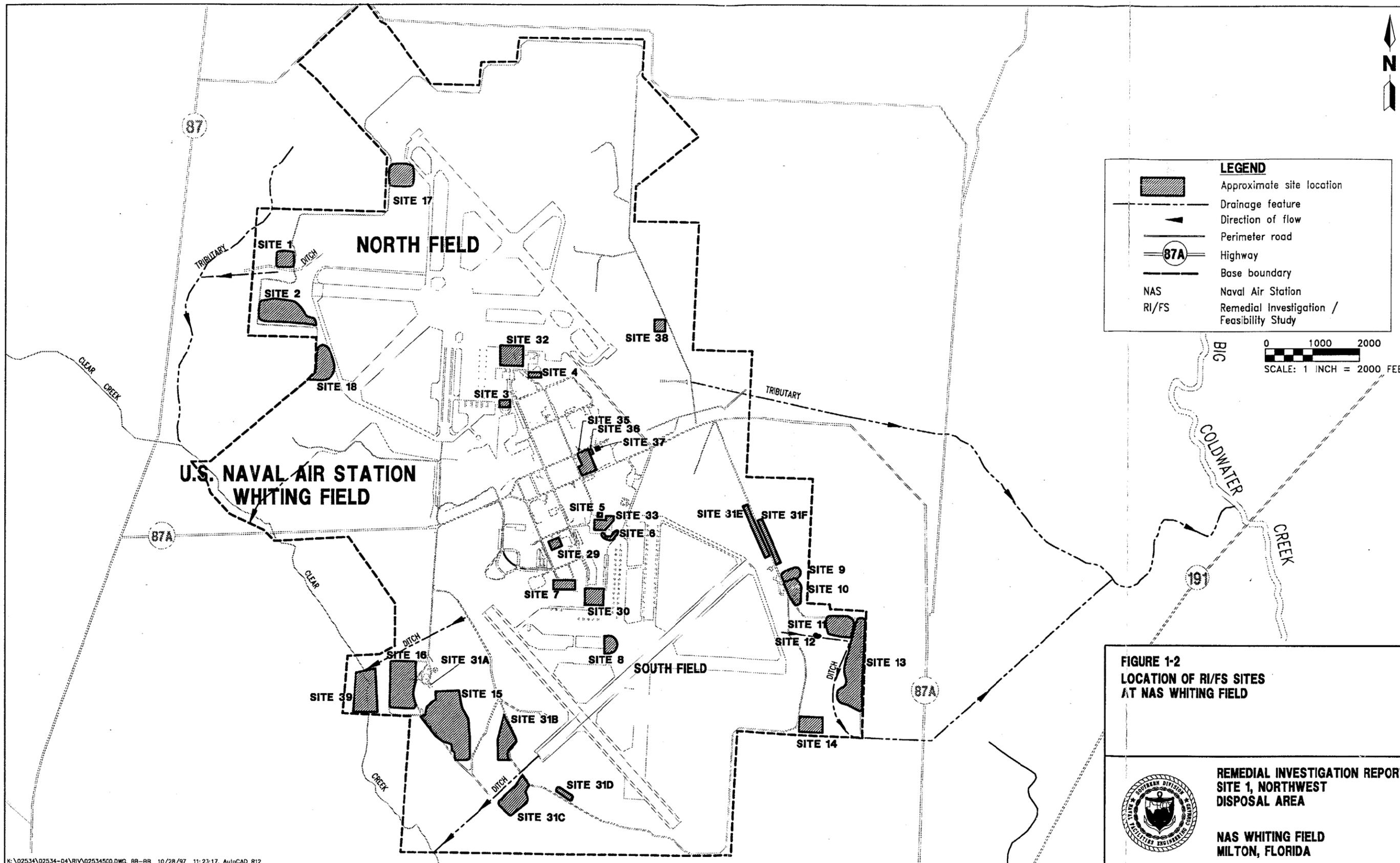
**FIGURE 1-1
FACILITY LOCATION MAP**



**REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST
DISPOSAL AREA**

**NAS WHITING FIELD
MILTON, FLORIDA**

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runoff flows along the southwestern site boundary and is intercepted by concrete drainage ditch "E." This ditch is present near the southern boundary of the site and conveys surface water from the North Air Field to Clear Creek.

1.3 REGULATORY SETTING. The Navy Installation Restoration (IR) program was designed to identify and abate or control contaminant migration resulting from past operations at naval installations. The IR program is the Navy response authority under Section 120 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and Executive Order 12580. CERCLA requires that Federal facilities comply with the act, both procedurally and substantively. SOUTHNAVFACENGCOM is the agency responsible for the Navy IR program in the southeastern United States. Therefore, SOUTHNAVFACENGCOM has the responsibility to process NAS Whiting Field through preliminary assessment (PA), site inspection, RI/FS, and remedial response selection in compliance with the guidelines of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] 300).

Section 105(a)(8)(A) of SARA requires the U.S. Environmental Protection Agency (USEPA) to develop criteria to set priorities for remedial action for chemicals detected in environmental media based on relative risk to human health and the environment. To meet this requirement, USEPA has established the Hazard Ranking System (HRS) as Appendix A to the NCP. First promulgated in 1982, the HRS was amended in December 1990, effective March 14, 1991 (55 Federal Register No. 241:51532-51667), to comply with requirements of Section 105(c)(1) of SARA to increase the accuracy of the assessment of relative risk. The HRS (March 1991) has been substantially revised and is designed to prioritize sites after the SI phase of the CERCLA process.

The HRS score for NAS Whiting Field was generated in 1993. The score was sufficient to place NAS Whiting Field on the National Priority List (NPL).

In January 1994, the USEPA placed NAS Whiting Field on a proposed list of sites to be included on the NPL (40 CFR 300, Federal Register, 18 January 1994), and on May 31, 1994, NAS Whiting Field was placed on the NPL effective June 30, 1994 (40 CFR 300, Federal Register, May 31, 1994). As a result, the RI/FS for NAS Whiting Field must follow the requirements of the NCP, as amended by SARA, and regulatory guidance for conducting RI/FS programs under CERCLA.

1.4 REPORT ORGANIZATION. The RI Report is organized into nine chapters (Chapters 1.0 to 9.0). Chapter 1.0 presents the purpose, site description, and regulatory setting for the RI at NAS Whiting Field. Chapter 2.0 summarizes previous investigations. Chapter 3.0 presents the investigative methodology for conducting the assessment. Chapter 4.0 presents the site-specific data quality assessment. Chapter 5.0 discusses the investigative results of the assessment. Chapter 6.0 presents the Human Health Risk Assessment (HHRA), and Chapter 7.0 presents the Ecological Risk Assessment (ERA). Chapter 8.0 discusses the fate and transport of chemicals determined to be human and/or ecological chemicals of potential concern. Chapter 9.0 provides a summary of the conclusions and recommendations. Chapter 10.0 presents professional review certification.

2.0 PREVIOUS INVESTIGATIONS

This chapter summarizes the previous investigations at Site 1, Northwest Disposal Area, at NAS Whiting Field.

2.1 INITIAL ASSESSMENT STUDY (IAS). Background information was gathered for the IAS (Envirodyne Engineers, Inc., 1985) by conducting a record search, performing an onsite survey, and conducting interviews with long-time employees and retired personnel familiar with the site.

From 1943 until 1965, general refuse and wastes associated with operation and maintenance of aircraft may have been disposed of at this site. Anecdotal evidence suggests this may include unknown quantities of waste paints, paint thinners, solvents, waste oils, and hydraulic fluids. Access to the site was uncontrolled, and there were no available written records of the types of wastes disposed of at the site (Envirodyne Engineers, Inc., 1985).

Envirodyne Engineers, Inc., recommended in the IAS that a Confirmation Study be completed based on the types of wastes possibly disposed of at the site, the potential for off-site migration, and the presence of human and ecological receptors. The Confirmation Study would typically consist of two parts: Verification and Characterization; however, only the verification phase was conducted.

2.2 VERIFICATION STUDY. The verification study (Geraghty & Miller, 1986) at Site 1 included installing one monitoring well (WHF-1-1) and collecting a groundwater sample. The monitoring well was installed to a depth of 122 feet below land surface (bls) along the southwestern edge of the site.

Groundwater elevation data collected in 1992 and 1993 (ABB-ES, 1995b) for the area suggest that the well was located hydraulically downgradient from the site. The groundwater sample was analyzed for USEPA priority pollutants, which includes volatile organic compounds (VOCs), acid and neutral extractable organic compounds, pesticides (including endrin, lindane, kepone, toxaphene, chlorodane, and malathion), herbicides (2,4-D and 2,4,5-TP Silvex), polychlorinated biphenyls (PCBs), and metals. No organic compounds were detected. One inorganic analyte (lead) was detected at concentrations below Florida's primary drinking-water regulations (Chapter 17-22.104, Florida Administrative Code [FAC]) that was in effect in 1986.

3.0 FIELD INVESTIGATIVE METHODS

Field investigative techniques used during the RI to collect the data are described in the RI/FS workplan, Volume II (E.C. Jordan, 1990), which provides descriptions of sampling methods, field personnel responsibilities, sample management, chain of custody, project documentation, change in field methods, protocols on corrective actions, decontamination procedures, waste management handling, and other general project standards and procedures in Section 3.1, General Site Operations.

Field and laboratory quality assurance and quality control (QA/QC) requirements for the RI activities comply with the RI/FS Quality Assurance Project Plan (QAPP) located in Appendix A of the RI/FS workplan, Volume II (E.C. Jordan, 1990). Health and safety requirements were in accordance with the general Health and Safety Plan located in Volume III of the RI/FS workplan (E.C. Jordan, 1990).

Field investigative methods not covered in the documents identified above are described in Technical Memorandum No. 7, RI Phase IIB workplan (ABB-ES, 1995d) and in the NAS Whiting Field GIR (ABB-ES, 1997).

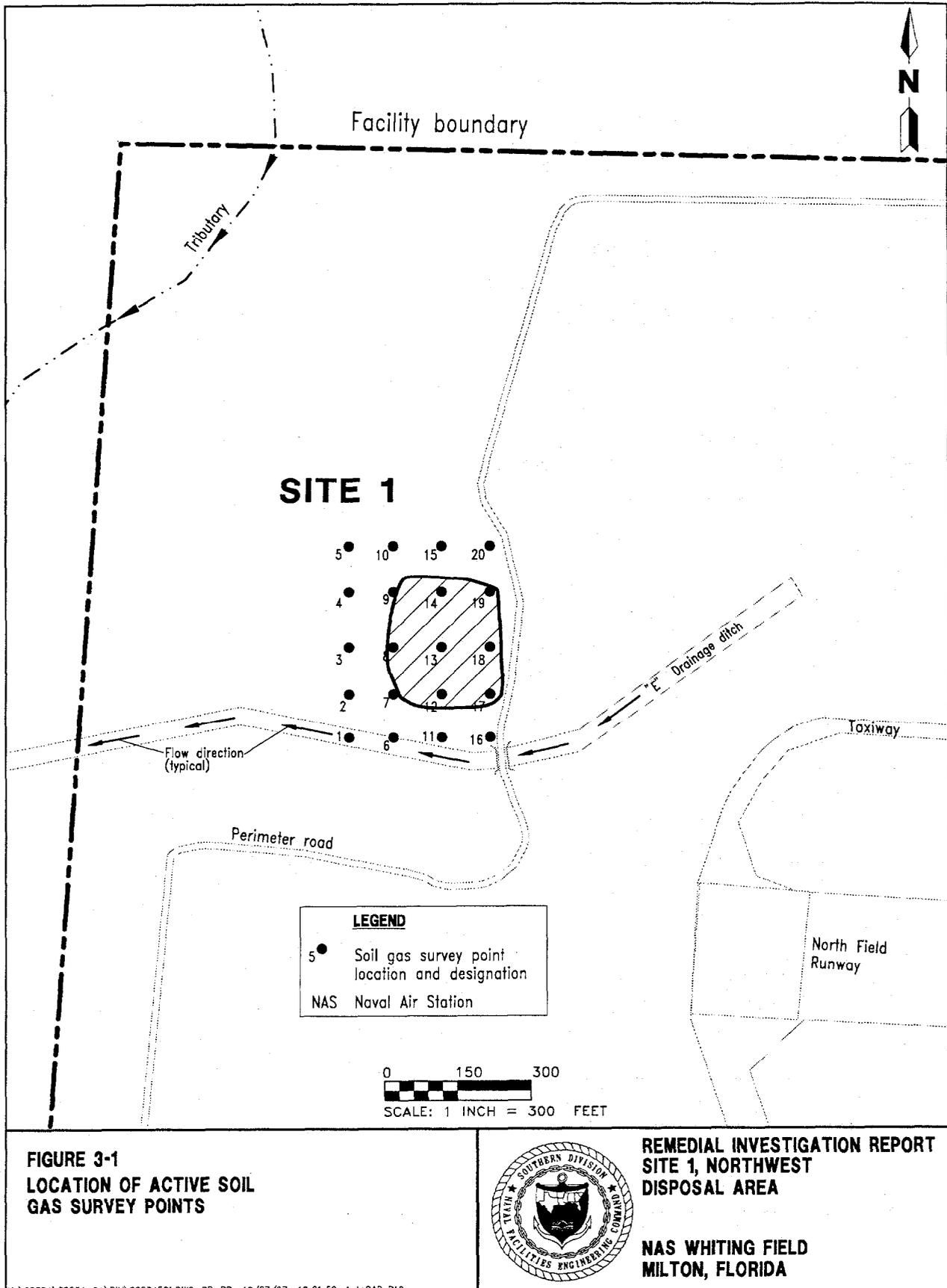
These field and laboratory investigation techniques are in general conformance with USEPA standard operating procedure (USEPA, 1991a and 1996) and were followed during the RI sampling and analysis program.

The RI Phase I investigation (ABB-ES, 1992c) at Site 1 consisted of collecting a groundwater sample using a piezocone penetrometer (PCPT) and Bengt-Arne Torstensson (BAT) sampler. The Phase IIA investigation included completion of a geophysical survey, collection of three surface soil samples and one subsurface soil sample from a test pit, installation of three monitoring wells, and collection of four groundwater samples. The Phase IIB investigation included an active soil gas survey, collection of five surface soil samples, installation of one monitoring well, and collection of five groundwater samples. The samples were analyzed for target compound list (TCL) VOCs, semivolatile organic compounds (SVOCs), pesticides and PCBs, and target analyte list (TAL) inorganic analytes.

The following provides a brief description of the number and types of environmental samples and the analytical methodology for the RI for Site 1, Northwest Disposal Area.

3.1 SOIL GAS SURVEY FOR METHANE. A soil gas survey was conducted in June 1995 at Site 1 to assess the presence of methane gas or other VOCs potentially emanating from the site. Soil gas samples were collected across the site and up to 100 feet beyond the site boundary. Sample locations were determined based on a 100- by 100-foot grid. The grid origin was located at an area that was assumed not to be influenced by soil gas emanating from the site. Figure 3-1 presents the locations of the active soil gas survey points.

At each location, an open-ended stainless-steel tube was pushed or manually driven to the proposed sampling depths of 1.5 feet and 3.0 feet bls. Organic vapor measurements were made at the two sampling depths. The air within the stainless-steel tube was purged with a vacuum pump to obtain a representative sample of soil gas. Organic vapor concentrations were measured in the field with



**FIGURE 3-1
LOCATION OF ACTIVE SOIL
GAS SURVEY POINTS**



**REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST
DISPOSAL AREA**

**NAS WHITING FIELD
MILTON, FLORIDA**

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3.0 FIELD INVESTIGATIVE METHODS

Field investigative techniques used during the RI to collect the data are described in the RI/FS workplan, Volume II (E.C. Jordan, 1990), which provides descriptions of sampling methods, field personnel responsibilities, sample management, chain of custody, project documentation, change in field methods, protocols on corrective actions, decontamination procedures, waste management handling, and other general project standards and procedures in Section 3.1, General Site Operations.

Field and laboratory quality assurance and quality control (QA/QC) requirements for the RI activities comply with the RI/FS Quality Assurance Project Plan (QAPP) located in Appendix A of the RI/FS workplan, Volume II (E.C. Jordan, 1990). Health and safety requirements were in accordance with the general Health and Safety Plan located in Volume III of the RI/FS workplan (E.C. Jordan, 1990).

Field investigative methods not covered in the documents identified above are described in Technical Memorandum No. 7, RI Phase IIB workplan (ABB-ES, 1995d) and in the NAS Whiting Field GIR (ABB-ES, 1998).

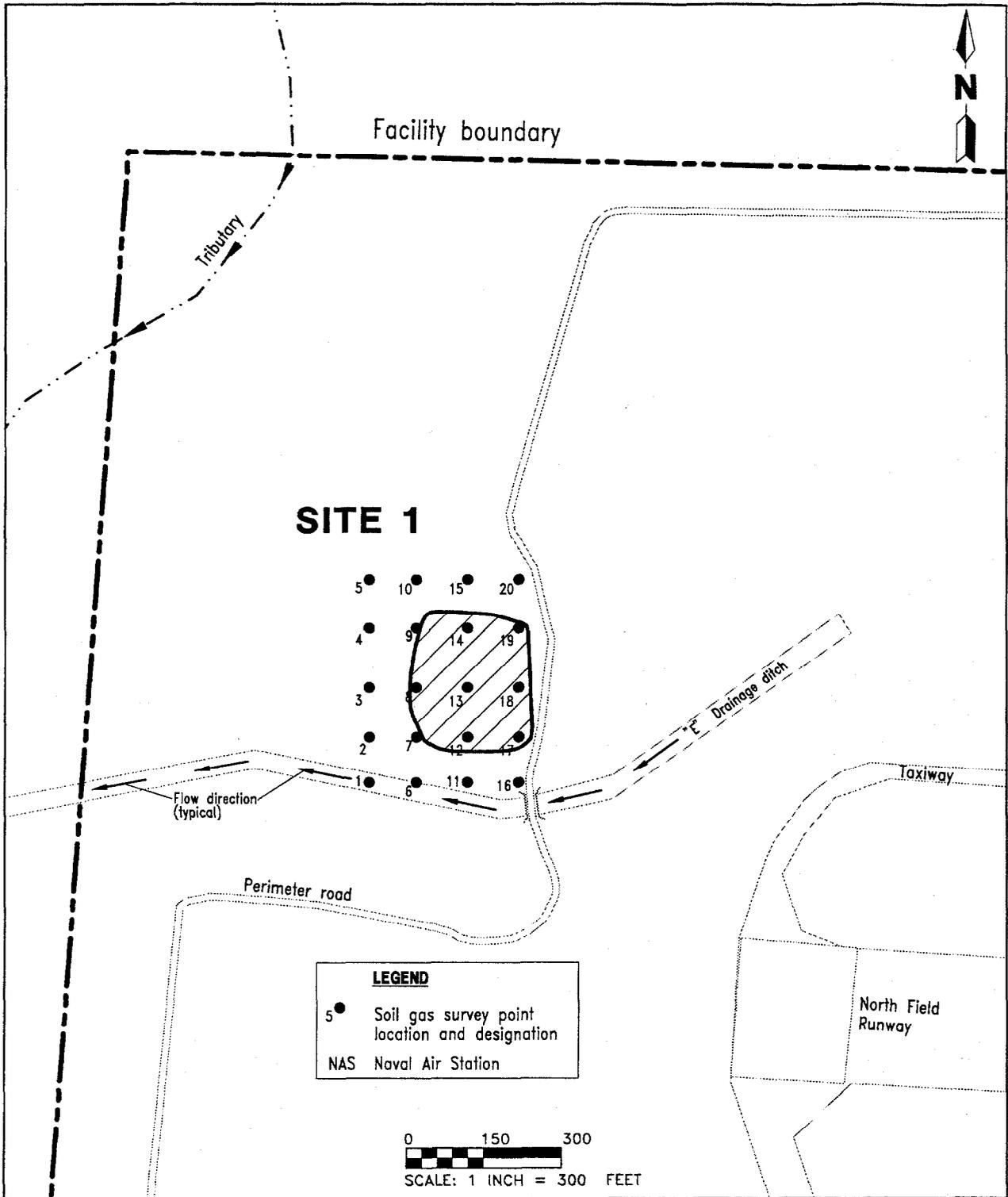
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**FIGURE 3-1
LOCATION OF ACTIVE SOIL
GAS SURVEY POINTS**



**REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST
DISPOSAL AREA**

**NAS WHITING FIELD
MILTON, FLORIDA**

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either a Portafid II™ or a Foxboro OVA-128™ organic vapor analyzer. Measurements of both total VOCs and vapors after a granulated charcoal filter (methane) were recorded. A comparison of the two measurements allowed a qualitative analysis of the presence of methane gas. Soil gas samples were not submitted for laboratory analysis.

Soil gas sample results are typically contoured to evaluate the soil gas measurements. The results of the soil gas survey are presented in Section 5.1.

3.2 GEOPHYSICAL SURVEY. Geophysical surveys at Site 1 were conducted between May 26, 1992, and June 14, 1992. The purpose of the geophysical surveys was to assess the lateral and vertical extent of the waste disposal area and locate buried metallic or nonmetallic objects that may indicate a potential waste disposal area.

Geophysical methods used at the site include electromagnetic (EM) induction and magnetometry (MAG). Blackhawk Geosciences, Inc., Golden, Colorado, was subcontracted by ABB-ES (presently HLA) to conduct the geophysical tasks. A technical report describing the methodology, results, and conclusions of the geophysical survey was prepared in February 1993 (ABB-ES, 1993).

Data from the EM and MAG surveys were collected along east to west grid lines that were spaced 40 feet apart. The grid lines were oriented with a magnetic compass and measuring tape. Data were collected at stations located at 10-foot intervals along each grid line. These grid lines were later surveyed by a Florida-licensed surveyor. The location of the grid and the plotted geophysical data are presented on Figures A-1 through A-4 in Appendix A. The results of the geophysical survey are presented in Section 5.2.

3.3 SURFACE SOIL ASSESSMENT. The surface soil assessment included the collection of three surface soil samples during Phase IIA and five surface soil samples during Phase IIB of the RI.

The three Phase IIA soil samples (01-SL-01 through 01-SL-03) were collected in August 1992 at locations where surface geophysical anomalies were interpreted to be present. Because these surface soil sample locations were biased based on geophysical anomalies, additional surface soil samples (Phase IIB) from other random locations were required to confirm the presence or absence of chemicals previously detected and to characterize the nature and extent of contamination.

Five Phase IIB surface soil samples (01S001 through 01S005) were collected in December 1995 at locations shown on Figure 3-2. In addition to providing unbiased sampling locations, these samples also support the ecological (potential exposure to terrestrial wildlife) and human health (exposure of transient persons to site soil) risk assessments. Locations were determined using the systematic sampling method where a point is chosen at random along a transect, and then samples are collected at equidistant intervals thereafter (Gilbert, 1987; USEPA, 1989a). Surface soil samples were collected from the land surface to a maximum depth of 12 inches bls using a decontaminated stainless-steel auger. Soil samples were described using the Unified Soil Classification System and recorded in a bound field logbook by ABB-ES (presently HLA) personnel.

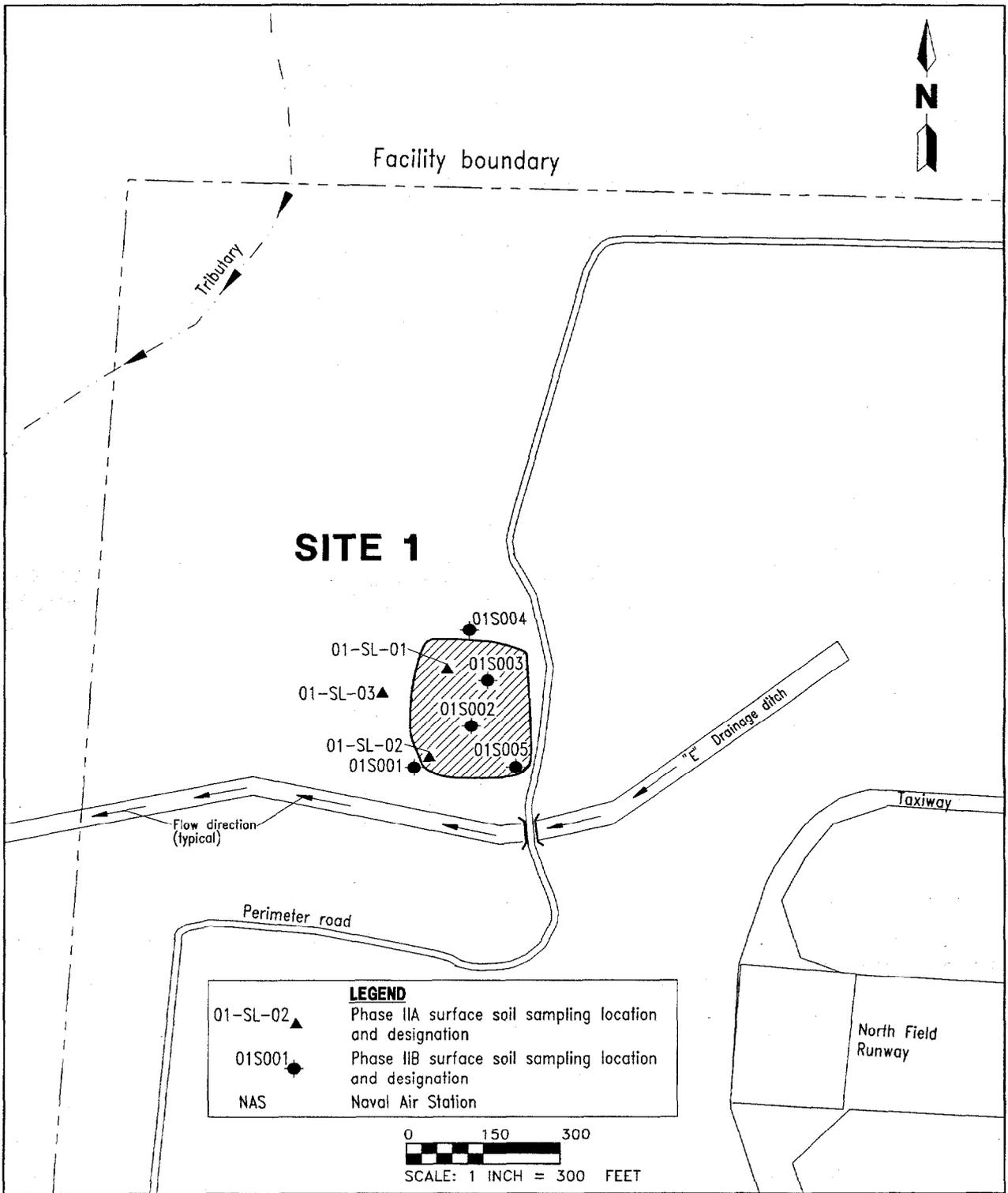


FIGURE 3-2
SURFACE SOIL SAMPLING LOCATIONS



REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST
DISPOSAL AREA

NAS WHITING FIELD
MILTON, FLORIDA

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The surface soil samples were analyzed for Contract Laboratory Program (CLP) (Naval Energy and Environmental Support Activity [NEESA] Level D) TCL VOCs, SVOCs, pesticides and PCBs, and TAL inorganic analytes. Three of the five Phase IIB surface soil samples were also analyzed to determine physical characteristics. The samples were analyzed for the following physical parameters: dry bulk density, sieve analysis, hydrometer analysis, Atterberg limits, and permeability.

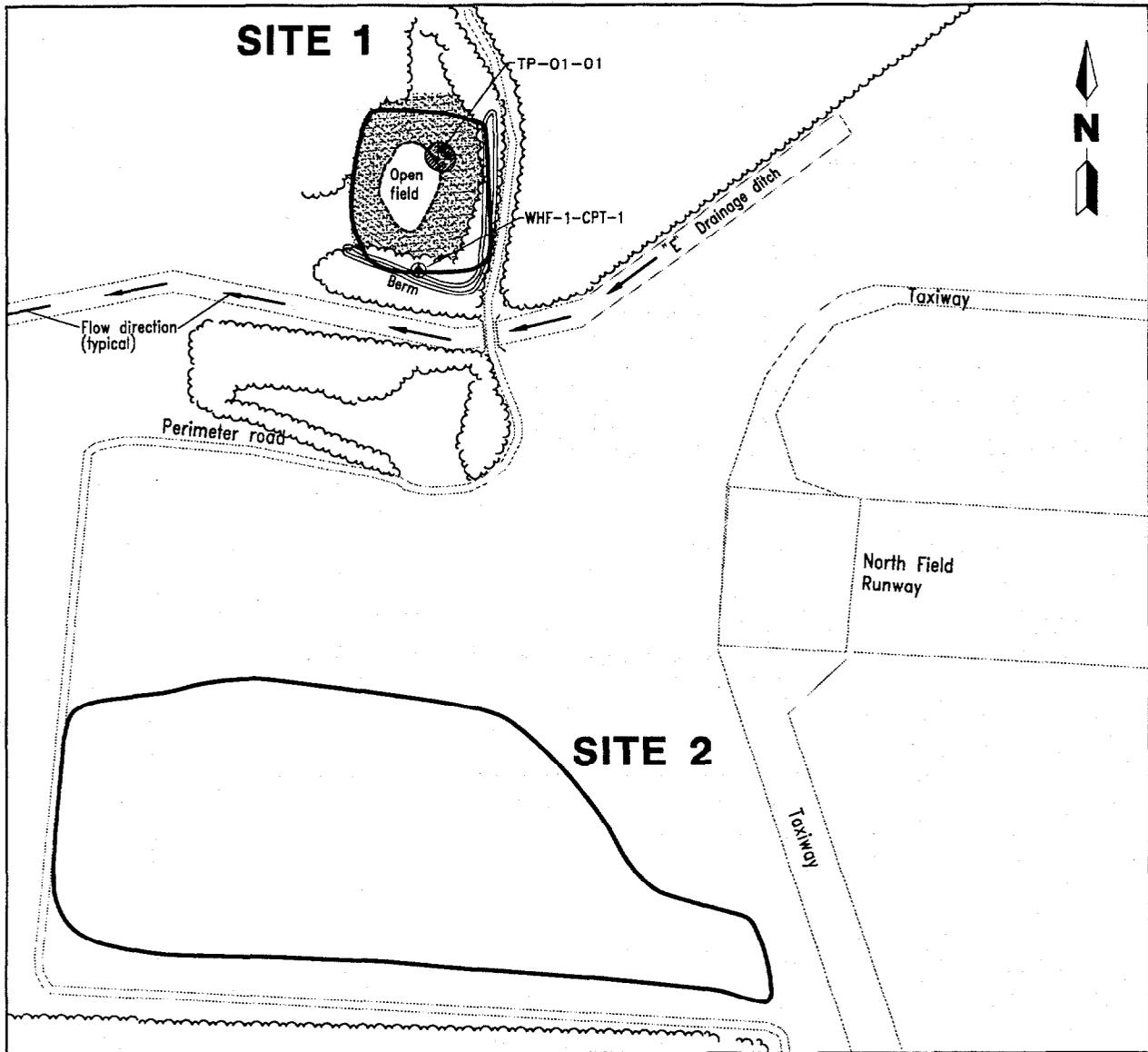
Background screening criteria were established by collecting background samples across the Installation from each USDA soil type identified at NAS Whiting Field. These data are presented in Subsection 3.3.1 of the GIR (ABB-ES, 1998). The arithmetic mean of analytes detected in the background soil samples was calculated by summing individual analyte concentrations and then dividing the sum by the number of samples from which the analytes were detected. Samples were then compared to twice the arithmetic mean of analyte concentrations detected in background surface soil samples associated with the Troup Loamy Sand soil type. The surface soil sampling results are discussed in Section 5.3 of this report.

3.4 SUBSURFACE SOIL ASSESSMENT. The RI subsurface investigation at Site 1 included a PCPT investigation, split-spoon sampling conducted during monitoring well installations, and test pit excavation and sampling. Detailed lithologic descriptions for all monitoring wells and PCPT soundings are presented in Phase I Technical Memorandum No. 1, Geological Assessment (ABB-ES, 1992a) and in Phase IIA Technical Memorandum No. 2, Geological Assessment (ABB-ES, 1995a). A summary of the Site 1 lithology is also presented in Section 5.6 of this report.

3.4.1 PCPT Investigation One PCPT exploration (WHF-1-CPT-1) was performed at Site 1 to a total depth of 138 feet bls in April 1991. The location of the PCPT exploration is presented on Figure 3-3. Specifically, a stainless-steel cone tip (equipped with electronic sensors) connected to stainless-steel rods was hydraulically pressed into the overburden soils. Measurements of end-bearing resistance, friction resistance, and pore pressure were recorded from the sensors throughout each sounding. The analog signals from the cone tip sensors were digitized for data logging, and analysis of the digital data was completed in the field using a data acquisition software system. Based on the cone readings, a lithologic description of the soils was computed with the aid of the software package.

The cone tip was advanced until the friction resistance of the overburden soils exceeded the power of the hydraulic system (refusal); the exploration was then terminated. The primary purpose of extending the boring explorations was to collect *in situ* groundwater samples using the BAT screening technique. The BAT *in situ* groundwater sampling technique was described in Phase I Technical Memorandum No. 5, Groundwater Assessment (ABB-ES, 1992c). A summary of the sounding designations, completion dates, proposed and actual depths, and the lithologic descriptions for the sounds are presented in Phase IIA Technical Memorandum No. 2, Geological Assessment (ABB-ES, 1995a).

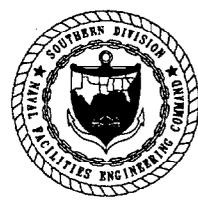
3.4.2 Split-Spoon Sampling Lithologic data were also recorded during monitoring well installation. A 2-foot split-spoon sample was collected for visual inspection by an ABB-ES (presently HLA) geologist. All data were entered into a bound logbook. Detailed soil descriptions and other pertinent data are presented in the boring logs for the soil boring investigation located in Phase



LEGEND	
WHF-1-CPT-1	Approximate RI Phase I PCPT location and designation
TP-01-01	RI Phase IIA test pit location and designation
(Shaded circle)	Geophysical anomaly
(Stippled area)	Area of planted pine trees
(Wavy line)	Older tree line
(Dashed line)	Approximate site boundary
PCPT	Piezo cone penetrometer
RI	Remedial Investigation
NAS	Naval Air Station

0 150 300
 SCALE: 1 INCH = 300 FEET

FIGURE 3-3
SITE 1, LOCATION OF
TEST PIT, PCPT EXPLORATION
AND GEOPHYSICAL ANAMOLY



REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST
DISPOSAL AREA

NAS WHITING FIELD
MILTON, FLORIDA

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IIA Technical Memorandum No. 2, Geological Assessment (ABB-ES, 1995a). Split-spoon samples were generally collected at 5-foot intervals during drilling of the monitoring wells. Monitoring well installations were conducted in conjunction with the hydrogeologic and groundwater investigations (summarized in Phase IIA Technical Memoranda Nos. 4 [ABB-ES, 1995b] and 5 [ABB-ES, 1995c], respectively).

3.4.3 Test Pitting A test pit was excavated on October 8, 1992, at Site 1 following the completion of the geophysical survey. UXB International, Inc., from Chantilly, Virginia, was subcontracted by ABB-ES (presently HLA) to conduct the test pit excavation.

The test pit was excavated at a location where a geophysical anomaly potentially defined buried materials. The purpose of the test pit was to characterize waste materials, if present, by the description, collection, and chemical analysis of a subsurface soil sample.

Prior to excavating the test pit, the proposed areal dimensions and orientation of the test pit were surveyed by UXB with a hand-held magnetometer, a terrain conductivity meter (FEREX™ 4.021), and a metal detector. Site-specific field activities also included clearing of vegetation.

After the test pit location and orientation had been determined, the four corners of the test pit were staked. The staked locations were referenced to the grid coordinates defined for the geophysical survey. A backhoe was used to excavate a rectangular pit. The physical description of each soil layer and waste type was recorded in the field logbook during test pit excavation. A subsurface soil sample was collected directly from the backhoe bucket during the excavation. Following sample collection, the test pit was backfilled with excavated soil.

One subsurface soil sample (01-SS-00-01) was collected on October 8, 1992, from a depth of 5 to 6 feet bls in the test pit (TP-01-01) excavated within the landfilled area. The location of the test pit is presented on Figure 3-3. Sampling results are discussed in Section 5.4 of this report.

3.5 GROUNDWATER ASSESSMENT. Groundwater assessment activities included collecting a groundwater sample with a BAT sampler during Phase I and collecting groundwater samples from monitoring wells installed in Phase IIA and IIB.

During the Phase I investigation, a groundwater sample (WHF-01-WP-01-01) was collected using the BAT sampling technique. The BAT groundwater sampling program was conducted in April 1991 in conjunction with the PCPT subsurface exploration to verify the potential contamination of groundwater downgradient of the site. Based on subsurface exploration data (lithology and pore pressure) collected from the PCPT soundings, the depth of the *in situ* BAT groundwater sample was determined. The groundwater sample was analyzed for VOCs and TAL metals. The location of the PCPT-BAT sample is presented on Figure 3-3, and the analytical results are presented in Subsection 5.5.1 of this report.

During the Phase IIA investigation, three groundwater monitoring wells (WHF-1-2, WHF-1-1S, and WHF-1-3) were installed in 1993. During Phase IIA of the RI, groundwater samples (WHF1-1, WHF1-1B, WHF1-2, and WHF1-3) were collected from the four existing Site 1 monitoring wells between October 15 and 19, 1993. During

Phase IIB, an additional monitoring well (WHF-1-4) was installed, and groundwater samples were collected from each of the monitoring wells. The monitoring well locations are presented on Figure 3-4, and the groundwater analytical data are discussed in Section 5.5.

During Phase IIA, the groundwater samples were collected from monitoring wells using a Teflon™ bailer after purging the monitoring wells with either a submersible or bladder pump. The groundwater samples were analyzed for CLP (NEESA Level C) TCL VOCs, SVOCs, pesticides and PCBs, and TAL inorganics.

During Phase IIB of the RI, groundwater samples were collected from the five monitoring wells at Site 1 between July 19 and 23, 1996. The groundwater samples were collected using low-flow sampling techniques and were analyzed for CLP (NEESA Level D) TCL VOCs, SVOCs, pesticides and PCBs, and TAL inorganic analytes. Samples for TAL inorganic analysis were unfiltered (total analysis) if turbidity was below 10 nephelometric turbidity units (NTUs). If turbidity was greater than 10 NTUs, an additional groundwater sample was collected and filtered (dissolved-phase inorganics) using a 45-micron filter. The purpose of the additional groundwater sample was to assess uncertainty associated with a turbid unfiltered groundwater sample.

Analyses were also conducted to assess secondary water quality parameters and provide data for assessing remedial alternatives in the FS. The analyses included alkalinity, chloride, sulfates, color, hardness, ammonia nitrates, total Kjeldahl nitrogen, nitrate and nitrite, pH, phosphorous, total dissolved solids, and sulfides.

3.6 HYDROGEOLOGIC ASSESSMENT. The hydrogeologic assessment of Site 1 included Site 1 and three adjacent sites, including Site 2 (Northwest Open Disposal Area), Site 17 (Crash Crew Training Area), and Site 18 (Crash Crew Training Areas). Data from all four sites were combined to provide a larger data set and better understanding of the hydrogeologic conditions.

The hydrogeologic field investigation activities included collecting water-level data from 13 monitoring wells and conducting slug test analyses on 4 monitoring wells. Monitoring well construction details for these sites are presented in Table 3-1. Results of the hydrogeologic assessment are presented in Section 5.7 of this report.

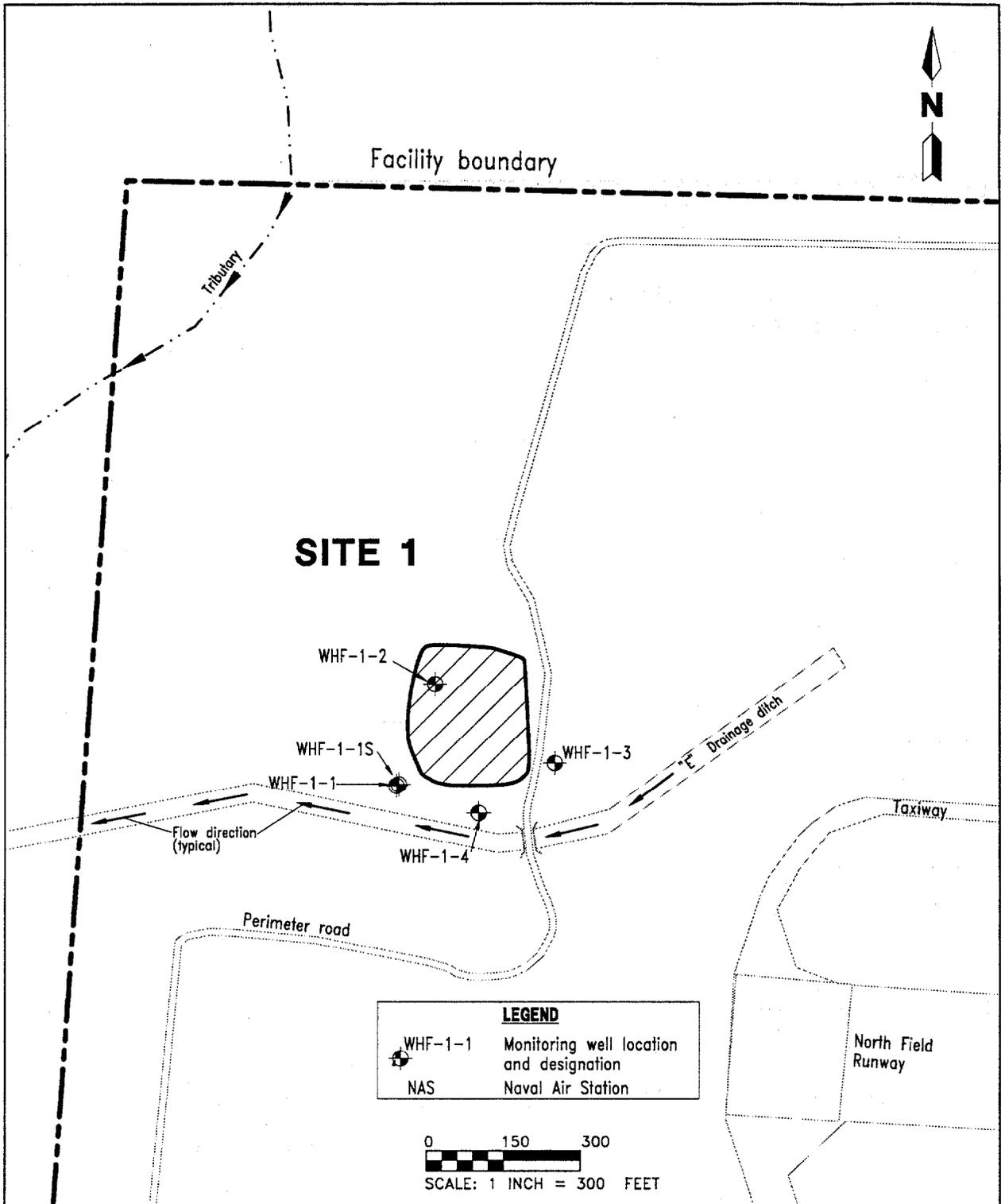


FIGURE 3-4
MONITORING WELL LOCATION MAP



REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST
DISPOSAL AREA

NAS WHITING FIELD
MILTON, FLORIDA

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**Table 3-1
Summary of Monitoring Well Construction Details**

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Monitoring Well Designation	RI Phase of Well Completion	Well Size (inches)	Land Surface Elevation (feet msl)	TOC Elevation (feet msl)	Total Well Depth (feet BTOC)	Approximate Screen Interval (feet BTOC)	Surface Casing Length (feet bls)
Northwest Disposal and Crash Crew Training Areas							
<u>Site 1, Northwest Disposal Area</u>							
WHF-1-1	VS	4	140.49	142.62	123.00	113 to 123	NA
WHF-1-1S	IIA	2	140.54	143.08	75.40	60 to 75	NA
WHF-1-2	IIA	2	142.59	145.61	78.80	63 to 78	NA
WHF-1-3	IIA	2	152.95	155.50	87.48	72 to 87	NA
WHF-1-4	IIB	2	--	151.86	80.39	70 to 80	NA
<u>Site 2, Northwest Open Disposal Area</u>							
WHF-2-1	IIA	2	148.48	150.80	87.42	72 to 87	NA
WHF-2-2	IIB	2	--	159.16	94.00	84 to 94	NA
WHF-2-3	IIB	2	--	160.63	93.35	83 to 93	NA
<u>Site 17, Crash Crew Training Area</u>							
WHF-17-1	VS	4	192.61	194.71	159.00	149 to 159	NA
WHF-17-1S	IIA	2	192.48	194.96	115.50	100 to 115	0 to 35
WHF-17-2	IIA	2	194.33	197.35	121.90	106 to 121	0 to 43
WHF-17-3	IIA	2	198.89	201.21	126.50	111 to 126	NA
<u>Site 18, Crash Crew Training Area</u>							
WHF-18-1	VS	4	161.56	163.57	120.20	110 to 120	NA
WHF-18-2	IIA	2	162.15	164.75	107.86	92 to 107	NA
WHF-18-3	IIA	2	172.73	175.64	112.90	97 to 112	NA
<p>Notes: RI = Remedial Investigation. msl = mean sea level. TOC = top of casing. BTOC = below top of casing. bls = below land surface. VS = Verification Study. NA = not applicable. IIA = Remedial Investigation Phase IIA. IIB = Remedial Investigation Phase IIB. -- = not available.</p>							

4.0 SITE-SPECIFIC DATA QUALITY ASSESSMENT

This chapter describes how the data generated during Phase IIB of the RI at Site 1 were managed and evaluated. Section 4.1 describes the analytical program and data management for the RI at Site 1. Section 4.2 summarizes the precision, accuracy, representativeness, completeness, and comparability (PARCCs) report on the data. Section 4.3 presents a summary of the Data Quality Assessment.

The soil and groundwater samples collected during Phase IIA of the RI were qualified according to USEPA functional guidelines for evaluation of organic (USEPA, 1994a) and inorganic (USEPA, 1994b) analytical data analyzed using USEPA CLP protocol. The data quality objective (DQO) assessment for the Phase IIA soil samples is presented in detail in RI Phase IIA Technical Memorandum No. 3 (ABB-ES, 1994). The DQO assessment for the Phase IIA groundwater samples is presented in detail in RI Phase IIA Technical Memorandum No. 5 (ABB-ES, 1995c).

4.1 ANALYTICAL PROGRAM. Samples collected during the Phase IIB of the RI at Site 1 were analyzed using field screening and off-site laboratory analytical methods. Field QC data are presented in Appendix B. Sampling locations are presented in Chapter 3.0 of this report and sample results are presented in Chapter 5.0 and Appendix C (soil data) and Appendix D (groundwater data).

Environmental samples (surface soil, subsurface soil, and groundwater) were collected and analyzed by an off-site laboratory using SW-846 methodology (USEPA, 1986a) for analysis of VOCs, SVOCs, pesticides, PCBs, metals, and cyanide. Some groundwater samples were also analyzed for wet chemistry analyses. The laboratory analytical program is described in more detail in Section 2.2 of the NAS Whiting Field GIR (ABB-ES, 1998).

Analytical results obtained for all environmental samples during the RI sampling events were submitted as NEESA Level D (USEPA Level IV) analytical packages for VOCs, SVOCs, pesticides, PCBs, metals, cyanide, and wet chemistry.

4.2 DATA REVIEW. Data validation is the technical review of individual analytical results relative to the following criteria:

- DQOs and the QAPP in the NAS Whiting Field Workplan (E. C. Jordan Co. Inc., 1990, and ABB-ES, 1995d).
- NEESA guidance document 20.2-047B, Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Program (NEESA, 1988).
- USEPA, Contract Laboratory Program National Functional Guidelines for Organic Data Review, June 1991 (USEPA, 1991b).
- USEPA, Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, July 1988 (USEPA, 1988).

The data validation process is described in Section 2.3 of the NAS Whiting Field GIR (ABB-ES, 1998).

The data were reviewed, validated, and evaluated using the PARCC specified in the DQOs. PARCC criteria are described in Section 2.3 of the NAS Whiting Field GIR (ABB-ES, 1998). The Site 1 Phase IIB soil and groundwater analytical data were validated by Laboratory Data Consultants, Inc., of Carlsbad, California, in 1996. The Site 1 Phase IIB data include sample delivery group (SDG) WFO06, WFO22, and WFO23. The subsections below summarize the PARCC criteria evaluation of the analytical data.

4.2.1 Precision Precision is a measure of the agreement or repeatability of a set of replicate results (relative percent difference [RPD]) obtained from duplicate laboratory analyses of samples collected from the same location and depth interval. Precision for analytical data collected during the RI sampling events was evaluated using results of field duplicate samples, laboratory duplicate samples, matrix spike and matrix spike duplicate (MS/MSD) samples, and/or consecutive laboratory control samples. The evaluation of precision for the RI sampling event is presented on Table 4-1 and summarized below.

The RPD criteria were not met for three environmental samples (one soil and two groundwater) and associated duplicates for one organic (acetone) and several inorganic analytes. None of the organic analytical results were qualified during the data validation process based on RPD criteria for environmental and associated duplicate sample pairs.

The RPD criteria for eight inorganic analytes (aluminum, barium, beryllium, calcium, magnesium, mercury, potassium, and sodium) in one soil sample (02S00401) from SDG WFO06 may not have been met because of sample heterogeneity. The inorganic analytical results were qualified during the data validation process based on the RPD evaluation criteria.

The RPD criteria for one VOC (acetone) and three inorganic analytes (aluminum, iron, and manganese) were not met for groundwater sample (01G00102) and associated duplicate in SDG WFO22.

The RPD criteria for two inorganic analytes (selenium and cyanide) were not met for groundwater sample (0ZG00301) and associated duplicate in SDG 023.

4.2.2 Accuracy Accuracy is a measure of the agreement between the true value and the value measured using an analytical method (percent recovery). Accuracy also is evaluated during data validation by assessing initial and continuing calibration data for the analytical instrument. Accuracy for analytical data collected during the RI sampling events was assessed by evaluating percentage recoveries for MS/MSD samples, surrogate recoveries, laboratory control samples, and initial and continuing calibration standard results. The evaluation of recoveries for MS/MSD samples is presented in Table 4-2 and summarized below.

The percent recovery for some of the soil and groundwater samples was above or below the target range; therefore, some analytical results may be biased high or low. Some of the analytical results for SVOCs and inorganic analytes were qualified based on the evaluation of percent recovery.

A summary of the surrogate spike samples and the surrogate compounds that were outside control limits for the Phase IIB samples collected at Site 1 is presented in Table 4-3. The required control limits were also identified for each surrogate compound. All the samples associated with these surrogates were qualified in accordance with the USEPA functional guidelines as presented in

**Table 4-1
Precision Summary for Soil and Groundwater Field Duplicate Samples**

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SDG Number	Sample ID	Compound	Sample Concentration	Duplicate Concentration	RPD	Control Limits
Soil						
WF006						
Organics (µg/kg)	02S00401	Acetone	ND	5	NC	50
		Dieldrin	8.3	8.0	4	50
		alpha-Chlordane	5.6	5.1	9	50
		gamma-Chlordane	3.5	2.9	19	50
TAL Metals (mg/kg)	02S00401	Aluminum	9,580	7580	23	20
		Arsenic	3.9	4.0	3	30
		Barium	27.7	15.9	54	30
		Beryllium	0.31	0.13	81	30
		Calcium	14,900	9900	40	20
		Chromium	13.6	14.0	3	30
		Cobalt	0.53	ND	NC	30
		Copper	4.3	3.8	12	30
		Iron	4,010	3,880	3	20
		Lead	10.9	11.6	6	20
		Magnesium	926	403	79	30
		Manganese	188	164	14	20
		Mercury	0.03	0.05	50	30
		Nickel	3.9	3.8	1	30
		Potassium	377	142	91	30
		Sodium	104	70.2	38	30
		Vanadium	12.9	11.7	10	30
		Zinc	13.1	12.5	5	30
		Cyanide	0.15	ND	NC	30
Groundwater						
WF022						
Organics (µg/l)	01G00102	Acetone	4	2	67	40
TAL Metals (µg/l)	01G00102	Aluminum	19.1	10.3	50	25
		Barium	15.6	15.6	0	25
		Beryllium	0.53	ND	NC	25
		Calcium	5,850	6,250	7	25
		Copper	ND	1.4	NC	25
		Iron	12.2	8.8	32	25
		Lead	1.3	1.5	14	25
		Magnesium	337	331	2	25

See notes at end of table.

Table 4-1 (Continued)
Precision Summary for Soil and Groundwater Field Duplicate Samples

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 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

SDG Number	Sample ID	Compound	Sample Concentration	Duplicate Concentration	RPD	Control Limits
TAL Metals ($\mu\text{g}/\ell$) (Continued)						
		Manganese	6.7	9.0	29	25
		Potassium	938	842	11	25
		Sodium	2,100	2,070	1	25
		Vanadium	ND	1.6	NC	25
		Zinc	10.2	11.4	11	25
		Cyanide	1.9	ND	NC	25
Groundwater						
WF-23						
Organics ($\mu\text{g}/\ell$)	02G00301	Acetone	ND	10	NC	40
		Carbon disulfide	1	ND	NC	40
TAL Metals ($\mu\text{g}/\ell$)	02G00301	Aluminum	79.3	84.6	6	25
		Barium	128	129	0.8	25
		Beryllium	0.39	ND	NC	25
		Calcium	113,000	113,000	0	25
		Iron	36.2	38.7	7	25
		Lead	1.4	1.3	7	25
		Magnesium	9,560	9,560	0.3	25
		Manganese	13.5	13.7	1	25
		Nickel	7.8	9.6	21	25
		Potassium	4,610	4,580	0.7	25
		Selenium	1.2	0.66	58	25
		Sodium	2,200	2,240	2	25
		Vanadium	3.0	2.8	7	25
		Zinc	1.8	2.0	11	25
		Cyanide	4.5	2.0	77	25

Notes: SDG = sample delivery group.
 ID = identification.
 RPD = relative percent difference.
 ND = nondetect.
 NC = not calculable.
 $\mu\text{g}/\text{kg}$ = micrograms per kilogram.

TAL = target analyte list.
 mg/kg = milligrams per kilogram.
 $\mu\text{g}/\ell$ = micrograms per liter.
 D_1 = sample concentration.
 D_2 = duplicate concentration.

$$RPD = 100 \times \frac{|D_1 - D_2|}{0.5(D_1 + D_2)} \quad (1)$$

**Table 4-2
Accuracy Summary for MS/MSD Samples**

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SDG Number	MS/MSD Sample	Analyte	% Recovery MS/MSD	Control Limits
WF006	Soil 02S00401			
	<u>Semivolatiles</u>			
		Phenol	-/92	26 to 90
		4-Chloro-3-methylphenol	-/104	26 to 103
		2,4-Dinitrotoluene	-/100	28 to 89
		Pyrene	29/30	35 to 142
	<u>TAL Metals¹</u>			
		Antimony	73.8	75 to 125
		Manganese	73.8	75 to 125
WF022	Groundwater BKG00101			
	<u>Semivolatiles</u>			
		4-Chloro-3-methylphenol	108/115	23 to 97
		4-Nitrophenol	88/93	10 to 80
		2,4-Dinitrotoluene	100/108	24 to 96
		Pentachlorophenol	106/118	9 to 103
WF023	Groundwater 02G00301			
	<u>Semivolatiles</u>			
		4-Nitrophenol	88/82	10 to 80
		2,4-Dinitrotoluene	97/-	24 to 96
		Pentachlorophenol	139/122	9 to 103

¹ MSD analyses are generally not performed for inorganic analysis and, therefore, only the percent Recovery for the MS is reported.

MS/MSD = matrix spike and matrix spike duplicate.

SDG = sample delivery group.

% = percent.

TAL = target analyte list.

Table 4-3
Accuracy Summary for Surrogate Recoveries Outside QC Criteria

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SDG Number	Sample ID	Spiked Analyte	Surrogate Recovery (%R) ¹	QC Limits (percent)
WF023	01G00201	Decachlorobiphenyl	32/28	60-150
WF023	01G00301	Decachlorobiphenyl	49/47	60-150

¹ Reported as value for first column/second column.

QC = quality control.
 SDG = sample delivery group.
 ID = identification.
 %R = percent recovery.

Subsection 3.3.4 of the GIR (ABB-ES, 1998). All data, based on surrogate recoveries, are acceptable for use in conducting the site characterization, risk assessment, and FS.

Initial calibrations are performed to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for compounds on the volatile TCL. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear calibration curve. Continuing calibrations are performed to ensure that the instrument is capable of producing acceptable qualitative and quantitative data.

Continuing calibration establishes the 12-hour Relative Response Factor on which the quantitations are based and checks satisfactory performance of the instrument on a day-to-day basis. Initial and continuing calibrations for organic analysis are measured by the percent Relative Standard Deviation (%RSD) for initial calibrations and the percent Difference (%D) for continuing calibrations. For inorganic analysis, the initial calibration verification and continuing calibration verification are measured.

Table 4-4 summarizes the initial and continuing calibration details for the surface soil and groundwater samples collected at Site 1.

The evaluations of the %RSD for the initial calibrations and the %D for the continuing calibrations indicate that the response factors for the system performance check compounds (SPCCs) generally met the required criteria for VOCs, SVOCs, pesticides, and PCBs. Samples associated with those SDGs in which certain VOCs, SVOCs, pesticides, and PCBs exhibiting an RRF that does not meet the minimum requirements were qualified as J/UJ.

4.2.3 Representativeness Representativeness is the degree to which the data obtained from an environmental sample accurately reflect the presence or absence of contamination at a site. Field quality control samples (including source water blanks, equipment rinse blanks, and trip blanks) and laboratory quality control samples (including method [organic analyses] and preparation blanks [inorganic analysis]) were used to assess representativeness. Representativeness

**Table 4-4
Summary of Initial and Continuing Calibration
for Site 1 Samples**

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SDG	Compound	Initial Calibration	Continuing Calibration	Qualifier
WF006	2,4-Dinitrophenol	--	33.1	UJ
	2,4-Dinitrophenol	--	27.0	UJ
	Diethylphthalate	--	30.1	UJ
	Diethylphthalate	--	27.1	UJ
	Alpha-BHC	21.7	--	UJ
	Alpha-BHC	20.3	--	UJ
WF022	4-Chloroaniline	--	31.6	J
	2,4-Dinitrophenol	--	27.6	J
	4,6-Dinitro-2-methylphenol	--	33.8	J
WF023	Acetone	30.2	33.2	J
	4-Nitroaniline	--	37.8	J
	Chrysene	--	27.8	J
	4,4'-DDT	23.6	--	J

Notes: Calibration values expressed as percent recovery.

SDG = sample delivery group.

-- = not detected.

UJ = The analyte was not detected above the reported sample IDL; however, the reported concentration is approximate and may not reliably be presumed to be less than the IDL value.

BHC = benzene hexachloride.

J = The analyte was positively identified and is reported as an approximate concentration.

DDT = dichlorodiphenyltrichloroethane.

also is assessed by review of the adherence to extraction and analysis holding times. The evaluation of representativeness in field quality control samples for the RI sampling event is presented in Table 4-5 and summarized below.

Trip Blanks. Acetone was detected in sample 01T00101 at a concentration of 9 micrograms per liter ($\mu\text{g}/\ell$). Environmental samples associated with the trip blanks with results greater than the instrument detection limit (IDL) but less than 10 times the amount detected in the trip blank were appropriately annotated with a J or UJ qualifier (Laboratory Data Consultants, 1996).

Rinsate Blanks. VOCs, if present, were not detected at concentrations exceeding their detection limits in the rinsate blanks. One SVOC, bis(2-ethylhexyl)phthalate, was detected in one of the rinsate blank samples at a concentration of 2 $\mu\text{g}/\ell$. SVOCs, if present, were not detected in associated soil samples at concentrations exceeding their detection limits.

Metals detected at concentrations exceeding the IDL and less than the contract-required detection limit (CRDLs) are aluminum, calcium, cyanide, and zinc.

Field Blank. 2-Butanone and di-n-octylphthalate were detected in the field blank at concentrations of 2 J $\mu\text{g}/\ell$ and 15 $\mu\text{g}/\ell$, respectively. Environmental samples associated with the field blank with results greater than the IDL but less than 10 times the amount detected in the field blank were appropriately annotated with a UJ qualifier.

Laboratory Method and Preparation Blanks. Concentrations of methylene chloride, acetone, di-n-butylphthalate, and bis(2-ethylhexyl)phthalate were detected in the laboratory method blanks associated with SDGs WF006, WF022, or WF023.

Environmental samples associated with method blanks that contained methylene chloride and acetone with results greater than IDL but less than 10 times the amount detected in the laboratory preparation blanks were annotated with UJ qualifier (Laboratory Data Consultants, 1996).

Aluminum, calcium, cobalt, copper, iron, magnesium, mercury, selenium, and sodium were detected in laboratory method blanks. Sample results greater than IDL but less than 5 times the amount detected in the laboratory preparation blanks were appropriately annotated with a J or UJ qualifier (Laboratory Data Consultants, 1996).

Sampling and analysis holding times for each analytical fraction were met in all samples.

Qualification of the environmental samples was required because of the detection of target analytes in laboratory and field blanks. Qualification of the RI data, based on blank contamination, was performed according to USEPA data validation guidelines (USEPA, 1988 and USEPA, 1991b).

4.2.4 Comparability Comparability is the confidence with which one data set can be compared with another and the degree to which the environmental data from each sampling event are considered equivalent. Comparability of the analytical data

**Table 4-5
Representativeness Summary for Site 1 Field Quality Control Samples**

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Sample Identifier:	01F00101	01R00101	01T00101	01R01101	01T01201
Collect Date:	06-DEC-95	06-DEC-95	05-DEC-95	23-JUL-96	22-JUL-96
Laboratory Sample No.:	G8876013	G8876012	G8864001	RB887005	RB887001
<u>Volatile Organic Compounds ($\mu\text{g}/\ell$)</u>					
Acetone	--	--	9 J	--	--
2-Butanone	2 J	--	--	--	--
<u>Semivolatile Organic Compounds ($\mu\text{g}/\ell$)</u>					
Di- <i>n</i> -octylphthalate	15	--	NA	--	NA
bis(2-Ethylhexyl)phthalate	--	2	NA	--	NA
<u>Pesticides and PCBs ($\mu\text{g}/\ell$)</u>					
None detected					
<u>Metals and Cyanide ($\mu\text{g}/\ell$)</u>					
Aluminum	--	--	NA	13.3 J	NA
Calcium	--	178 J	NA	--	NA
Zinc	--	2.9 J	NA	--	NA
Cyanide	--	--	NA	2.6 J	NA
Notes: $\mu\text{g}/\ell$ = micrograms per kilogram. -- = analyte not detected. J = estimated value. NA = not analyzed. PCB = polychlorinated biphenyl.					

was assured by using standard operating procedures for sample collection, by using standard chemical analytical methods, and by reporting the analytical results in standard units (SU). The sampling, shipment, and analytical protocols were consistent with USEPA standard operation procedures and methodologies described in workplans for NAS Whiting Field throughout the period of the RI.

4.2.5 Completeness Completeness is the percentage of useable data reported and validated compared with the total number of measurements made. Useable data are those measurements that were not rejected (qualified with an "R") during the validation process. None of the analytical data were rejected. The goal for analytical completeness for the RI sampling event was 85 percent useable data. The completeness goal of 85 percent was met for all matrices and all parameters.

4.3 SUMMARY. Based on the results of the QC sample analyses, the established precision and accuracy goals of the project were achieved (Table 4-6). Some field- and/or laboratory-derived contamination was present in some of the QC samples, which required the results from some of the environmental samples to be amended. QC sample results and data validation criteria indicate a 100 percent completeness was achieved, thus, satisfying the 85 percent completeness goal. Standard methods of analyses and units of measure were used throughout the project, thus meeting the QC criteria and the DQOs presented in the workplan.

Overall, the data generated during the sampling event meet established DQOs and are acceptable for use in site characterization, risk assessment, and evaluation of corrective measures.

**Table 4-6
Summary of DQO Assessment - PARCC Parameters**

Remedial Investigation Report Site 1, Northwest Disposal Area Naval Air Station Whiting Field Milton, Florida					
	Precision ¹	Accuracy ²	Representativeness	Completeness (%)	Comparability
Surface and Subsurface Soil Samples					
TCL VOC	Acceptable	Acceptable	Acceptable	100	Acceptable
TCL SVOCs	Acceptable	Acceptable	Acceptable	100	Acceptable
Pesticides and PCBs	Acceptable	Acceptable	Acceptable	100	Acceptable
TAL Metals and Total Cyanides	Acceptable	Acceptable	Acceptable	100	Acceptable

¹ Cumulative of sampling and analytical components.

² Analytical component.

Notes: All the units are expressed as the ratio of number of analytes meeting the quality control criteria to the total number of analytes.

DQO = data quality objective.

PARCC = precision, accuracy, reproducibility, completeness, and comparability.

% = percent.

TCL VOCs = target compound list volatile organic compounds.

TCL SVOCs = target compound list semivolatile organic compounds.

PCB = polychlorinated biphenyl.

TAL = target analyte list.

5.0 INVESTIGATIVE RESULTS

The following sections present the analytical results of the soil gas, surface soil, and groundwater sampling events.

5.1 SOIL GAS. Nineteen of the 20 proposed soil gas locations were sampled at Site 1 (Figure 3-1). One location was determined to be within a concrete ditch (E ditch) and was not sampled. Table 5-1 presents the analytical results obtained from the soil gas survey including total VOCs and methane (filtered reading). Measurable concentrations of total VOCs or methane were not present in any of the soil gas samples collected at the site. This suggests that landfilled materials, if present, are not generating measurable concentrations of organic vapors. Additionally, because measurable concentrations of total VOCs and methane were not detected, contour maps were not prepared.

5.2 GEOPHYSICAL SURVEY. The geophysical survey identified one isolated anomaly. The anomaly (less than 50 gammas) is observed in the total magnetic field data (Figure A-2) in the north central area of the survey area. There is no corresponding anomaly observed in the EM-31 quadrature (Figure A-3) or in-phase (Figure A-4) conductivity data.

The geophysical survey results neither support nor provide evidence of a disposal area at Site 1.

No landfill materials were encountered within the explored depth of a test pit excavated at the geophysical anomaly. The test pit excavation determined the anomaly to be a concrete reinforcement rod present on the surface.

5.3 SURFACE SOIL ASSESSMENT. Table 5-2 summarizes the analytical results for organic and inorganic analytes detected in eight surface soil samples (and a duplicate) at Site 1. Table 5-3 summarizes the frequency of detection, range of detection limits, range of detection concentrations, mean of detected concentrations, and background screening values for Site 1 surface soil samples. The sample locations are shown on Figure 3-2.

TCL VOCs. Xylenes (total) were the only VOCs detected in the eight surface soil samples (and a duplicate) collected at Site 1. The compound was detected in samples from two locations (01-SL-01 and 01-SL-03) at concentrations less than the Florida Department of Environmental Protection (FDEP) residential cleanup goal for soils.

TCL SVOCs. SVOCs were not detected in the surface soil samples and a duplicate.

Pesticides and PCBs. A single pesticide compound, dieldrin, was detected in one surface soil sample (01-SL-01). The detected dieldrin concentration was less than the FDEP residential cleanup goal for soils. No PCBs were detected in the surface soil samples.

TAL Metals and (Total) Cyanide. Nineteen TAL metals and cyanide were detected in the surface soil samples. Eleven analytes (aluminum, arsenic, cadmium, chromium, iron, lead, magnesium, mercury, potassium, vanadium, and cyanide) exceeded the background screening values in some samples. Arsenic exceeded the

Table 5-1
Summary of Active Soil Gas Survey, July 17 and 18, 1995

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Sample ID	Depth (feet)	Total VOC (ppm)	Methane (ppm)	Methane/VOC (percent)	Rinsate Blank (ppm)
2	1.5	0	0	NA	0
	3.0	0	0	NA	
3	1.5	0	0	NA	0
	3.0	0	0	NA	
4	1.5	0	0	NA	0
	3.0	0	0	NA	
5	1.5	0	0	NA	0
	3.0	0	0	NA	
6	1.5	0	0	NA	1
	3.0	0	0	NA	
7	1.5	0	0	NA	0
	3.0	0	0	NA	
8	1.5	0	0	NA	0
	3.0	0	0	NA	
9	1.5	0	0	NA	0
	3.0	0	0	NA	
10	1.5	0	0	NA	0
	3.0	0	0	NA	
11	1.5	0	0	NA	0
	3.0	0	0	NA	
12	1.5	0	0	NA	0
	3.0	0	0	NA	
13	1.5	0	0	NA	0
	3.0	0	0	NA	
14	1.5	0	0	NA	0
	3.0	0	0	NA	
15	1.5	0	0	NA	0
	3.0	0	0	NA	
16	1.5	0	0	NA	0
	3.0	0	0	NA	

See notes at end of table.

Table 5-1 (Continued)
Summary of Active Soil Gas Survey, July 17 and 18, 1995

Remedial Investigation Report
 Site 1, Northwest Disposal Area
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Sample ID	Depth (feet)	Total VOC (ppm)	Methane (ppm)	Methane/VOC (percent)	Rinsate Blank (ppm)
17	1.5	0	0	NA	0
	3.0	0	0	NA	
18	1.5	0	0	NA	0
	3.0	0	0	NA	
19	1.5	0	0	NA	0
	3.0	0	0	NA	
20	1.5	0	0	NA	2
	3.0	0	0	NA	

Notes: ID = identification.
 VOC = volatile organic compounds.
 ppm = parts per million.
 NA = not applicable.

**Table 5-2
Summary of Analytical Results for Surface Soil Samples**

Remedial Investigation Report
Site 1, Northwest Disposal Area
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Sample Identifier:	01-SL-01	01-SL-02	01-SL-03	01-SL-03A	01S00101	01S00201	01S00301	01S00401	01S00501
Collect Date:	11-AUG-92	11-AUG-92	11-AUG-92	11-AUG-92	05-DEC-95	05-DEC-95	05-DEC-95	05-DEC-95	05-DEC-95
Laboratory Sample No.:	22454011	22454012	22457001	22457002	G8864002	G8864003	G8864004	G8864005	G8864006
<u>Volatile Organic Compounds (µg/kg)</u>									
Xylenes (total)	1 J	--	2 J	2 J	--	--	--	--	--
<u>Semivolatile Organic Compounds (µg/kg)</u>									
None detected									
<u>Pesticides and PCBs (µg/kg)</u>									
Dieldrin	1.5 J	--	--	--	--	--	--	--	--
<u>Inorganic Analytes (mg/kg)</u>									
Aluminum	5,700	10,500	14,800	13,500	4,530	14,600	15,200	5,330	14,500
Arsenic	1.3 J	1.8 J	3.2 J	3.2 J	3.4	3.2	4.1	1.9 J	4.2
Barium	9.6 J	14.7 J	15.7 J	14.3 J	5.4 J	18 J	16.9 J	8.6 J	12.8 J
Beryllium	0.1 J	0.15 J	0.14 J	0.15 J	0.05 J	0.15 J	0.17 J	0.06 J	0.14 J
Cadmium	--	0.71 J	--	--	--	--	--	--	--
Calcium	321 J	264 J	--	--	--	--	--	--	--
Chromium	5.5	17.8	48 J	11.9 J	5.5	12.5	15.1	3.8	10.8
Cobalt	1.3 J	1.2 J	0.87 J	0.92 J	--	0.72 J	--	--	0.93 J
Copper	5.6 J	7.1	--	--	--	5.4 J	4.8 J	--	4.4 J
Iron	3,960	10,400	13,700	9,940	3,390	9,600	10,200	2,980	9,910
Lead	8.9 J	3.5 J	--	--	4	5.7	5.7	3.8	44
Magnesium	84.8 J	193 J	219 J	153 J	61.1 J	293 J	266 J	113 J	141 J
Manganese	85	5.6	20.2	20.5	23.7	19.3 J	18.7 J	66.8 J	68.1 J
Mercury	--	--	0.34	--	--	0.01 J	0.01 J	0.02 J	0.02 J
Nickel	--	--	3.6 J	3.4 J	--	--	--	--	--
Potassium	--	--	157 J	--	--	241 J	249 J	--	141 J
Sodium	185 J	219 J	--	--	--	--	--	--	--
See notes at end of table.									

**Table 5-3
Summary of Surface Soil Analytical Results**

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Analyte	Frequency of Detection ¹	Range of Detection Limits	Range of Detected Concentrations ²	Mean of Detected Concentrations ³	Background Screening Values ⁴	USEPA Region III RBCs ⁵ Residential/ Industrial	Soil Cleanup Goals for Florida ⁶ Residential/ Industrial
TCL Volatile Organic Compounds (µg/kg)							
Xylenes (total)	2/8	6 to 11	1 to 2	1.5		13,000/92,000	13,000/92,000
TCL Semivolatile Organic Compounds (µg/kg)							
None detected							
Pesticides and PCBs (µg/kg)							
Dieldrin	1/8	3.6 to 19	1.5 to 1.5	1.5		⁷ 4/360	70/300
Inorganic Analytes (mg/kg)							
Aluminum	8/8	40	4,530 to 15,200	10,600	15,848	⁸ 7,800/100,000	75,000/--
Antimony	0/8	12	--	--	8.0	⁸ 3.1/82	26/220
Arsenic	8/8	2	1.3 to 4.2	2.9	¹¹ 4.62	⁷ 0.43/3.8	⁹ 0.8/ ¹¹ 4.62
Barium	8/8	40	5.4 to 18	12.6	23.2	⁸ 550/14,000	5,200/84,000
Beryllium	8/8	1	0.05 to 0.17	0.12	0.3	⁷ 0.15/1.3	0.2/1.0
Cadmium	1/8	1	0.71 to 0.71	0.71	0.58	⁸ 3.9/100	37/600
Calcium	2/8	1,000	264 to 321	293	396	--/--	--/--
Chromium	8/8	2	3.8 to 30	12.6	11.0	^{8,12} 39/1,000	¹² 290/430
Cobalt	5/8	10	0.72 to 1.3	0.99	3.0	⁸ 470/12,000	4,700/110,000
Copper	5/8	5	4.4 to 7.1	5.5	9.4	⁸ 310/8,200	¹⁰ 2,900/72,000
Iron	8/8	20	2,980 to 11,800	7,780	8,832	⁸ 2,300/61,000	--/--
Lead	7/8	0.6	3.5 to 44	10.8	11.4	¹² 400	500/1,000
Magnesium	8/8	1,000	61.1 to 293	167	268	--/--	--/--
Manganese	8/8	3	5.6 to 85	38.4	392	⁸ 180/4,700	370/5,500
Mercury	5/8	0.1	0.01 to 0.195	0.05	0.12	⁸ 2.3/61	23/480
Nickel	1/8	8	3.5 to 3.5	3.5	7.2	⁸ 160/4,100	1,500/26,000
See notes at end of table.							

Table 5-3 (Continued)
Summary of Surface Soil Analytical Results

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Analyte	Frequency of Detection ¹	Detection Limits	Range of Detected Concentrations ²	Mean of Detected Concentrations ³	Background Screening Values ⁴	USEPA Region III RBCs ⁵ Residential/ Industrial	Cleanup Goals for Florida ⁶ Residential/ Industrial
Inorganic Analytes (mg/kg) (Continued)							
Potassium	4/8	1,000	141 to 329	240	177	--/--	--/--
Selenium	0/8	1	--	--	0.4	39/ ⁸ 1,000	390/9,900
Silver	0/8	2	--	--	0.70	39/ ⁸ 1,000	380/9,000
Sodium	2/8	1,000	185 to 219	202	406	--/--	--/--
Thallium	0/8	2	--	--	0.32	--/--	--/--
Vanadium	8/8	10	8.1 to 33.6	21.7	21.8	55/ ⁸ 1,400	23,000/560,000
Zinc	7/8	4	3.9 to 11.5	7.1	15.4	2,300/ ⁸ 61,000	640/550,000
Cyanide	3/8	0.5	0.13 to 1.1	0.51	0.28	--/--	1,600/40,000

¹ Frequency of detection is the number of samples in which the analyte was detected divided by the total number of samples analyzed (excluding rejected values). An environmental sample and associated duplicate are counted as one sample.

² If the target analyte is not detected in either the environmental sample or associated duplicate, the value used for the nondetection is one-half the reporting limit.

³ The mean of detected concentrations is the arithmetic mean of all environmental samples in which the analyte was detected; it includes a single value for an environmental sample and associated duplicate. The arithmetic mean does not include those environmental samples in which the analyte was not detected.

⁴ The background screening value for organics is the mean detected concentration and will not be used for screening purposes in the risk assessment. The background screening value for inorganics is two times the mean detected background concentration and will be used for screening purposes in the risk assessment.

⁵ Source: Memorandum dated February 17, 1997, from Roy L. Smith, Technical Support Section. USEPA Region III to RBC Table Mailing List. Subject: Risk Based Concentrations Table.

⁶ Source: Memorandum dated September 29, 1995a, from John M. Ruddell, Director, Florida Department of Environmental Protection (FDEP), Division of Waste Management, to District Directors, Waste Program. Subject: Soil Cleanup Goals for Florida.

⁷ The values correspond to a human cancer risk level of 1 in 1,000,000.

⁸ The calculated values correspond to a noncancer hazard quotient of 0.1.

⁹ Source: Updated Memorandum dated January 19, 1996, from John M. Ruddell, Director, FDEP, Division of Waste Management to District Directors, Waste Program. Subject: Applicability of Soil Cleanup Goals for Florida.

¹⁰ Source: Updated Memorandum dated April 5, 1995, from Ligia Mora Applegate, Director, FDEP, Technical Review Section, Bureau of Waste Cleanup, to Time Barr, Technical Review Section, Bureau of Waste Cleanup. Subject: Cleanup Goals for Military Sites in Florida.

See notes at end of table.

Table 5-3 (Continued)
Summary of Surface Soil Analytical Results

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¹¹ A site-specific soil cleanup goal for arsenic based on a modified soil background data set was approved by the FDEP (Appendix G, the FDEP, 1998).

¹² Source: Memorandum dated July 14, 1994, from Elliott P. Laws, Assistant Administrator, USEPA, to Regional Administrators, USEPA. Subject: Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities.

¹³ The values given are for hexavalent chromium.

Notes: USEPA = U.S. Environmental Protection Agency.

RBC = risk-based concentration.

TCL = target compound list.

$\mu\text{g}/\text{kg}$ = micrograms per kilogram.

PCB = polychlorinated biphenyl.

mg/kg = milligrams per kilogram.

-- = criteria not available.

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act.

RCRA = Resource Conservation and Recovery Act.

Federal and Residential and Industrial RBC and the Florida soil cleanup goal for residential soil use in two surface soil samples (01S00301 and 01S00501). The concentration did not exceed the FDEP-approved modified site-specific industrial-use soil cleanup goal of 4.62 mg/kg.

5.4 SUBSURFACE SOIL ASSESSMENT. The test pit subsurface soil sample was collected from a depth of 5 to 6 feet bls and was compared to the surface soil background sample concentrations. The analytical results from the soil sample collected from the test pit were compared to the background soil samples as surrogates to assess whether or not analyte concentrations potentially exceed naturally occurring concentrations. Table 5-4 summarizes the analytical results for organic compounds and inorganic analytes for the subsurface soil sample collected from the Site 1 test pit. The location of the test pit is shown on Figure 3-3.

TCL VOCs. One VOC (acetone) was detected at a concentration of 51 $\mu\text{g}/\ell$ in the subsurface soil sample. Acetone is a commonly recognized field or laboratory derived contaminant according to the USEPA CLP Functional Guidelines for Organic Data Review (USEPA, 1991b).

TCL SVOCs. No SVOCs were detected in the subsurface soil sample collected from Site 1.

Pesticides and PCBs. No pesticides or PCBs were detected in the subsurface soil sample from Site 1.

TAL Metals and (Total) Cyanide. Sixteen TAL metals were detected in the subsurface soil sample. Mercury was detected at 0.17 milligrams per kilogram (mg/kg), which exceeds background screening concentration of 0.14 mg/kg. The remaining TAL metals were detected at concentrations less than their respective background screening values. Cyanide (total), if present, was not detected in the sample at concentrations that exceed the detection limit. The concentrations of the 16 TAL metals detected in the subsurface soil sample were less than the FDEP industrial cleanup goals for soils.

5.5 GROUNDWATER ASSESSMENT. The groundwater assessment at Site 1 consisted of collecting a groundwater sample using a BAT sampler during Phase I and collecting groundwater samples from onsite monitoring wells during Phase IIA and IIB.

5.5.1 Phase I Groundwater Samples The RI Phase I investigation at Site 1 consisted of collecting a groundwater sample using a PCPT and BAT sampler in the south central perimeter of the site (Figure 3-3). The groundwater sample was collected from 130 feet bls and analyzed for VOCs and TAL inorganic analytes at an off-site laboratory. Carbon disulfide was detected in the sample (ABB-ES, 1992c), but was interpreted by ABB-ES (presently HLA) to be an artifact resulting from decontamination procedures because carbon disulfide was also detected at similar concentrations in the associated equipment blank. Twelve inorganic analytes (aluminum, barium, calcium, chromium, copper, iron, lead, magnesium, manganese, nickel, sodium, and zinc) were also detected in the groundwater sample. Sodium was also detected in the associated equipment blank. Detailed results are summarized in the RI Phase I Technical Memorandum No. 5 (ABB-ES, 1992c).

**Table 5-4
Summary of Analytical Results for
Subsurface Soil Sample from Test Pit 5 at Site 1**

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Locator:	01SS0101	2 × Arithmetic	USEPA Region IV RBCs	Soil Cleanup
Collect Date:	08-OCT-92	Mean of	(Industrial Values)	Goals for Florida
Lab Sample No.:	22935005	Facilitywide		(Industrial Values) ¹
		Subsurface Soil		
<u>Volatile Organic Compounds (µg/kg)</u>				
Acetone	51 J	NA		1,800,000
<u>Semivolatile Organic Compounds (µg/kg)</u>				
None detected				
<u>Pesticides and PCBs (µg/kg)</u>				
None detected				
<u>Inorganic Analytes (mg/kg)</u>				
Aluminum	4,780	25,400	⁵ 100,000	> 1 × 10 ⁶
Arsenic	1.1 J	5.8	⁶ 3.8	² 4.62
Barium	6.3 J	15.4	⁵ 14,000	84,000
Beryllium	0.08 J	0.26	100	1.0
Calcium	56.7 J	438	--	--
Chromium	6	20.8	1,000	⁴ 430
Copper	2.5 J	8.2	8,200	³ 72,000
Iron	5,100	16,500	61,000	--
Lead	2.6	8.6	400	1,000
Magnesium	76 J	264	--	--
Manganese	8.4	40.6	4,700	5,500
Mercury	0.17 J	0.14	61	480
Nickel	1.7 J	5.2	4,100	26,000
Sodium	167 J	400	--	--
Vanadium	13	41.2	1,400	4,800
Zinc	6.1 J	15.6	61,000	560,000
See notes at end of table.				

Table 5-4 (Continued)
Summary Analytical Results for
Subsurface Soil Sample from Test Pit 5 at Site 1

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¹ Source: Memorandum dated September 29, 1995a from John M. Ruddell, Director, Florida Department of Environmental Protection (FDEP), Division of Waste Management to District Directors, Waste Program. Subject: Soil Cleanup Goals for Florida.

² A site-specific soil cleanup goal for arsenic was approved by the FDEP (see Appendix G).

³ Source: Updated Memorandum dated April 5, 1995, from Ligia Mora Applegate, Director, FDEP, Technical Review Section, Bureau of Waste Cleanup, to Tim Barr, Technical Review Section, Bureau of Waste Cleanup. Subject: Cleanup Goals for Military Sites in Florida.

⁴ Value is for hexavalent chromium.

⁵ The calculated value corresponds to a noncancer hazard quotient of 0.1.

⁶ The value corresponds to a human cancer risk level of 1,000,000.

Notes: 2x = two times.

μg/kg = micrograms per kilogram.

J = the associated numerical value is an estimated quantity.

NA = not analyzed in background surface soil samples.

PCBs = polychlorinated biphenyls.

mg/kg = milligrams per kilogram.

> = greater than.

-- = criteria not available.

☒ = analyte concentrations either exceeded twice the mean background concentration of the analyte or analyte was not detected in the background surface soil samples.

The groundwater sample collected using the BAT sampler is considered appropriate for preliminary screening but is not used to support risk assessment conclusions or decision making relative to response actions.

5.5.2 Phase II Groundwater Samples Table 5-5 presents field parameter data, and Table 5-6 presents the analytical results for groundwater samples collected at Site 1 during the Phase IIA and IIB sampling events. The locations of the Site 1 monitoring wells are shown on Figure 3-4. Below is a discussion of the analytical results for the Phase IIA and IIB sampling events.

Field Parameters. Field parameter results are presented in Table 5-5. The pH values for groundwater samples collected at Site 1 ranged from 4.58 to 5.59 SUs. The pH values were below the lower range for the Florida secondary drinking water requirements of 6.5 SUs but were within the range observed in background samples collected at NAS Whiting Field (ABB-ES, 1998).

The temperature measurements ranged from 22.0 to 26.0 °C, and the specific conductance ranged from 20 to 30 micromhos per centimeter ($\mu\text{mhos/cm}$).

Turbidity measurements for Phase IIA groundwater samples ranged from 3.29 to 5,888 NTUs. Turbidity measurements for Phase IIB groundwater samples, collected using low-flow sampling methods, ranged from 3 to 11 NTUs. With one exception, the Phase IIB groundwater samples had turbidity measurements below 10 NTUs except WHF-1-3. A filtered groundwater sample was inadvertently not collected from monitoring well WHF-1-3 during Phase IIB.

Phase IIA Sampling Event. No VOCs or SVOCs were detected in any of the groundwater samples collected at Site 1 during this sampling event. The pesticide compound beta-benzene hexachloride (beta-BHC) was detected in groundwater samples collected from one shallow and one intermediate depth monitoring well (WHF-1-1S and WHF-1-1, respectively). Currently, no Federal or State maximum contaminant levels (MCLs) exist for the compound.

Nineteen inorganic analytes were detected in groundwater samples collected during Phase IIA from Site 1 monitoring wells. Ten inorganic analytes, including aluminum, beryllium, chromium, copper, iron, lead, manganese, mercury, silver, and vanadium, were detected in groundwater samples collected from the shallow monitoring wells (WHF-1-1S, WHF-1-2, and WHF-1-3) at concentrations exceeding the background screening criteria. Seven of the analytes were detected at concentrations exceeding the Federal and State MCLs. The analytes and their respective Federal and State MCL are aluminum ($200 \mu\text{g/l}$), beryllium ($4 \mu\text{g/l}$), chromium ($100 \mu\text{g/l}$), iron ($300 \mu\text{g/l}$), lead ($15 \mu\text{g/l}$), manganese ($50 \mu\text{g/l}$), and nickel ($100 \mu\text{g/l}$).

Eleven inorganic analytes were detected in the groundwater samples collected from the intermediate depth monitoring well (WHF-1-1). None of the detected concentrations exceeded the background screening criteria or the Federal or State MCLs.

Phase IIB Sampling Event. One volatile and one semivolatile compound were detected, and 15 inorganic analytes were detected in the Phase IIB groundwater samples. Only aluminum and iron were detected at concentrations that exceed Federal and State MCLs.

Table 5-5
Summary of Groundwater Field Parameters

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Monitoring Well Designation	Date Sampled	pH (SU)	Temperature (°C)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Redox (mV)	DO (percent)
WHF-1-1	10-18-93	5.03	23	20	3.92	--	--
WHF-1-1	7-19-96	5.59	22.5	29	3.90	394.8	6.15
WHF-1-1S	10-18-93	5.04	23	30	374	--	--
WHF-1-1S	7-19-96	5.03	26	29	4.06	416.8	6.20
WHF-1-2	10-19-93	4.58	22	30	5,888	--	--
WHF-1-2	7-22-96	4.90	26	22	3.0	390	5.4
WHF-1-3	10-15-93	4.74	22.4	21	1,390	--	--
WHF-1-3	7-23-96	4.93	24.9	20	11	--	4.6
WHF-1-4	7-22-96	5.08	26	20	9.3	400	5.2

Notes: SU = standard unit.
°C = degrees Celsius.
µmhos/cm = micromhos per centimeter.
NTU = nephelometric turbidity unit.
mV = millivolt.
DO = dissolved oxygen.
-- = not recorded.

**Table 5-6
Summary of Analytical Results Detected in Site 1 Groundwater Samples**

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Well Identifier:	Phase II A Sampling Event				Phase II B Sampling Event						
	WHF-1-1S	WHF-1-1	WHF-1-2	WHF-1-3	WHF-1-1S	WHF-1-1	WHF-1-1	WHF-1-2	WHF-1-2	WHF-1-3	WHF-1-4
Sample Identifier:	WHF1-1B	WHF1-1	WHF1-2	WHF1-3	01G00101	01G00102	01G00102D	01G00201	01G00201F	01G00301	01G00401
Collect Date:	18-OCT-93	18-OCT-93	19-OCT-93	15-OCT-93	19-JUL-96	19-JUL-96	19-JUL-96	22-JUL-96	22-JUL-96	23-JUL-96	22-JUL-96
Laboratory Sample No.:	90177002	90177001	90178001	90175002	RB873007	RB873008	RB873009	RB887003	RB887004	RB887006	RB887002
<u>Volatile Organic Compounds (µg/l)</u>											
Carbon disulfide	--	--	--	--	1 J	--	--	--	NA	--	--
<u>Semivolatile Organic Compounds (µg/l)</u>											
bis(2-Ethylhexyl)phthalate	--	--	--	--	--	--	--	--	NA	2 J	--
<u>Pesticides and PCBs (µg/l)</u>											
beta-BHC	0.019 J	0.025 J	--	--	--	--	--	--	NA	--	--
<u>Inorganic Analytes (µg/l)</u>											
Aluminum	30,700	132 J	61,700	10,800	--	--	--	842	--	202	--
Barium	72.7 J	5.7 J	118 J	28.9 J	15.6 J	15.6 J	15.6 J	71.4 J	26 J	21.3 J	19.7 J
Beryllium	2.2 J	0.48 J	10 J	0.89 J	--	0.53 J	--	0.51 J	--	--	0.53 J
Calcium	3,120 J	1,070 J	1,090 J	1,300 J	796 J	5,850	6,250	2,730 J	2,070 J	960 J	712 J
Chromium	111	--	1,150	24.7	--	--	--	7.2 J	--	5.8 J	--
Cobalt	5.5 J	--	--	--	--	--	--	--	--	--	--
Copper	68.4	2.3 J	36.8 J	12.2 J	--	--	1.4 J	2.4 J	--	1.6 J	--
Iron	104,000	65.9 J	318,000	15,800	--	--	--	2,630	--	256	246
Lead	20.4	1.7 J	36.2	4.7	--	--	--	--	--	--	--
Magnesium	2,280 J	314 J	1,810 J	1260 J	719 J	337 J	331 J	807 J	712 J	717 J	644 J
Manganese	243	14.8 J	374	57.4	6.7 J	6.7 J	9 J	10.5 J	4.8 J	4.4 J	3.4 J
Mercury	0.23	--	0.36	--	--	--	--	--	--	--	--
Nickel	13.8 J	--	210	--	--	--	--	9.6 J	--	11 J	7.4 J

See notes at end of table.

Table 5-6 (Continued)
Summary of Analytical Results Detected in Site 1 Groundwater Samples

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Well Identifier:	Phase II A Sampling Event				Phase II B Sampling Event						
	WHF-1-1S	WHF-1-1	WHF-1-2	WHF-1-3	WHF-1-1S	WHF-1-1	WHF-1-1	WHF-1-2	WHF-1-2	WHF-1-3	WHF-1-4
Sample Identifier:	WHF1-1B	WHF1-1	WHF1-2	WHF1-3	01G00101	01G00102	01G00102D	01G00201	01G00201F	01G00301	01G00401
Collect Date:	18-OCT-93	18-OCT-93	19-OCT-93	15-OCT-93	19-JUL-96	19-JUL-96	19-JUL-96	22-JUL-96	22-JUL-96	23-JUL-96	22-JUL-96
Laboratory Sample No.:	90177002	90177001	90178001	90175002	RB873007	RB873008	RB873009	RB887003	RB887004	RB887006	RB887002
Inorganic Analytes (µg/l) (Continued)											
Potassium	2,420 J	614 J	3,090 J	1,220 J	714 J	938 J	842 J	634 J	458 J	554 J	--
Silver	5.8 J	--	--	--	--	--	--	--	--	--	--
Sodium	2,510 J	1,980 J	2,670 J	2,340 J	1,550 J	2,100 J	2,070 J	2,330 J	2,260 J	2,070 J	1980 J
Vanadium	268	--	1,360	77.5	--	--	1.6 J	9 J	--	--	1.3 J
Zinc	50	--	109	22.5	--	--	--	90.8	58.2	70.2	--
Cyanide	--	--	2.5 J	--	--	1.9 J	--	--	--	--	--
<p>Notes: D = duplicate sample. F = filtered sample. µg/l = micrograms per liter. -- = analyte not detected. J = estimated value. PCB = polychlorinated biphenyl. BHC = benzene hexachloride. NA = not analyzed.</p>											

The number and concentration of inorganic analytes detected in groundwater samples collected during the 1996 sampling event are generally lower than the corresponding samples collected during the 1993 sampling event. The low-flow sampling procedure resulted in less turbid groundwater samples for the Phase IIB sampling event as compared to the groundwater samples collected during Phase IIA. Because the low-flow sampling method produces less turbid samples that are more representative of the surficial aquifer than those obtained with a bailer, the preferred data set was from the Phase IIB sampling event.

VOCs. One VOC (carbon disulfide) was detected in a groundwater sample collected from monitoring well WHF-1-1S. Currently, no Federal or State MCLs exist for the compound. However, the State of Florida has established a groundwater guidance concentration under FAC 62-520.400(1) carbon disulfide. The detected concentration (1.0 $\mu\text{g}/\ell$) did not exceed the groundwater guidance concentration of 700 $\mu\text{g}/\ell$.

SVOCs. One SVOC (bis(2-ethylhexyl)phthalate) as detected in a groundwater sample collected from monitoring well WHF 1-3 at Site 1. The detected concentration (2 $\mu\text{g}/\ell$) was below the State Primary MCL of 5 $\mu\text{g}/\ell$ (FDEP, 1994).

Pesticides and PCBs. No pesticide or PCB compounds were detected in any Phase IIB groundwater samples.

Inorganic Analytes. Fifteen inorganic analytes, including aluminum, barium, beryllium, cadmium, chromium, copper, cyanide, iron, magnesium, manganese, nickel, potassium, sodium, vanadium, and zinc were detected in groundwater samples collected from shallow monitoring wells (WHF 1-1S, WHF 1-2, WHF 1-3, and WHF 1-4). Two of the analytes, aluminum and iron, were detected at concentrations exceeding the Federal and State Secondary MCLs.

Eight inorganic analytes were detected in the groundwater sample collected from the intermediate depth monitoring well (WHF-1-1) at Site 1. None of the concentrations detected exceeded the Federal or State MCLs.

Table 5-7 provides basic statistical parameters of detected analyte concentrations in Site 1 Phase IIB groundwater samples, including the frequency of detection, range, mean, and screening value. The range of analyte concentrations in Site 1 groundwater samples were compared in Table 5-7 to Federal and State of Florida applicable or relevant and appropriate requirements (ARARs), including Federal primary MCLs, the State of Florida primary and secondary drinking water standards, and the Florida groundwater guidance concentrations. Because the results of the Phase IIA groundwater sampling event are not considered to be representative of the groundwater conditions at the site due to sample turbidity, they are not reported on Table 5-7.

Filtered Groundwater Samples. One filtered sample for TAL inorganics (metals only) was collected from monitoring well WHF 1-2 for comparison purposes only during the Phase IIB RI. Table 5-6 also contains a summary of analytes detected in the filtered sample (sample identifier 01G00201F). Comparison of the analytical results between the filtered sample and the corresponding unfiltered sample indicates that, in general, 50 percent fewer analytes are detected in the filtered sample. In addition, analyte concentrations in the filtered sample are lower than the corresponding concentrations in the unfiltered sample.

**Table 5-7
Basic Statistical Summary and ARARs for Analytes Detected in Site 1 Groundwater Samples**

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Analyte	Frequency of Detection ¹	Range of Detected Analyte Concentration ²	Mean Analyte Concentration	Background Screening Values ³	Federal MCLs ⁴	Florida Groundwater Guidance	
						Concentration ⁵	Basis ⁶
<u>Volatile Organic Compounds (µg/l)</u>							
Carbon disulfide	1/5	1 to 1	1.0	NA	NA	700	S
<u>Semivolatile Organic Compounds (µg/l)</u>							
bis(2-Ethylhexyl)phthalate	1/5	2 to 2	2.0	NA	5	5	P
<u>Inorganic Analytes (µg/l)</u>							
Aluminum	2/5	202 to 842	522	654	200	200	S
Antimony	0/5	--	--	20.4	6	6	P
Barium	5/5	15.6 to 71.4	28.7	72.6	2,000	2,000	P
Beryllium	3/5	0.51 to 0.53	0.52	0.94	4	4	P
Cadmium	0/5	--	--	4.4	5	5	P
Calcium	5/5	712 to 6,050*	2,249.6	3,316	NA	NA	
Chromium	2/5	5.8 to 7.2	6.5	30	100	100	P
Copper	3/5	1.4 to 2.4	1.8	10.7	⁷ 100	1,000	S
Iron	3/5	246 to 2,630	1,044	964	⁸ 300	300	S
Magnesium	5/5	334* to 807	644.2	2,426	NA	NA	
Manganese	5/5	3.4 to 10.5	6.57	42.8	⁸ 50	50	S
Nickel	3/5	7.4 to 11	9.33	42.8	100	100	P
Potassium	4/5	554 to 890*	698	1,528	NA	NA	
Selenium	0/5	--	--	0.98	50	50	P
Sodium	5/5	1,550 to 2,330	2,003	4,772	⁹ NA	160,000	P
Vanadium	3/5	1.3 to 9	3.97	3.8	NA	49	T
Zinc	2/5	70.2 to 90.8	80.5	200	⁸ 5,000	5,000	S
Cyanide	1/5	1.9 to 1.9	1.9	7	200	200	P

See notes at end of table.

Table 5-7 (Continued)
Basic Statistical Summary and ARARs for Analytes Detected in Site 1 Groundwater Samples

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- ¹ Frequency of detection is the fraction of total samples analyzed in which the analyte was detected.
- ² Value indicated by an asterisk is the average of the sample and its duplicate. If the target analyte was not detected in either the environmental sample or associated duplicate, the value used for the nondetection is one-half the reporting limit.
- ³ Background screening values for organic compounds are the arithmetic mean concentrations; for inorganic analytes it is two times the arithmetic mean concentrations. The latter values are used for analyte screening in risk assessment.
- ⁴ Federal MCLs are maximum permissible concentrations of contaminants in water that are delivered to a user by a public water system.
- ⁵ Source: Groundwater Guidance Concentration, Florida Department of Environmental Protection, June 1994.
- ⁶ The concentrations are based on a number of enforceable and nonenforceable State of Florida regulations:
P = primary drinking water standards based on Florida Administrative Code (FAC) Rule 17-550.310, .320
S = secondary drinking water standards based on FAC Rule 17-550.310, .320
T = systemic toxicants based on FAC Rule 17-520.400 (1) (d)
- ⁷ Treatment technique requirement for drinking water distribution system.
- ⁸ Secondary MCL.
- ⁹ No MCL has been determined for sodium, but a reporting limit of 20,000 $\mu\text{g}/\ell$ has been established.

Notes: ARARs = Applicable or Relevant and Appropriate Requirements.
MCL = maximum contaminant level.
TCL = target compound list.
 $\mu\text{g}/\ell$ = micrograms per liter.
NA = no applicable standard currently exists.
TAL = target analyte list.
* = average of a sample and its duplicate.
-- = not detected.

5.6 GEOLOGIC ASSESSMENT. Surface soils were generally described as yellow to orange (fine- to very fine-grained) clayey sand or light tan (fine- to very fine-grained) silty sand. The shallow soil (2 to 7 feet bls) tended to be brown to red brown in color and contained interbedded sand silt and clay layers (ABB-ES, 1995a).

The lithology of Site 1 consists of light colored, poorly graded (fine- to medium-grained) sands to a depth of at least 130 feet bls. Only two clay layers were encountered at the location of one monitoring well (WHF-1-2) drilled at the site. One clay layer was approximately 2 inches in thickness and encountered at 20 feet bls, and a 1-inch clay layer was encountered at 50 feet bls. Layers of clay and silt were thin (less than 1 inch in thickness) and infrequently encountered below 20 feet (ABB-ES, 1995a).

Detailed descriptions can be found in the boring and monitoring well logs presented in the RI Phase IIA Technical Memorandum No. 2 (ABB-ES, 1995a). A general discussion of the geology at NAS Whiting Field is presented in Subsection 1.4.5 of the GIR (ABB-ES, 1998).

5.7 HYDROGEOLOGIC ASSESSMENT. The hydrogeologic assessment included determining horizontal and vertical hydraulic gradients, hydraulic conductivities, and seepage velocities. The hydrogeologic assessment results are used to evaluate the transport of human health and ecological chemicals of potential concern from the site by groundwater flow. Chapter 8.0 of this report covers contaminant fate and transport for human health and ecological chemicals of potential concern at Site 1.

Groundwater Flow Direction. Table 5-8 summarizes the results of the water-level measurements recorded for the RI/FS sites in the Northwest Disposal and Crash Crew Training Areas (i.e., Site 1 and adjacent Sites 2, 17, and 18) during the RI field program. Groundwater flow patterns for the measurement events are similar, and potentiometric surface maps depicting the February 8 and 9, 1994, event (Figure 5-1) and the November 7 to 9, 1996, event (Figure 5-2) are included in the body of this report. The data from the measurement events indicated a groundwater flow direction to the south-southwest. Facilitywide water table elevation data are provided in Appendix D of the GIR (ABB-ES, 1998).

Horizontal and Vertical Gradients. Table 5-9 provides a summary of the horizontal hydraulic gradients calculated for the Northwest Disposal and Crash Crew Training Areas. The horizontal hydraulic gradients in the area ranged from 0.0059 foot per foot (ft/ft) (monitoring wells WHF-18-2 and WHF-18-3) to 0.0016 ft/ft monitoring wells WHF-17-1S and WHF-17-2). The average hydraulic gradient for each measurement event ranged from 0.0034 ft/ft for October 1994 to 0.0053 ft/ft for November 1996. The overall average horizontal hydraulic gradient for all measurement events from 1993 through 1996 was 0.0039 ft/ft.

Table 5-10 presents a summary of the vertical hydraulic gradients calculated for the Northwest Disposal and Crash Crew Training Areas. The vertical hydraulic gradients were calculated using well pairs at Site 1 (monitoring wells WHF-1-1S and WHF-1-1) and Site 17 (monitoring wells WHF-17-1S and WHF-17-1). Values calculated for the paired monitoring wells ranged from 0.01580 ft/ft to 0.0005 ft/ft. Vertical hydraulic gradients were mostly in a downward direction; however, an upward gradient was observed on Site 17 during the July 25 to 27, 1996, survey and observed on Site 1 during the November 7 to 9, 1996, survey.

Table 5-8
Summary of Water-Level Elevations

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Monitoring Well Designation	Well TOC Elevation (msl)	Well Depth (feet BTOC)	September 30 and October 1, 1993		February 8 and 9, 1994		June 22 to 24, 1994	
			Depth to Groundwater (feet BTOC)	Groundwater Elevation (feet above msl)	Depth to Groundwater (feet BTOC)	Groundwater Elevation (feet above msl)	Depth to Groundwater (feet BTOC)	Groundwater Elevation (feet above msl)
Northwest Disposal and Crash Crew Training Areas								
Site 1, Northwest Disposal Area								
WHF-1-1	142.62	123.00	64.70	77.92	66.00	76.62	66.26	76.36
WHF-1-1S	143.08	75.40	64.40	78.68	65.84	77.24	66.11	76.97
WHF-1-2	145.61	78.80	66.13	79.48	67.53	78.08	67.99	77.62
WHF-1-3	155.50	87.48	76.68	78.82	78.02	77.48	78.51	76.99
WHF-1-4	151.86	79.30	--	--	--	--	--	--
Site 2, Northwest Open Disposal Area								
WHF-2-1	150.80	87.42	77.96	72.84	79.18	71.62	79.00	71.80
WHF-2-2	159.16	91.70	--	--	--	--	--	--
WHF-2-3	160.63	91.60	--	--	--	--	--	--
Site 17, Crash Crew Training Area								
WHF-17-1	194.71	159.00	111.10	83.61	112.39	82.32	113.56	81.15
WHF-17-1S	194.96	115.50	111.29	83.67	112.60	82.36	113.78	81.18
WHF-17-2	197.35	121.90	114.05	83.30	115.35	82.00	116.52	80.83
WHF-17-3	201.21	126.50	117.52	83.69	117.12	84.09	117.53	81.09
Site 18, Crash Crew Training Area								
WHF-18-1	163.57	120.20	93.29	70.28	94.53	69.04	94.61	68.96
WHF-18-2	164.75	107.86	95.82	68.93	97.04	67.71	98.03	66.72
WHF-18-3	175.64	112.90	104.30	71.34	105.59	70.05	105.90	69.74
See notes at end of table.								

**Table 5-8 (Continued)
Summary of Water-Level Elevations**

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Monitoring Well Designation	Well TOC Elevation (msl)	Well Depth (feet BTOC)	October 10 to 13, 1994		January 10 to 13, 1995		April 19 and 20, 1995	
			Depth to Groundwater (feet BTOC)	Groundwater Elevation (feet above msl)	Depth to Groundwater (feet BTOC)	Groundwater Elevation (feet above msl)	Depth to Groundwater (feet BTOC)	Groundwater Elevation (feet above msl)
Northwest Disposal and Crash Crew Training Areas								
Site 1, Northwest Disposal Area								
WHF-1-1	142.62	123.00	64.15	78.47	64.36	78.26	64.02	78.60
WHF-1-1S	143.08	75.40	63.92	79.16	64.13	78.95	63.80	79.28
WHF-1-2	145.61	78.80	65.72	79.89	65.91	79.70	65.57	80.04
WHF-1-3	155.50	87.48	76.23	79.27	76.32	79.18	76.10	79.40
WHF-1-4	151.86	79.30	--	--	--	--	--	--
Site 2, Northwest Open Disposal Area								
WHF-2-1	150.80	87.42	76.94	73.86	77.45	73.35	76.96	73.84
WHF-2-2	159.16	91.70	--	--	--	--	--	--
WHF-2-3	160.63	91.60	--	--	--	--	--	--
Site 17, Crash Crew Training Area								
WHF-17-1	194.71	159.00	111.49	83.22	110.94	83.77	110.97	83.74
WHF-17-1S	194.96	115.50	111.72	83.24	111.15	83.81	111.17	83.79
WHF-17-2	197.35	121.90	114.45	82.90	113.89	83.46	113.92	83.43
WHF-17-3	201.21	126.50	123.65	74.97	114.87	83.75	114.88	83.74
Site 18, Crash Crew Training Area								
WHF-18-1	163.57	120.20	92.28	71.29	92.50	71.07	92.35	71.22
WHF-18-2	164.75	107.86	94.76	69.99	94.97	69.78	94.85	69.90
WHF-18-3	175.64	112.90	103.55	72.09	103.48	72.16	103.46	72.18
See notes at end of table.								

Table 5-8 (Continued)
Summary of Water-Level Elevations

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Monitoring Well Designation	Well TOC Elevation (msl)	Well Depth (feet BTOC)	July 28 and 29, 1995		October 12 to 14, 1995		January 19 and 20, 1996	
			Depth to Groundwater (feet BTOC)	Groundwater Elevation (feet above msl)	Depth to Groundwater (feet BTOC)	Groundwater Elevation (feet above msl)	Depth to Groundwater (feet BTOC)	Groundwater Elevation (feet above msl)
Northwest Disposal and Crash Crew Training Areas								
Site 1, Northwest Disposal Area								
WHF-1-1	142.62	123.00	62.42	80.20	61.84	80.78	58.18	84.44
WHF-1-1S	143.08	75.40	62.12	80.96	61.58	81.50	57.81	85.27
WHF-1-2	145.61	78.80	63.86	81.75	63.27	82.34	59.59	86.02
WHF-1-3	155.50	87.48	74.33	81.17	74.03	81.47	70.08	85.42
WHF-1-4	151.86	79.30	--	--	--	--	--	--
Site 2, Northwest Open Disposal Area								
WHF-2-1	150.80	87.42	75.56	75.24	75.21	75.59	71.50	79.30
WHF-2-2	159.16	91.70	--	--	--	--	--	--
WHF-2-3	160.63	91.60	--	--	--	--	--	--
Site 17, Crash Crew Training Area								
WHF-17-1	194.71	159.00	109.17	85.54	108.85	85.86	104.88	89.83
WHF-17-1S	194.96	115.50	109.39	85.57	109.05	85.91	105.09	89.87
WHF-17-2	197.35	121.90	112.13	85.22	111.80	85.55	107.87	89.48
WHF-17-3	201.21	126.50	113.12	85.50	112.73	85.89	109.82	88.80
Site 18, Crash Crew Training Area								
WHF-18-1	163.57	120.20	90.76	72.81	91.09	72.48	86.81	76.76
WHF-18-2	164.75	107.86	93.28	71.47	93.69	71.06	89.37	75.38
WHF-18-3	175.64	112.90	101.93	73.71	102.13	73.51	97.58	78.06
See notes at end of table.								

Table 5-8 (Continued)
Summary of Water-Level Elevations

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Monitoring Well Designation	Well TOC Elevation (msl)	Well Depth (feet BTOC)	April 25 to 27, 1996		July 25 to 27, 1996		November 7 to 9, 1996	
			Depth to Groundwater (feet BTOC)	Groundwater Elevation (feet above msl)	Depth to Groundwater (feet BTOC)	Groundwater Elevation (feet above msl)	Depth to Groundwater (feet BTOC)	Groundwater Elevation (feet above msl)
Northwest Disposal and Crash Crew Training Areas								
Site 1, Northwest Disposal Area								
WHF-1-1	142.62	123.00	57.58	85.04	57.43	85.19	58.92	83.70
WHF-1-1S	143.08	75.40	57.13	85.95	57.09	85.99	59.53	83.55
WHF-1-2	145.61	78.80	58.78	86.83	58.76	86.85	60.18	85.43
WHF-1-3	155.50	87.48	69.40	86.10	69.23	86.27	70.63	84.87
WHF-1-4	151.86	79.30	66.27	85.59	66.17	85.69	67.62	84.24
Site 2, Northwest Open Disposal Area								
WHF-2-1	150.80	87.42	71.21	79.59	71.47	79.33	72.95	77.85
WHF-2-2	159.16	91.70	79.96	79.20	80.08	79.08	81.58	77.58
WHF-2-3	160.63	91.60	80.40	80.23	80.38	80.25	81.89	78.74
Site 17, Crash Crew Training Area								
WHF-17-1	194.71	159.00	103.44	91.27	102.82	91.89	103.96	90.75
WHF-17-1S	194.96	115.50	103.66	91.30	103.83	91.13	104.16	90.80
WHF-17-2	197.35	121.90	106.40	90.95	105.73	91.62	106.91	90.44
WHF-17-3	201.21	126.50	107.26	91.36	106.81	91.81	107.68	90.94
Site 18, Crash Crew Training Area								
WHF-18-1	163.57	120.20	86.69	76.88	86.62	76.95	88.05	75.52
WHF-18-2	164.75	107.86	89.37	75.38	89.32	75.43	90.73	74.02
WHF-18-3	175.64	112.90	97.57	78.07	97.51	78.13	98.70	76.94

Notes: TOC = top of casing.
msl = mean sea level.
BTOC = below top of casing.
-- = no data.

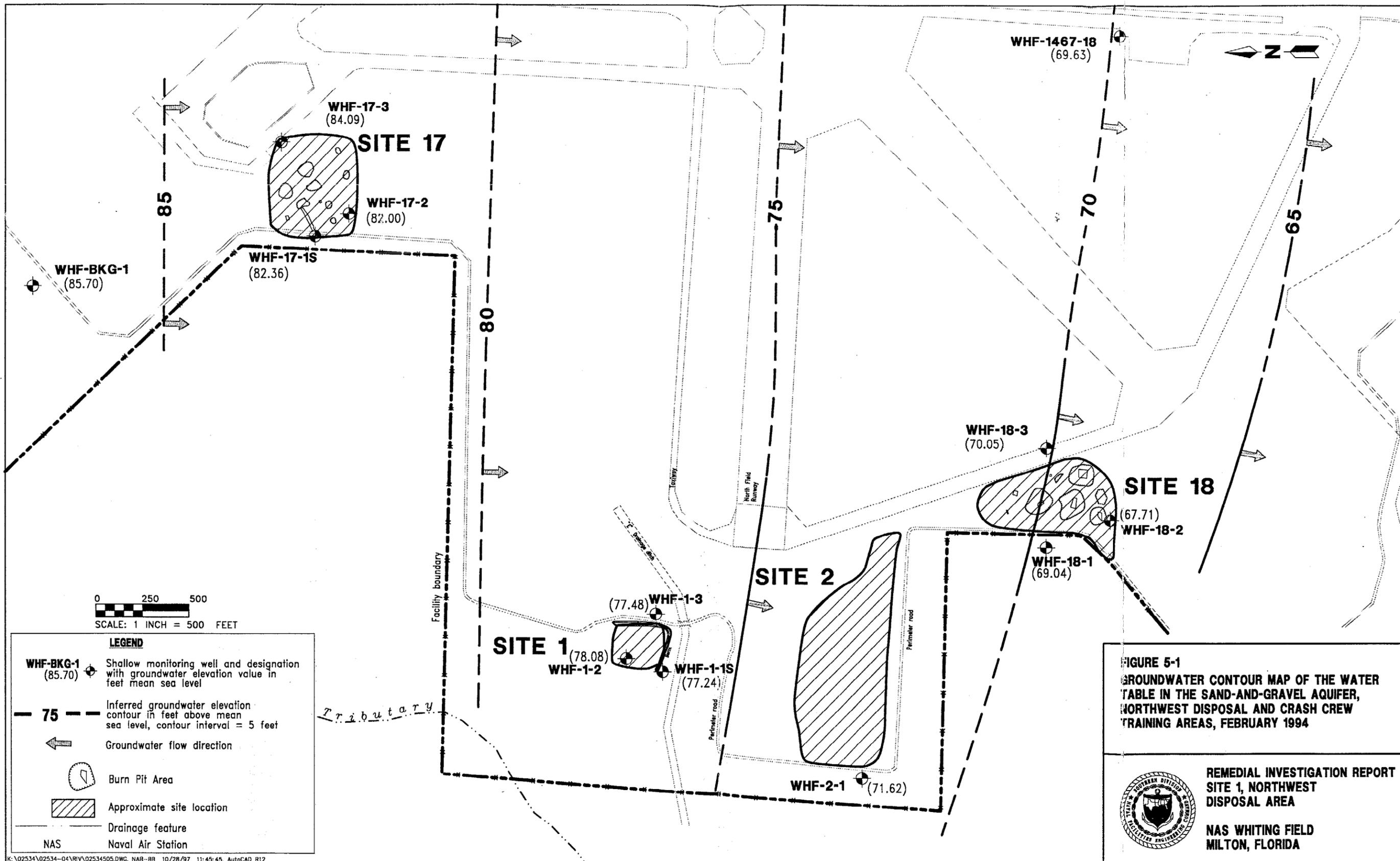


FIGURE 5-1
GROUNDWATER CONTOUR MAP OF THE WATER
TABLE IN THE SAND-AND-GRAVEL AQUIFER,
NORTHWEST DISPOSAL AND CRASH CREW
TRAINING AREAS, FEBRUARY 1994



REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST
DISPOSAL AREA
NAS WHITING FIELD
MILTON, FLORIDA

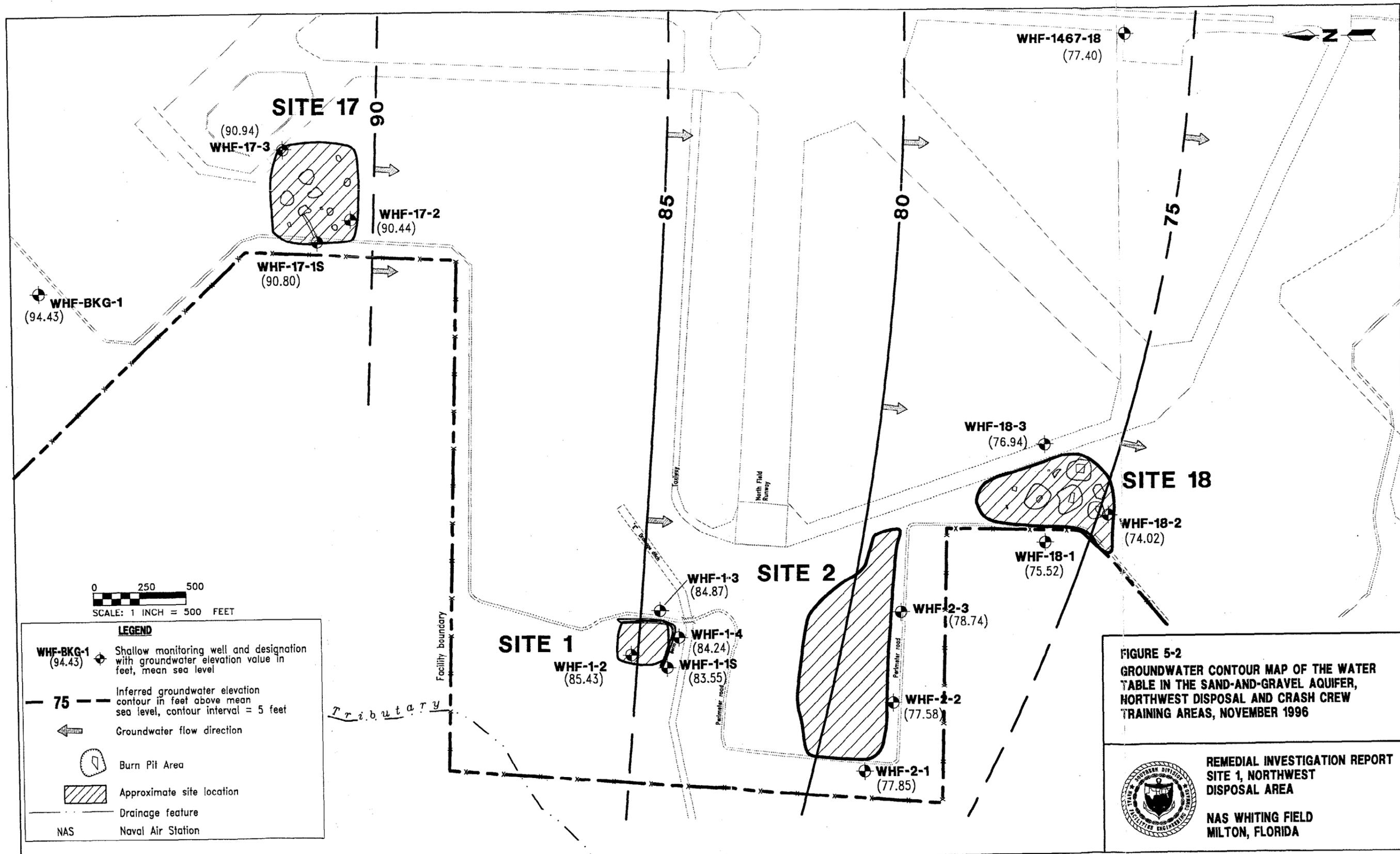


FIGURE 5-2
GROUNDWATER CONTOUR MAP OF THE WATER
TABLE IN THE SAND-AND-GRAVEL AQUIFER,
NORTHWEST DISPOSAL AND CRASH CREW
TRAINING AREAS, NOVEMBER 1996

REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST
DISPOSAL AREA

NAS WHITING FIELD
MILTON, FLORIDA



LEGEND

- WHF-BKG-1** (94.43) Shallow monitoring well and designation with groundwater elevation value in feet, mean sea level
- 75** Inferred groundwater elevation contour in feet above mean sea level, contour interval = 5 feet
- Groundwater flow direction
- Burn Pit Area
- Approximate site location
- Drainage feature
- NAS** Naval Air Station

Table 5-9
Summary of Horizontal Hydraulic Gradients

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Well Designation	Distance Between Wells (feet)	September 30 to October 1, 1993		February 8 and 9, 1994		June 22 to 24, 1994		October 10 to 13, 1994	
		Water Level (msl)	Horizontal Gradient (ft/ft)	Water Level (msl)	Horizontal Gradient (ft/ft)	Water Level (msl)	Horizontal Gradient (ft/ft)	Water Level (msl)	Horizontal Gradient (ft/ft)
Northwest Disposal and Crash Crew Training Areas									
WHF-17-1S	218	83.67	0.0017	82.36	0.0017	81.18	0.0016	83.24	0.0016
WHF-17-2		83.30		82.00		80.83		82.90	
WHF-18-3	511	71.34	0.0047	70.05	0.0046	69.74	0.0059	72.09	0.0041
WHF-18-2		68.93		67.71		66.72		69.99	
WHF-1-2	205	79.48	0.0039	78.08	0.0041	77.62	0.0032	79.89	0.0036
WHF-1-1S		78.68		77.24		76.97		79.16	
WHF-1-1S	1,201	78.68	0.0049	77.24	0.0047	76.97	0.0043	79.16	0.0044
WHF-2-1		72.84		71.62		71.80		73.86	
	Average gradient		0.0038		0.0038		0.0038		0.0034

See notes at end of table.

Table 5-9 (Continued)
Summary of Horizontal Hydraulic Gradients

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Well Designation	Distance Between Wells (feet)	January 10 to 13, 1995		April 19 and 20, 1995		July 28 and 29, 1995		October 12 to 14, 1995	
		Water Level (msl)	Horizontal Gradient (ft/ft)	Water Level (msl)	Horizontal Gradient (ft/ft)	Water Level (msl)	Horizontal Gradient (ft/ft)	Water Level (msl)	Horizontal Gradient (ft/ft)
Northwest Disposal and Crash Crew Training Areas									
WHF-17-1S	218	83.81	0.0016	83.79	0.0017	85.57	0.0016	85.91	0.0017
WHF-17-2		83.46		83.43		85.22		85.55	
WHF-18-3	511	72.16	0.0047	72.18	0.0045	73.71	0.0044	73.51	0.0048
WHF-18-2		69.78		69.90		71.47		71.06	
WHF-1-2	205	79.70	0.0037	80.04	0.0037	81.75	0.0039	82.34	0.0041
WHF-1-1S		78.95		79.28		80.96		81.50	
WHF-1-1S	1,201	78.95	0.0047	79.28	0.0045	80.96	0.0048	81.50	0.0049
WHF-2-1		73.35		73.84		75.24		75.59	
	Average gradient		0.0037		0.0036		0.0037		0.0039

See notes at end of table.

**Table 5-9 (Continued)
Summary of Horizontal Hydraulic Gradients**

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Well Designation	Distance Between Wells (feet)	January 19 and 20, 1996		April 25 to 27, 1996		July 25 to 27, 1996		November 7 to 9, 1996	
		Water Level (msl)	Horizontal Gradient (ft/ft)	Water Level (msl)	Horizontal Gradient (ft/ft)	Water Level (msl)	Horizontal Gradient (ft/ft)	Water Level (msl)	Horizontal Gradient (ft/ft)
Northwest Disposal and Crash Crew Training Areas									
WHF-17-1S	218	89.87	0.0018	91.30	0.0016	91.13	0.0022	90.80	0.0017
WHF-17-2		89.48		90.95		91.62		90.44	
WHF-18-3	511	78.06	0.0052	78.07	0.0053	78.13	0.0053	76.94	0.0057
WHF-18-2		75.38		75.38		75.43		74.02	
WHF-1-2	205	86.02	0.0037	86.83	0.0043	86.85	0.0042	85.43	0.0092
WHF-1-1S		85.27		85.95		85.99		83.55	
WHF-1-1S	1,201	85.27	0.0050	85.95	0.0053	85.99	0.0055	83.55	0.0047
WHF-2-1		79.30		79.59		79.33		77.85	
	Average gradient		0.0039		0.0041		0.0043		0.0053

Notes: msl = mean sea level.
ft/ft = feet per foot.

Table 5-10
Summary of Vertical Hydraulic Gradients

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Well Number	Bottom of Well Elevation (msl)	Vertical Distance Between Screens (feet)	September 30 and October 1, 1993			February 8 and 9, 1994		
			Groundwater Elevation (msl)	Vertical Gradient (ft/ft)	Vertical Flow Direction	Groundwater Elevation (msl)	Vertical Gradient (ft/ft)	Vertical Flow Direction
Northwest Disposal and Crash Crew Training Areas								
WHF-1-1S	67.68	48.06	78.68	0.0158	Downward	77.24	0.0129	Downward
WHF-1-1	19.62		77.92			76.62		
WHF-17-1S	79.46	43.75	83.67	0.0013	Downward	82.36	0.0009	Downward
WHF-17-1	35.71		83.61			82.32		
See notes at end of table.								

Table 5-10 (Continued)
Summary of Vertical Hydraulic Gradients

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Well Number	Bottom of Well Elevation (msl)	Vertical Distance Between Screens (feet)	June 22 to 24, 1994			October 10 to 13, 1994		
			Groundwater Elevation (msl)	Vertical Gradient (ft/ft)	Vertical Flow Direction	Groundwater Elevation (msl)	Vertical Gradient (ft/ft)	Vertical Flow Direction
Northwest Disposal and Crash Crew Training Areas								
WHF-1-1S	67.68	48.06	76.97	0.0127	Downward	79.16	0.0144	Downward
WHF-1-1	19.62		76.36			78.47		
WHF-17-1S	79.46	43.75	81.18	0.0007	Downward	83.24	0.0005	Downward
WHF-17-1	35.71		81.15			83.22		
See notes at end of table.								

Table 5-10 (Continued)
Summary of Vertical Hydraulic Gradients

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Well Number	Bottom of Well Elevation (msl)	Vertical Distance Between Screens (feet)	January 10 to 13, 1995			April 19 and 20, 1995		
			Groundwater Elevation (msl)	Vertical Gradient (ft/ft)	Vertical Flow Direction	Groundwater Elevation (msl)	Vertical Gradient (ft/ft)	Vertical Flow Direction
Northwest Disposal and Crash Crew Training Areas								
WHF-1-1S	67.68	48.06	78.95	0.0144	Downward	79.28	0.0141	Downward
WHF-1-1	19.62		78.26			78.60		
WHF-17-1S	79.46	43.75	83.81	0.0009	Downward	83.79	0.0011	Downward
WHF-17-1	35.71		83.77			83.74		
See notes at end of table.								

Table 5-10 (Continued)
Summary of Vertical Hydraulic Gradients

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Well Number	Bottom of Well Elevation (msl)	Vertical Distance Between Screens (feet)	July 28 and 29, 1995			October 12 to 14, 1995		
			Groundwater Elevation (msl)	Vertical Gradient (ft/ft)	Vertical Flow Direction	Groundwater Elevation (msl)	Vertical Gradient (ft/ft)	Vertical Flow Direction
Northwest Disposal and Crash Crew Training Areas								
WHF-1-1S	67.68	48.06	80.96	0.0158	Downward	81.50	0.0150	Downward
WHF-1-1	19.62		80.20			80.78		
WHF-17-1S	79.46	43.75	85.57	0.0007	Downward	85.91	0.0011	Downward
WHF-17-1	35.71		85.54			85.86		
See notes at end of table.								

Table 5-10 (Continued)
Summary of Vertical Hydraulic Gradients

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Well Number	Bottom of Well Elevation (msl)	Vertical Distance Between Screens (feet)	January 19 and 20, 1996			April 25 to 27, 1996		
			Groundwater Elevation (msl)	Vertical Gradient (ft/ft)	Vertical Flow Direction	Groundwater Elevation (msl)	Vertical Gradient (ft/ft)	Vertical Flow Direction
Northwest Disposal and Crash Crew Training Areas								
WHF-1-1S	67.68	48.06	85.27	0.0173	Downward	85.95	0.0189	Downward
WHF-1-1	19.62		84.44			85.04		
WHF-17-1S	79.46	43.75	89.87	0.0009	Downward	91.30	0.0007	Downward
WHF-17-1	35.71		89.83			91.27		
See notes at end of table.								

Table 5-10 (Continued)
Summary of Vertical Hydraulic Gradients

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Well Number	Bottom of Well Elevation (msl)	Vertical Distance Between Screens (feet)	July 25 to 27, 1996			November 7 to 9, 1996		
			Groundwater Elevation (msl)	Vertical Gradient (ft/ft)	Vertical Flow Direction	Groundwater Elevation (msl)	Vertical Gradient (ft/ft)	Vertical Flow Direction
Northwest Disposal and Crash Crew Training Areas								
WHF-1-1S	67.68	48.06	85.99	0.0166	Downward	83.55	-0.0031	Upward
WHF-1-1	19.62		85.19			83.70		
WHF-17-1S	79.46	43.75	91.13	-0.0174	Upward	90.80	0.0011	Downward
WHF-17-1	35.71		91.89			90.75		
Notes: msl = mean sea level. ft/ft = feet per foot.								

Hydraulic Conductivity and Seepage Velocity. Four slug tests were conducted in the Northwest Disposal and Crash Crew Training Areas during the RI. Table 5-11 summarizes the hydraulic conductivity values calculated for monitoring wells in the Northwest Disposal and Crash Crew Training Areas. Three trials of rising head slug tests were conducted in four monitoring wells in the Northwest Disposal and Crash Crew Training Areas.

Hydraulic conductivity data from monitoring well WHF-18-2 were rejected because they exceeded the 20 percent variance criteria in the data validation procedure. The validation of hydraulic conductivity data is presented in Section 2.3 in Table 2-2 of Technical Memorandum No. 4, Hydrogeologic Assessment, January 1995 (ABB-ES, 1995b).

Average hydraulic conductivity values for individual monitoring wells ranged from 4.01 feet per day (ft/day) (1.42×10^{-3} centimeters per second [cm/sec]) for WHF-17-2 to 19.47 ft/day (6.87×10^{-3} cm/sec) for WHF-1-1S. The screen interval lithology (fine- to medium-grained sand) around monitoring wells WHF-1-1S and WHF-2-1 was almost five times more conductive than the lithology (poorly graded medium-grained sand) around WHF-17-2S. The geometric mean of the hydraulic conductivity data from Sites 1, 2, and 17 was 11.43 ft/day (4.03×10^{-3} cm/sec).

Seepage Velocity. Table 5-12 summarizes the average linear pore water velocity (seepage velocities) for the water table zone of the sand and gravel aquifer for sites in the Northwest Disposal and Crash Crew Training Areas. The calculations used an assumed effective porosity (n) of 0.35 for the site. The value represents silty through poorly graded sands (Fetter, 1988). Seepage velocities for individual sites ranged from 0.02 ft/day at Site 17 to 0.26 ft/day at Sites 1 and 2. The average of the seepage velocity values for the Northwest Disposal and Crash Crew Training Area sites was 0.17 ft/day (62 feet per year [ft/yr]).

Table 5-11
Summary of Hydraulic Conductivity (K) Data from Slug Tests

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 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Well Number	Range of K (ft/day)	Number of Usable Runs	Average K (ft/min)	Average K (ft/day)	Average K (cm/sec)
Shallow/Intermediate Monitoring Wells					
Site 1, Northwest Disposal Area					
WHF-1-1S	18.09 to 20.33	3	0.0135	19.47	6.87×10^{-3}
Site 2, Northwest Open Disposal Area					
WHF-2-1	16.79 to 20.35	3	0.0133	19.14	6.75×10^{-3}
Site 17, Crash Crew Training Area					
WHF-17-2	3.67 to 4.50	2	0.0028	4.01	1.42×10^{-3}
Site 18, Crash Crew Training Area					
WHF-18-2	R	R	R	R	R
Geometric Mean				11.43	4.03×10^{-3}
Notes: Average is the arithmetic average.					
ft/day = feet per day.			cm/sec = centimeters per second.		
ft/min = feet per minute.			R = data rejected.		

Table 5-12
Summary of Seepage Velocities

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Investigation Area	Sites	Monitoring Well Pair	Horizontal ¹ Gradient (ft/ft)	K ² (ft/day)	Effective Porosity (n)	Seepage Velocity (ft/day)
Northwest Disposal and Crash Crew Training Area	1	WHF-1-1S and WHF-1-2	0.0043	19.47	0.35	0.24
	1 and 2	WHF-1-1S and WHF-2-1	0.0048	19.14	0.35	0.26
	17	WHF-17-1S and WHF-17-2	0.0017	4.01	0.35	0.02
Arithmetic average						0.17

¹ Horizontal gradients are the average value for all groundwater measurements performed between September 30, 1993 and November 9, 1996.

² The K is averaged where values are available for both wells in the well pair.

Notes: ft/ft = feet per foot.
 K = hydraulic conductivity (ft/day).
 ft/day = feet per day.

6.0 HUMAN HEALTH RISK ASSESSMENT

An HHRA has been conducted as part of the RI for Site 1 at NAS Whiting Field. The purpose of the HHRA is to characterize the risks associated with the potential exposures to site-related chemicals. This HHRA is conducted in accordance with the following guidance documents:

- *Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A)* (USEPA, 1989b),
- *Guidance for Data Useability in Risk Assessment (Part A)*, Final (USEPA, 1992a), and
- *Region IV Risk Assessment Guidance* (USEPA, 1995b).

Additionally, the HHRA will consider FDEP guidance:

- *Soil Cleanup Goals for Florida* (FDEP, 1995),
- *Applicability of Soil Cleanup Goals for Florida* (FDEP, 1996), and
- *Groundwater Guidance Concentrations* (FDEP, 1994).

The methodology for the HHRA is described in Chapter 2.0 of the GIR (ABB-ES, 1998). The HHRA methodology presented in the GIR (ABB-ES, 1998) consists of the following steps:

- data evaluation
- selection of chemicals of potential concern
- exposure assessment
- toxicity assessment
- risk characterization

Site 1 is located in the Northwest Disposal Area of Whiting Field. The site is a wooded, pine-tree planted area. The location, physical description, and history associated with Site 1 are described in Chapter 1.0 of this report. During the RI, surface soil, subsurface soil, and groundwater were collected from Site 1. The investigation methodology, sampling locations, and the sampling rationale are presented in Chapter 3.0 of this report. A discussion of the analytical results is presented in Chapter 5.0.

6.1 DATA EVALUATION. The data evaluation involves numerous activities, including sorting data by medium, evaluating analytical methods, evaluating quantitation limits, and evaluating quality of data with respect to qualifiers and codes.

The DQOs for collecting environmental samples and conducting laboratory analyses are described in the GIR (ABB-ES, 1998). Chemical analyses were performed in accordance with the CLP Statement of Work. The analytical results were evaluated, using the National Functional Guidelines (USEPA, 1988; USEPA, 1991b) to assess the laboratory's compliance with the analytical methodology. The analytical data were reviewed, validated, and evaluated using the PARCC criteria specified in the DQOs. Based on a third party's evaluation of the analytical

data's conformance with the DQOs, the data presented in this report are acceptable for use in this HHRA.

CRDLs are compared to Federal USEPA, USEPA Region III Risk-Based Concentrations (RBCs), and Florida screening values. Surface and subsurface soil CRDLs were compared to Region III RBCs for soils and Florida Cleanup Goals for residential and industrial scenarios, respectively. Groundwater CRDL were compared to Florida Guidance Concentrations and Region III tap water RBCs. Analyte-specific sample quantitation limit (SQLs) that are above RBCs, Federal USEPA, and Florida screening values are identified and discussed in the uncertainty analysis.

The data set used for the HHRA is consistent with the data set described in the RI report. However, the groundwater evaluated in the HHRA is only from the Phase IIB RI sampling event, the most recent sampling event (July 1996). The Phase IIB sampling event included low-flow groundwater sampling techniques, as opposed to the use of a bailer. The low-flow sampling produced groundwater samples of low turbidity that are more representative of the actual aquifer conditions and were therefore indicated as the preferred data set.

6.2 SELECTION OF HUMAN HEALTH CHEMICALS OF POTENTIAL CONCERN (HHPCs). HHPCs were selected per the methodology described in Section 2.5 of the GIR (ABB-ES, 1998). This HHPC methodology considers (1) frequency of detection of analytes, (2) consistency with background conditions, (3) a comparison to regulatory and risk-based screening values, and (4) presence in blanks or laboratory quality control samples.

In selecting HHPCs, USEPA Region IV criteria will be used (USEPA, 1995a). For each medium, the following criteria will be employed to exclude detected analytes from the list of HHPCs. Each criterion by itself is justification for excluding the analyte:

Less than 5 Percent Frequency of Detection. If an analyte has a frequency of detection (number of samples in which the analyte is detected divided by the number of samples analyzed for that analyte) less than 5 percent (USEPA, 1995a) and is not selected as an HHPC in another medium, it is not selected as an HHPC. The frequency of detection screening criteria are only considered when there are greater than 20 samples in a specific media; therefore, no HHPCs were eliminated from this HHRA based on this screening criteria.

Less than Background Screening Concentrations. If the maximum detected concentration of an analyte is less than twice the arithmetic mean of the background concentration (inorganics only), the analyte is not selected as an HHPC (USEPA, 1995b). The background screening values for surface soil, groundwater, and subsurface soil are identified below.

- A representative surface soil background data set consisting of eight Troup Loamy Soil samples is used for background screening of Site 1 surface soil. Sample locations are identified on Figure 3-10, and sampling rationales are discussed in Subsection 3.3.1 of the GIR (ABB-ES, 1998). The background surface soil data used for screening Site 1 surface soils at Site 1 are presented in Table 3-8 of the GIR (ABB-ES, 1998). Table 3-9 in the GIR (ABB-ES, 1998) presents the summary statistics and background screening value (twice the arithmetic

mean of detected analyte concentrations) used in the Site 1 HHRA surface soil evaluation.

- Sixteen background subsurface soil sample locations for Whiting Field are identified in Figure 3-10 and are discussed in Subsection 3.3.1 of the GIR (ABB-ES, 1998). Tables 3-15 through 3-17 present analyte concentrations detected in the background samples for various types of subsurface soil. All background subsurface soil data were combined into one data set for background screening due to the limited number of background samples of certain soil types. Table 3-18 in the GIR (ABB-ES, 1998) presents the summary statistics for analytes detected in background subsurface soil samples and used for selecting HHCCPs in Site 1 subsurface soil.
- Ten groundwater samples were collected from upgradient or cross-gradient monitoring well locations that are consistent with background conditions. Groundwater sample locations are identified on Figure 3-12 and are discussed in Subsection 3.3.3 of the GIR (ABB-ES, 1998). Table 3-21 presents background screening data for groundwater. Table 3-24 presents the summary statistics used for screening the groundwater at Site 1.

Less than Risk-Based Screening Concentrations, Standards, and Guidelines. If the maximum detected concentration of the analyte in a medium is less than its corresponding adjusted USEPA Region III RBC (USEPA, 1997a), and less than Federal and Florida standards and guidelines, the analyte is not selected as a HHCCP (USEPA, 1995b). In the USEPA Region III RBC table, the target hazard quotient (HQ) is 1 and the target cancer risk is 1×10^{-6} . All RBCs based on noncarcinogenic effects are adjusted for a target HQ of 0.1 per Region IV guidance (USEPA, 1995b).

The residential and industrial soil RBCs are used for surface and subsurface soil, respectively. FDEP has approved a site-specific soil cleanup goal for arsenic of 4.62 mg/kg. This site-specific soil cleanup goal is based on the combined use of surface and subsurface soil at covered landfill sites, as detailed in Appendix G. No RBC is available for lead in soil due to a lack of toxicity data. Based on USEPA recommendation, a screening level of 400 mg/kg for lead under residential land use is used as the RBC for lead in soil (USEPA, 1994c). The maximum detected concentrations of analytes in surface soil are also compared to residential Florida Soil Cleanup Goals reference. The maximum detected concentration of any organic analyte in surface soil that was also detected in groundwater (above a standard or guideline) is compared to the Florida Leaching Value reference for that analyte.

For groundwater, tap water RBCs (March 1997), Federal MCLs (February 1996) and Florida Guidance Concentrations (June 1994) are used. No RBC is available for lead in groundwater; therefore, the treatment technology action level for lead in drinking water of 15 $\mu\text{g}/\ell$ is used (USEPA, 1994c).

Less than Essential Nutrient Screening Values. If the maximum detected concentration of an essential nutrient (i.e., sodium, potassium, magnesium, chloride, iodine, phosphorus, and calcium) in a medium is below a toxic level and consistent with or only slightly above its background concentration, the

essential nutrient is not selected as an HHCP. The derivation of essential nutrient screening values is presented in the GIR.

HHCPs were not screened using the iron essential nutrient value; however, if iron is determined to be a risk driver, a comparison of the risk concentrations against the essential nutrient level for iron will be presented in the uncertainty section for that medium.

Within Five Times the Associated Blank Concentrations. The concentrations are within 5 times or 10 times the concentrations in associated blanks (USEPA, 1989b, USEPA, 1992a).

If the analyte meets any of the above criteria, is not a member of the same chemical class as other HHCPs in the medium, and is not a breakdown product of other HHCPs in the medium, then the analyte is not selected as an HHCP. In situations where multiple screening values are available, a chemical is excluded only if its maximum concentration is less than all of the corresponding screening values. Appendix E present the RBCs, regulatory guidance values, and ARARs that are used in HHCP selection. After applying these criteria with professional judgment, HHCPs are identified for each medium. HHCP selection for each medium is presented below in Paragraphs 5.2.2.1 through 5.2.2.3.

6.2.1 Site 1 Surface Soil Eight samples (01-SL-01, 01-SL-02, 01-SL-03 and its duplicate 01-SL-03A, and 01S00101 through 01S00501) were collected from Site 1 (Figure 3-2). VOCs, SVOCs, PCBs, and inorganic data from all of these samples are evaluated in this HHRA. Table 6-1 identifies the three inorganic analytes (aluminum, arsenic, and iron) selected as HHCPs for surface soil at Site 1.

6.2.2 Site 1 Subsurface Soil One subsurface soil sample (01SS0101) and a reanalysis of pesticides and PCBs in 01SS0101RE collected from test pit PP-01-01 were collected from Site 1 (Figure 3-3). VOCs, SVOCs, pesticides, PCBs, and inorganic data from this sample are evaluated in this HHRA. Table 6-2 presents the HHCPs selected for subsurface soil at Site 1. No analytes were selected as HHCPs in the subsurface soil.

6.2.3 Site 1 Groundwater Five groundwater samples (01G00101 through 01G00501 and the duplicate sample for 01G00102 [01G00102D]) were collected from Site 1 (Figure 3-4). VOCs, SVOCs, pesticides, PCBs, and inorganic data from these samples are evaluated in this HHRA. The 1996 sampling event for groundwater, which used the low-flow method described in Section 3.5, was evaluated in this HHRA. As shown in Table 6-3, two inorganics (aluminum and iron) were selected as HHCPs in groundwater.

6.3 EXPOSURE ASSESSMENT. The exposure assessment methodology is described in Subsection 2.5.3 of the GIR (ABB-ES, 1998). This process involves several steps:

- characterization of the exposure setting in terms of physical characteristics and the populations that may potentially be exposed to site-related chemicals;
- identification of potential exposure pathways and receptors; and

Table 6-1
Selection of Human Health Chemicals of Potential Concern
for Surface Soil Associated with Site 1

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Milton, Florida

Analyte	Frequency of Detection ¹	Range of Reporting Limits	Range of Detected Concentrations ²	Mean of Detected Concentrations ³	Background Screening Concentration ⁴	Selected Screening Concentration ⁵	Analyte HHCP? (Yes/No)	Reason ⁶
Volatile Organic Compounds (µg/kg)								
Xylene	2/8	6 to 11	1 to 2*	1.5	NA	13,000,000	No	S
Pesticides (µg/kg)								
Dieldrin	1/8	3.6 to 19	1.5	1.5	NA	40	No	S
Inorganic Analytes (mg/kg)								
Aluminum	8/8	NA	4,530 to 15,200	10,600	15,848	7,800	Yes	
Arsenic	8/8	NA	1.3 to 4.2	2.9	3.2	0.43	Yes	
Barium	8/8	NA	5.4 to 18	12.6	23.2	550	No	B, S
Beryllium	8/8	NA	0.05 to 0.17	0.12	0.36	0.15	No	B
Cadmium	1/8	1	0.71	0.71	0.58	3.9	No	S
Calcium	2/8	1,000	264 to 321	293	396	1,000,000	No	B, S
Chromium	8/8	NA	3.8 to 30*	12.6	11.0	39	No	S
Cobalt	5/8	10	0.72 to 1.3	0.99	3.0	470	No	B, S
Copper	5/8	5	4.4 to 7.1	5.5	9.4	310	No	B, S
Cyanide	3/8	0.5 to 1	0.13 to 1.1	0.51	0.28	160	No	S
Iron	8/8	NA	2,980 to 11,800*	7,780	8,832	2,300	Yes	
Lead	7/8	0.6 to 1	3.5 to 44	10.8	11.4	400	No	S
Magnesium	8/8	NA	61.1 to 293	167	268	460,468	No	S
Manganese	8/8	NA	5.6 to 85	38.4	392	180	No	B, S
Mercury	5/8	0.1	0.01 to 0.195*	0.05	0.12	2.3	No	S
Nickel	1/8	8	3.5*	3.5	7.2	160	No	B, S
Potassium	4/8	1,000	141 to 329*	240	177	1,000,000	No	S
Sodium	2/8	1,000	185 to 219	202	406	1,000,000	No	B, S
Vanadium	8/8	NA	8.1 to 33.6	21.7	21.8	55	No	S
Zinc	7/8	4	3.9 to 11.5*	7.1*	15.4	2,300	No	B, S

See notes at end of table.

Table 6-1 (Continued)
Selection of Human Health Chemicals of Potential Concern
for Surface Soil Associated with Site 1

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station, Whiting Field
Milton, Florida

¹ Frequency of detection is the number of samples in which the analyte was detected over the total number of samples analyzed (excluding rejected values).

² A value indicated by an asterisk is the average of a sample and its duplicate. For duplicate samples having one nondetect, one-half of the contract-required quantification limit/contract-required detection limit is used as a surrogate concentration for the nondetect.

³ The mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples with "R", "U", or "UU" validation qualifiers.

⁴ The background screening value is twice the average of detected concentrations for inorganic analytes in background samples.

⁵ For all chemicals except the essential nutrients (calcium, magnesium, potassium, and sodium), the lesser of the U.S. Environmental Protection Agency (USEPA) Region III Risk-Based Concentration (RBC) table for residential soil exposure per January 1993 guidance ("Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening," EPA/903/R-93-001) or the Florida Soil Cleanup Goals residential scenario (Florida Department of Environmental Protection, 1996) was used for screening. For inorganic analytes that are HHCCPs in groundwater, the Florida Soil Cleanup Goals based on leachability were also used for screening. Values from the USEPA Region III RBC Tables, dated May 30, 1996, are based on an excess lifetime cancer risk of 10^{-6} or an adjusted hazard quotient of 0.1. For the essential nutrients, screening values were derived based on recommended daily allowances. Lead value is from the Revised Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites (OSWER Directive 9355.4-12) (USEPA, 1994c). Values are presented in Appendix E of this Remedial Investigation report.

⁶ Analyte was included or excluded from the risk assessment for the following reasons:

B = the maximum detected concentration did not exceed the background screening concentration; therefore, the analyte will not be considered further.

S = the maximum detected concentration did not exceed the screening concentration; therefore, the analyte will not be considered further.

Notes: The average of a sample and its duplicate is used for all table calculations.

Samples: 01-SL-01, 01-SL-02, 01-SL-03, 01S00101, 01S00201, 01S00301, 01S00401, 01S00501.

Duplicate sample: 01-SL-03A.

Background samples: BKG-SL-02, BKG-SL-06, BKG-SL-07, BKG-SL-08, BKS00101, BKS00201, BKS00401, and BKS00501.

Background duplicate sample: BKS00201D.

HHCCP = human health chemical of potential concern.

$\mu\text{g}/\text{kg}$ = micrograms per kilogram.

mg/kg = milligrams per kilogram.

NA = not applicable.

* = average of a sample and its duplicate.

Table 6-2
Selection of Human Health Chemicals of Potential Concern
for Subsurface Soil Associated with Site 1

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station, Whiting Field
Milton, Florida

Analyte	Frequency of Detection ¹	Range of Reporting Limit	Range of Detected Concentrations	Mean of Detected Concentrations ²	Background Screening Concentration ³	Selected Screening Concentration ⁴	Analyte HHCPC? (Yes/No)	Reason ⁵
Volatile Organic Compounds (µg/kg)								
Acetone	1/1	NA	51	51	NA	1,800,000	No	S
Inorganic Analytes (mg/kg)								
Aluminum	1/1	NA	4,780	4,780	25,400	100,000	No	B, S
Arsenic	1/1	NA	1.1	1.1	5.8	3.7	No	B, S
Barium	1/1	NA	6.3	6.3	15.4	14,000	No	B, S
Beryllium	1/1	NA	0.08	0.08	0.26	1.0	No	B, S
Calcium	1/1	NA	56.7	56.7	438	1,000,000	No	B, S
Chromium	1/1	NA	6	6	20.8	430	No	B, S
Copper	1/1	NA	2.5	2.5	8.2	8,200	No	B, S
Iron	1/1	NA	5,100	5,100	16,500	61,000	No	B, S
Lead	1/1	NA	2.6	2.6	8.6	400	No	B, S
Magnesium	1/1	NA	76	76	264	460,468	No	B, S
Manganese	1/1	NA	8.4	8.4	40.6	4,700	No	B, S
Mercury	1/1	NA	0.17	0.17	ND	61	No	S
Nickel	1/1	NA	1.7	1.7	5.2	4,100	No	B, S
Sodium	1/1	NA	167	167	ND	1,000,000	No	S
Vanadium	1/1	NA	13	13	41.2	1,400	No	B, S
Zinc	1/1	NA	6.1	6.1	15.6	61,000	No	B, S
See notes at end of table.								

Table 6-2 (Continued)
Selection of Human Health Chemicals of Potential Concern
for Subsurface Soil Associated with Site 1

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station, Whiting Field
Milton, Florida

¹ Frequency of detection is the number of samples in which the analyte was detected over the total number of samples analyzed (excluding rejected values).

² The mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples with "R", "U", or "UJ" validation qualifiers.

³ The background screening value is twice the average of detected concentrations for inorganic analytes in background samples.

⁴ For all chemicals except the essential nutrients (calcium, magnesium, potassium, and sodium), lesser of the U.S. Environmental Protection Agency (USEPA) Region III Risk-Based Concentration (RBC) table for industrial soil exposure per January 1993 guidance ("Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening," EPA/903/R-93-001) or Florida Soil Cleanup Goals industrial scenario (Florida Department of Environmental Protection, 1996) were used for screening. For inorganic analytes that are HHCPs in groundwater, the Florida Soil Cleanup Goals based on leachability were also used for screening. Actual values are taken from the USEPA Region III RBC Tables dated May 30, 1996, and are based on an excess lifetime cancer risk of 10^{-6} or an adjusted hazard quotient of 0.1. For the essential nutrients, screening values were derived based on recommended daily allowances. Lead value is from the Revised Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites (OSWER Directive 9355.4-12) (USEPA, 1994c). Values are presented in Appendix E of this Remedial Investigation report.

⁵ Analyte was included or excluded from the risk assessment for the following reasons:

B = the maximum detected concentration did not exceed the background; therefore the analyte will not be considered further.

S = the maximum detected concentration did not exceed the screening concentration; therefore, the analyte will not be considered further.

Notes: The average of a sample and its duplicate is used for all table calculations.

Samples: 01SS0101, 01SS0101RE (PCBs/pesticides only)

Background samples: BKB00101, BKB00102, BKB201, BKB00202, BKB00301, BKB00302, BKB00401, BKB00402, BKB00501, BKB00502, BKB00601, BKB00602, BKB00701, BKB00702

Background duplicate samples: BKB00401D and BKB00602D

HHCP = human health chemical of potential concern.

$\mu\text{g}/\text{kg}$ = micrograms per kilogram.

NA = not applicable.

ND = not detected in any background sample.

mg/kg = milligrams per kilogram.

Table 6-3
Selection of Human Health Chemicals of Potential Concern
for Unfiltered Groundwater Associated with Site 1

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station, Whiting Field
Milton, Florida

Analyte	Frequency of Detection ¹	Reporting Limit Range	Range of Detected Concentrations ²	Mean of Detected Concentrations ³	Background Screening Concentration ⁴	Selected Screening Concentration ⁵	Analyte HHCP? (Yes/No)	Reason ⁶
<u>Volatile Organic Compounds (µg/l)</u>								
Carbon disulfide	1/5	10	1	1	NA	100	No	S
<u>Semivolatile Organic Compounds (µg/l)</u>								
bis(2-Ethylhexyl)phthalate	1/5	10	2	2	NA	4.8	No	S
<u>Inorganic Analytes (µg/l)</u>								
Aluminum	2/5	NR	202 to 842	522	654	50	Yes	
Barium	5/5	NA	15.6 to 71.4	28.7	72.6	260	No	B, S
Beryllium	3/5	NR	0.51 to 0.53	0.44	0.58	0.016	No	B
Calcium	5/5	NA	712 to 6,050*	2,250	3,316	1,055,398	No	S
Chromium	2/5	NR	5.8 to 7.2	6.5	30	18	No	B, S
Copper	3/5	NR	1.4 to 2.4	1.6	10.7	150	No	B, S
Cyanide	1/5	NR	1.9	0.95	7.0	73	No	B, S
Iron	3/5	NR	246 to 2,630	1,044	964	300	Yes	
Magnesium	5/5	NA	334* to 807	644	2,430	118,807	No	B, S
Manganese	5/5	NA	3.4 to 10.5	6.6	42.8	50	No	B, S
Nickel	3/5	NR	7.4 to 11	9.3	42.8	73	No	B, S
Potassium	4/5	NR	554 to 890*	698	1,530	297,016	No	B, S
Sodium	5/5	NA	1,550 to 2,330	2,000	4,770	160,000	No	B, S
Vanadium	3/5	NR	0.8* to 9	3.7	3.8	26	No	S
Zinc	2/5	NR	7.2 to 90.8	80.5	200	1,100	No	B, S

See notes at end of table.

Table 6-3 (Continued)
Selection of Human Health Chemicals of Potential Concern
for Unfiltered Groundwater Associated with Site 1

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station, Whiting Field
Milton, Florida

¹ Frequency of detection is the number of samples in which the analyte was detected over the total number of samples analyzed (excluding rejected values).

² The value indicated by an asterisk is the average of a sample and its duplicate. For duplicate samples having one nondetect, one-half of the contract-required quantification limit/contract-required detection limit is used as a surrogate concentration for the nondetect.

³ The mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples with "R", "U", or "UJ" validation qualifiers.

⁴ The background screening value is twice the average of detected concentrations for inorganic analytes in background samples.

⁵ For all chemicals except the essential nutrients (calcium, magnesium, potassium, and sodium). The lesser of the U.S. Environmental Protection Agency (USEPA), Region III Risk-Based Concentration (RBC) table for tap water exposure per January 1993 guidance ("Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening," EPA/903/R-93-001) or the Florida "Groundwater Concentration" (Florida Department of Environmental Protection, 1996) was used for screening. Actual values are taken from the USEPA Region III RBC Tables dated May 30, 1996, and are based on an excess lifetime cancer risk of 10^{-6} or an adjusted hazard quotient of 0.1. For the essential nutrients, screening values were derived based on recommended daily allowances. Values are presented in Appendices B-1 and B-2 of the General Information Report (ABB-ES, 1998).

⁶ Analyte was included or excluded from the risk assessment for the following reasons:

B = the maximum detected concentration did not exceed the background screening concentration; therefore, the analyte will not be considered further.

S = the maximum detected concentration did not exceed the screening concentration; therefore, the analyte will not be considered further.

Notes: The average of a sample and its duplicate is used for all table calculations.

Samples: 01G00101 through 01G00401, and 01G00102

Duplicate sample: 01G00102D

Background samples: BKG00101 through BKG00103, BKG00201 through BKG00203, BKG00301 through BKG00303

Background duplicate sample: BKG00101D

HHPCP = human health chemical of potential concern.

$\mu\text{g}/\ell$ = micrograms per liter.

NA = not applicable.

NR = not reported.

* = average of a sample and its duplicate.

- quantification of exposure for each population in terms of the amount of chemical either ingested, inhaled, or absorbed through the skin from all complete exposure pathways.

Summaries of potential exposure pathways to chemicals detected at Site 1 are presented on Figure 6-1. The potential pathways, including medium and route of exposure, the potentially exposed population, and the rationale for pathway selection or exclusion, are provided in Table 6-4 and are described in more detail in Subsections 6.3.1 through 6.3.3. Receptor-specific exposure parameters for each exposure scenario are presented in Appendix C to the GIR (ABB-ES, 1998).

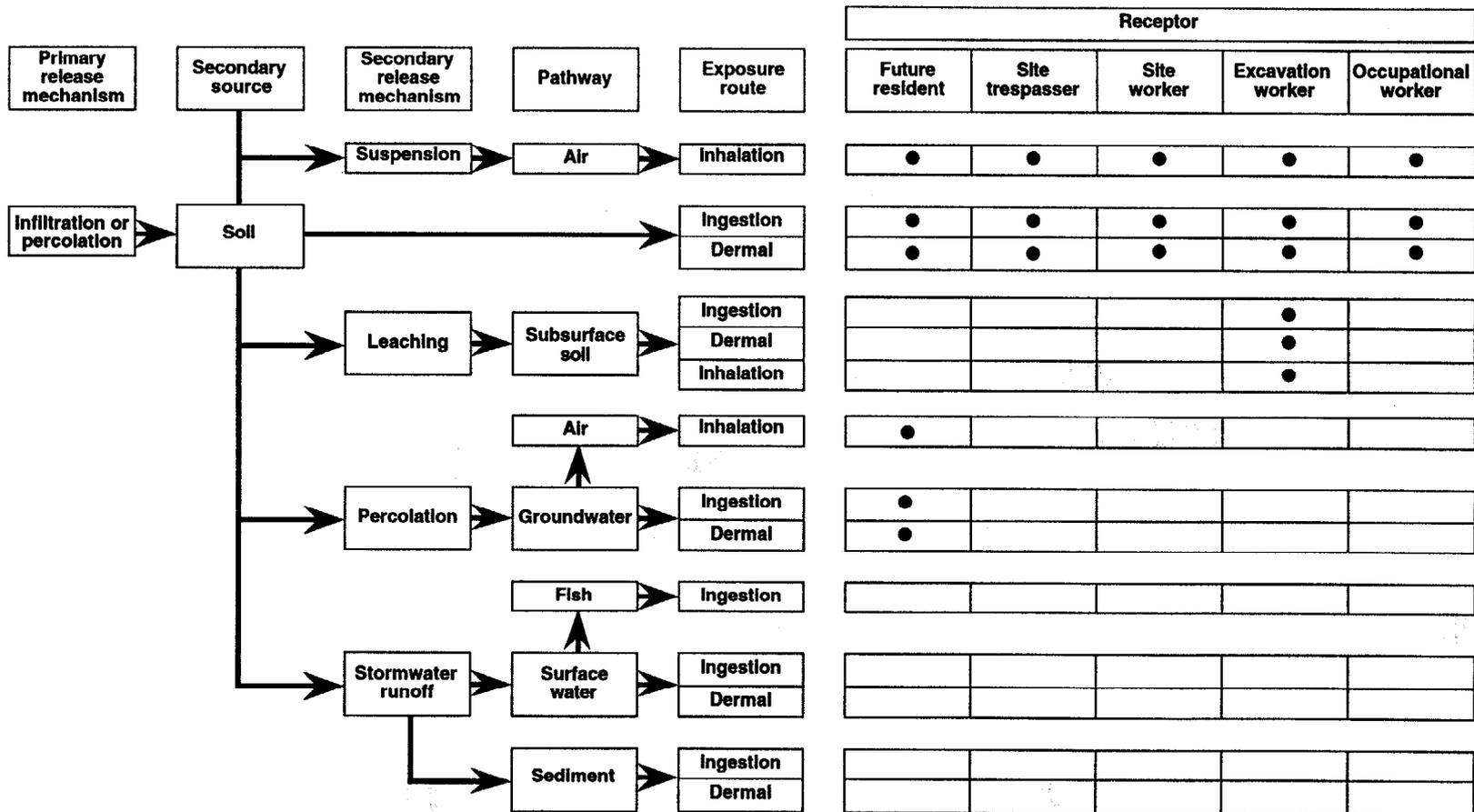
Risk calculation spreadsheets in Appendix E to this RI report also contain the assumed exposure parameters and quantitation of exposures.

6.3.1 Site 1 Surface Soil No humans currently reside or work at Site 1. Currently there are no plans for residential development. However, Site 1 may be developed eventually for residential land use; therefore, the residential receptor will be evaluated as part of the potential future land-use scenario. Since there are no buildings present at the site, exposure of occupational workers will be only considered as part of the future land-use scenario. Other possible future exposure scenarios include excavation activities, such as installation of utility lines, and site maintenance, such as mowing the grass. Site maintenance activities may also include occasional silvaculture activities by a forestry worker.

Site 1 is located by the northwest facility boundary so adult and adolescent trespassers could obtain access to the site. Exposures of potential future residents (combined adult and child), potential future occupational workers, current and future site maintenance workers, future excavation workers, and current and future trespassers (combined adult and child) to surface soil contaminants through ingestion, dermal contact, and inhalation of particulates are evaluated in this HHRA.

6.3.2 Site 1 Subsurface Soil There are no current exposures to subsurface soil because no excavation or construction activities are ongoing at Site 1. However, if Site 1 is developed for residential or industrial use or if excavation activities occur in the future, an excavation worker could be exposed to contaminants in subsurface soil. Therefore, exposure of excavation or construction workers to contaminants in subsurface soil (incidental ingestion, dermal contact, and inhalation of fugitive dust) would have been evaluated in this HHRA, but there were no HHCCPs identified.

6.3.3 Site 1 Groundwater Currently, groundwater at Site 1 is not used for any potable or nonpotable purpose. However, in the event that Site 1 or areas hydraulically downgradient of Site 1 are developed for residential use, the exposure pathway to chemicals in groundwater could become complete. Therefore, hypothetical future domestic use of the surficial aquifer (adult and child ingestion) is evaluated in this HHRA as a worst-case estimate of potential future receptors (i.e., future potential worker scenarios are not evaluated). Inhalation of volatiles and dermal contact with groundwater while showering is not evaluated because no VOCs were selected as HHCCPs.



NOTE:
NAS = Naval Air Station

**FIGURE 6-1
SITE 1, COMPLETE EXPOSURE PATHWAYS
FOR HUMAN RECEPTORS**



**REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST
DISPOSAL AREA**

**NAS WHITING FIELD
MILTON, FLORIDA**

Table 6-4
Summary of Potential Exposure Pathways, Site 1

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station, Whiting Field
 Milton, Florida

Medium of Exposure	Route of Exposure	Potentially Exposed Population	Selected for Evaluation?	Reason for Selection or Evaluation
<u>Current Land Use</u>				
Surface Soil	Dermal contact with soil, ingestion of soil, and inhalation of fugitive dust.	Resident (adult and child)	No	No humans currently reside or work at Site 1. Adolescents and adults may be exposed to contaminants in the surface soil while trespassing. The site maintenance workers may be exposed to contaminants in surface soil while performing routine site activities.
		Trespasser (adult and adolescent)	Yes	
		Occupational worker (adult)	No	
		Site maintenance worker (adult)	Yes	
		Excavation worker (adult)	No	
Subsurface Soil	Dermal contact with soil, ingestion of soil, and inhalation of fugitive dust.	Excavation worker (adult)	No	No excavation activities are currently ongoing at Site 1.
Groundwater	Ingestion of groundwater as drinking water.	Resident (adult and child)	No	There are no current exposures to groundwater.
<u>Future Land Use</u>				
Surface soil	Dermal contact with soil, ingestion of soil, and inhalation of fugitive dust.	Resident (child and adult)	Yes	If Site 1 is developed for residential use, residents could be exposed to chemicals in surface soil. Exposure of trespasser, occupational worker, site maintenance worker, and excavation worker to chemicals in surface soil is possible if the site is developed in the future.
		Trespasser (adolescent and adult)	Yes	
		Occupational worker (adult)	Yes	
		Site maintenance worker (adult)	Yes	
		Excavation worker (adult)	Yes	
Subsurface soil	Dermal contact with soil, ingestion of soil, and inhalation of fugitive dust.	Excavation worker (adult)	Yes	An excavation worker could be exposed to subsurface soil during excavation activities if the site is developed in the future.
Groundwater	Ingestion of groundwater as drinking water and dermal contact with and inhalation of volatiles while showering	Resident (adult and child)	Yes	If Site 1 is developed for residential use, drinking water wells in the surficial aquifer could be influenced by contaminants in the groundwater associated with Site 1. Therefore, future residents could be exposed to contaminants in the surficial aquifer.

6.3.4 Exposure Point Concentrations (EPCs) EPCs for all HHCPs in surface soil and groundwater have been quantified according to Paragraph 2.5.3.3 of the GIR (ABB-ES, 1998). This quantification process involves developing assumptions regarding exposure conditions and exposure scenarios for each receptor to estimate the total amount of contaminants that a hypothetical receptor may ingest, dermally absorb, or inhale from each exposure pathway. The ultimate goal of this step, as defined in USEPA guidance, is to identify the combination of these exposure variables or parameters that results in the most intense level of exposure that may "reasonably" be expected to occur under current and future site conditions (USEPA, 1989b).

The EPCs for HHCPs in surface soil and groundwater are presented in Tables 6-5 and 6-6, respectively (there were no HHCPs selected for subsurface soil). The EPCs were used with receptor-specific exposure parameters to quantify exposures to the HHCPs, as shown in the risk calculation spreadsheets in Appendix E to this report.

6.4 TOXICITY ASSESSMENT. The toxicity assessment evaluates the available evidence on the potential adverse effects associated with exposure to each HHCP. With this information, a relationship between the extent of exposure and the likelihood or severity of adverse human health effects is developed. Two steps are typically associated with toxicity assessment: hazard identification and dose-response assessment.

- Hazard identification is the process of determining if exposure to an agent can cause a particular adverse health effect and, more importantly, if that effect will occur in humans. The objectives of the hazard identification in the HHRA are to (1) identify which of the contaminants detected at the site are potential hazards, and (2) summarize their potential toxicity in brief nontechnical language.
- A dose-response assessment is conducted to characterize and quantify the relationship between intake, or dose, of an HHCP and the likelihood of a toxic effect or response. There are categories of toxic effects evaluated in this HHRA: carcinogenic and noncarcinogenic. Following USEPA guidance for HHRA (USEPA, 1989b), these two endpoints (cancer and noncancer) are evaluated separately. As a result of the dose-response assessment, identified dose-response values are used to estimate the incidence of adverse effects as a function of human exposure to a chemical.

The toxicity assessment methodology is described in Subsection 2.5.4 of the GIR (ABB-ES, 1998).

Appendix E to this report contains brief toxicity summaries for HHCPs identified in surface soil and groundwater at Site 1. Appendix E to this report also contains dose-response information for the HHCPs (Tables E-4 through E-9). Dose-response values used in this HHRA were current as of April 1997 for Integrated Risk Information System (IRIS) and November 1995 for Health Effects Assessment Summary Tables.

Table 6-5
Exposure Point Concentrations
for Human Health Chemicals of Potential Concern
for Surface Soil Associated with Site 1

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station, Whiting Field
 Milton, Florida

Analyte	Frequency of Detection ¹	Maximum Detected Concentration	95% UCL ²	Exposure Point Concentration ³
Inorganic Analytes (mg/kg)				
Aluminum	8/8	15,200	NC	15,200
Arsenic	8/8	4.2	NC	4.2
Iron	8/8	11,800	NC	11,800

¹ Frequency of detection is the number of samples in which the analyte was detected over the total number of samples analyzed (excluding rejected values).

² 95% UCL of the arithmetic mean is calculated using all samples. One-half the contract-required quantitation limit/contract-required detection limit is used as a surrogate for nondetects. The UCL is not calculated when there are less than 10 total samples.

³ Exposure point concentration is the lower of either the 95% UCL concentration or maximum detected concentration.

Notes: % = percent.

UCL = upper confidence limit (see footnote 2).

mg/kg = milligrams per kilogram.

NC = not calculated.

Table 6-6
Exposure Point Concentrations for Human Health Chemicals of Potential Concern,
Unfiltered Groundwater Associated with Site 1

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station, Whiting Field
 Milton, Florida

Analyte	Frequency of Detection ¹	Maximum Detected Concentration	Arithmetic Mean ²	Exposure Point Concentration ³
Inorganic Analytes (µg/l)				
Aluminum	2/5	842	209	209
Iron	3/5	2,630	626	626

¹ Frequency of detection is the number of samples in which the analyte was detected over the number of samples analyzed.

² Arithmetic mean of all samples calculated using one-half the contract-required detection limit for nondetects.

³ Exposure point concentration equals the arithmetic mean. If the maximum detected concentration is less than the arithmetic mean, the maximum detected concentration is the exposure point concentration.

Note: µg/l = micrograms per liter.

6.5 RISK CHARACTERIZATION. Risk characterization is the final step in the risk assessment process. This step involves the integration of the exposure and toxicity assessments into a qualitative or quantitative expression of potential human health risks associated with contaminant exposure. Quantitative estimates of both carcinogenic and noncarcinogenic risks are made for each HHCP and 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).

Risk estimates for potential exposures to surface soil and groundwater under current and potential future land use scenarios are discussed in Paragraphs 6.5.1 and 6.5.2. These risk estimates are then compared to Federal USEPA and FDEP carcinogenic and noncarcinogenic target levels.

The USEPA guidelines, established in the NCP, indicate that the total lifetime cancer risk due to exposure to the HHCPs at a site, by each complete exposure pathway, should not exceed a range of 1 in 1,000,000 (1×10^{-6}) to 1 in 10,000 (1×10^{-4}) (USEPA, 1990). FDEP has indicated that chemical-specific risks greater than one in one million (1×10^{-6}) warrant further consideration.

An HQ less than 1 indicates that noncarcinogenic toxic effects are not expected to occur due to HHCP exposure. Hazard indices (HIs) greater than 1 may be indicative of possible noncarcinogenic toxic effects, but the circumstances must be evaluated on a case-by-case basis (USEPA, 1989b). As the HI increases, so does the likelihood that adverse effects might be associated with exposure.

Table 6-7 summarizes the cancer and noncancer risk under a current land use scenario for Site 1. Table 6-8 summarizes the cancer and noncancer risk under a potential future land-use scenario for Site 1.

6.5.1 Site 1 Surface Soil

Current Land Use. The risk calculations for surface soil exposure are shown in Tables E-10 through E-23 in Appendix E to this report. The cancer risks associated with exposure to surface soil (ingestion, dermal contact, and fugitive dust inhalation) are 5×10^{-7} for an aggregate (combined adult and adolescent) trespasser, and 1×10^{-7} for a site maintenance worker. Both receptors' cancer risk values are less than the USEPA acceptable cancer risk range of 1×10^{-4} to 1×10^{-6} and FDEP's target risk of 1×10^{-6} . The noncancer risks associated with surface soil ingestion, dermal contact, and fugitive dust inhalation under current land use (adolescent trespasser, adult trespasser, and site worker) are below USEPA's and FDEP's target HI of 1. Figures 6-2 and 6-3 present summaries of cancer risks and HIs, respectively, associated with exposure scenarios under current land use.

Potential Future Land Use. The cancer risks associated with exposure to surface soil (ingestion, dermal contact, and fugitive dust inhalation) are 1×10^{-5} for an aggregate resident (combined adult and child), 5×10^{-7} for an aggregate trespasser (combined adult and adolescent), 1×10^{-6} for an occupational worker, 1×10^{-7} for a site maintenance worker, and 5×10^{-8} for an excavation worker. All of these potential future receptor risks are within or less than the USEPA acceptable cancer risk range; however, the potential future residential risk exceeds the Florida target risk of 1×10^{-6} (due to arsenic). Figure 6-4 presents a summary of cancer risk associated with exposure scenarios under future land use.

**Table 6-7
Risk Summary, Current Land Use for Site 1**

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station, Whiting Field
Milton, Florida

Land Use	Exposure Route	HI*	ELCR*
Current Land Use			
Surface Soil			
Adult Trespasser:	Incidental ingestion	0.01	3×10^{-7}
	Dermal contact	0.02	2×10^{-8}
	Inhalation of particulates	ND	9×10^{-11}
	Total Adult Trespasser:	0.03	3×10^{-7}
Adolescent Trespasser:	Incidental ingestion	0.02	2×10^{-7}
	Dermal contact	0.03	1×10^{-8}
	Inhalation of particulates	ND	5×10^{-11}
	Total Adolescent Trespasser:	0.05	2×10^{-7}
Total Risk to Trespasser (Adult and Adolescent) exposed to Surface Soil:		NC	5×10^{-7}
Site Maintenance Worker:	Incidental ingestion	0.004	1×10^{-7}
	Dermal contact	0.01	2×10^{-8}
	Inhalation of particulates	ND	4×10^{-10}
	Total Site Maintenance Worker:	0.02	1×10^{-7}
Notes: * = receptor totals may vary from spreadsheets due to rounding algorithm. HI = hazard index. ELCR = excess lifetime cancer risk. NC = not calculated because child and adult HIs are not additive. ND = no dose-response data for this exposure route were available for human health chemicals of potential concern in this medium.			

Table 6-8
Risk Summary, Future Land Use for Site 1

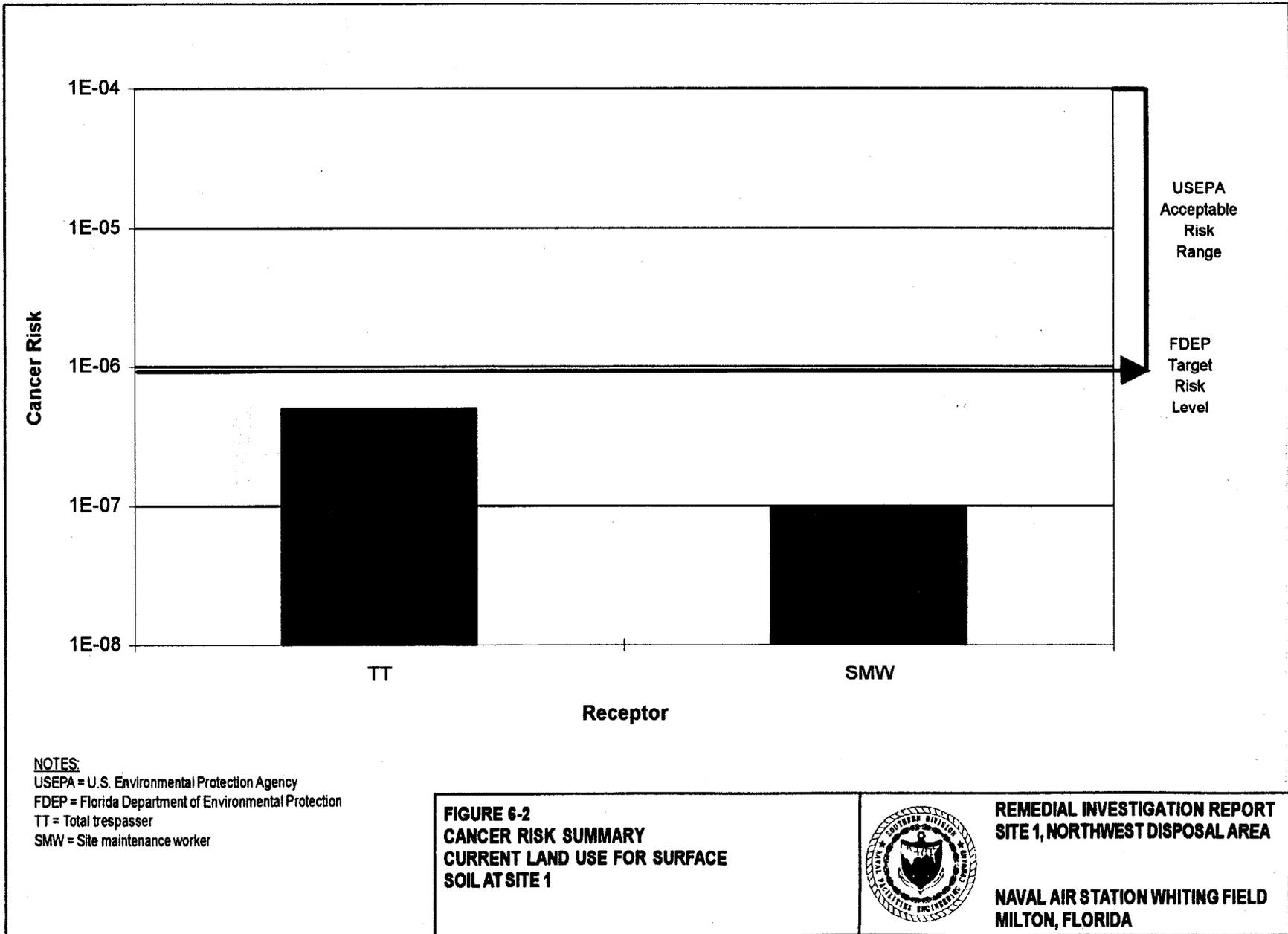
Remedial Investigation Report
Site 1, Northwest Disposal Area
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Milton, Florida

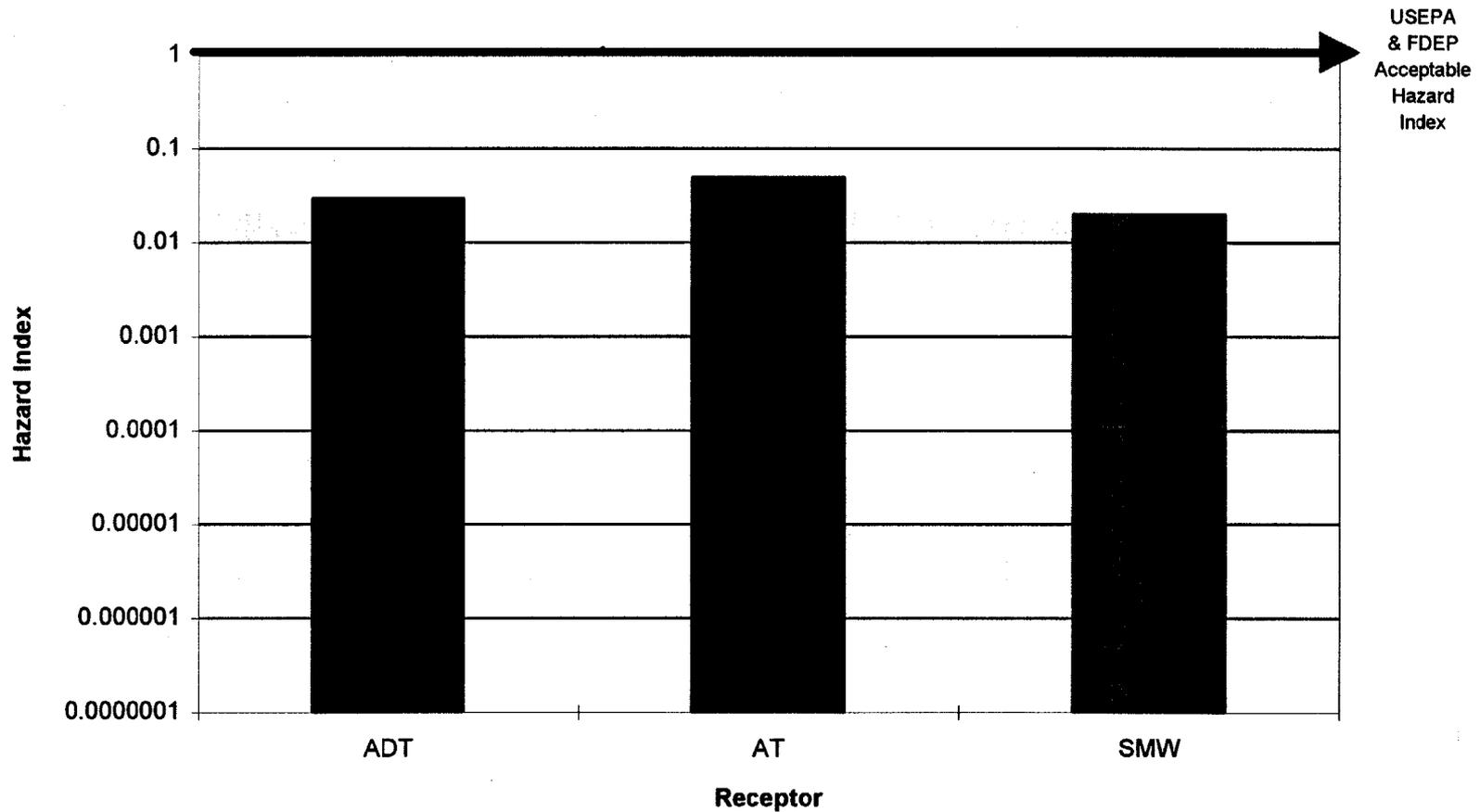
Land Use	Exposure Route	HI*	ELCR*
Future Land Use			
Surface Soil			
Adult Trespasser:	Incidental ingestion	0.01	3×10^{-7}
	Dermal contact	0.02	2×10^{-8}
	Inhalation of particulates	ND	9×10^{-11}
	Total Adult Trespasser:	0.03	3×10^{-7}
Adolescent Trespasser:	Incidental ingestion	0.02	2×10^{-7}
	Dermal contact	0.03	1×10^{-8}
	Inhalation of particulates	ND	5×10^{-11}
	Total Adolescent Trespasser:	0.05	2×10^{-7}
Total Risk to Trespasser (Adult and Adolescent) Exposed to Surface Soil:		NC	5×10^{-7}
Adult Resident:	Incidental ingestion	0.09	3×10^{-8}
	Dermal contact	0.2	2×10^{-7}
	Inhalation of particulates	ND	3×10^{-9}
	Total Adult Resident:	0.3	3×10^{-8}
Child Resident:	Incidental ingestion	0.9	7×10^{-6}
	Dermal contact	0.3	7×10^{-8}
	Inhalation of particulates	ND	4×10^{-9}
	Total Child Resident:	1	7×10^{-6}
Total Risk to Resident (Adult and Adolescent) Exposed to Surface Soil:		NC	1×10^{-5}
Occupational Worker:	Incidental ingestion	0.03	1×10^{-6}
	Dermal contact	0.05	5×10^{-8}
	Inhalation of particulates	ND	1×10^{-9}
	Total Occupational Worker:	0.08	1×10^{-6}
Site Maintenance Worker:	Incidental ingestion	0.004	1×10^{-7}
	Dermal contact	0.01	2×10^{-8}
	Inhalation of particulates	ND	4×10^{-10}
	Total Site Maintenance Worker:	0.02	1×10^{-7}
Excavation Worker:	Incidental ingestion	0.04	5×10^{-8}
	Dermal contact	0.01	6×10^{-10}
	Inhalation of particulates	ND	2×10^{-11}
	Total Excavation Worker:	0.05	5×10^{-8}
See notes at end of table.			

Table 6-8 (Continued)
Risk Summary, Future Land Use for Site 1

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station, Whiting Field
 Milton, Florida

Land Use	Exposure Route	HI*	ELCR*
Future Land Use			
Groundwater			
Adult Resident:	Ingestion of groundwater as drinking water	0.07	NE
	Total Adult Resident:	0.07	NE
Child Resident:	Ingestion of groundwater as drinking water	0.1	NE
	Total Child Resident:	0.1	NE
	Total Risk to Resident (Adult and Child) Exposed to	NC	NE
	Groundwater:		
<p>Notes: * = receptor totals may vary for spreadsheets due to rounding algorithm. HI = hazard index. ELCR = excess lifetime cancer risk. NC = not calculated because child and adult HIs are not additive. ND = no dose-response data for this exposure route were available for human health chemicals of potential concern in this medium. NE = not evaluated, no carcinogenic chemical of potential concern selected.</p>			





NOTES:

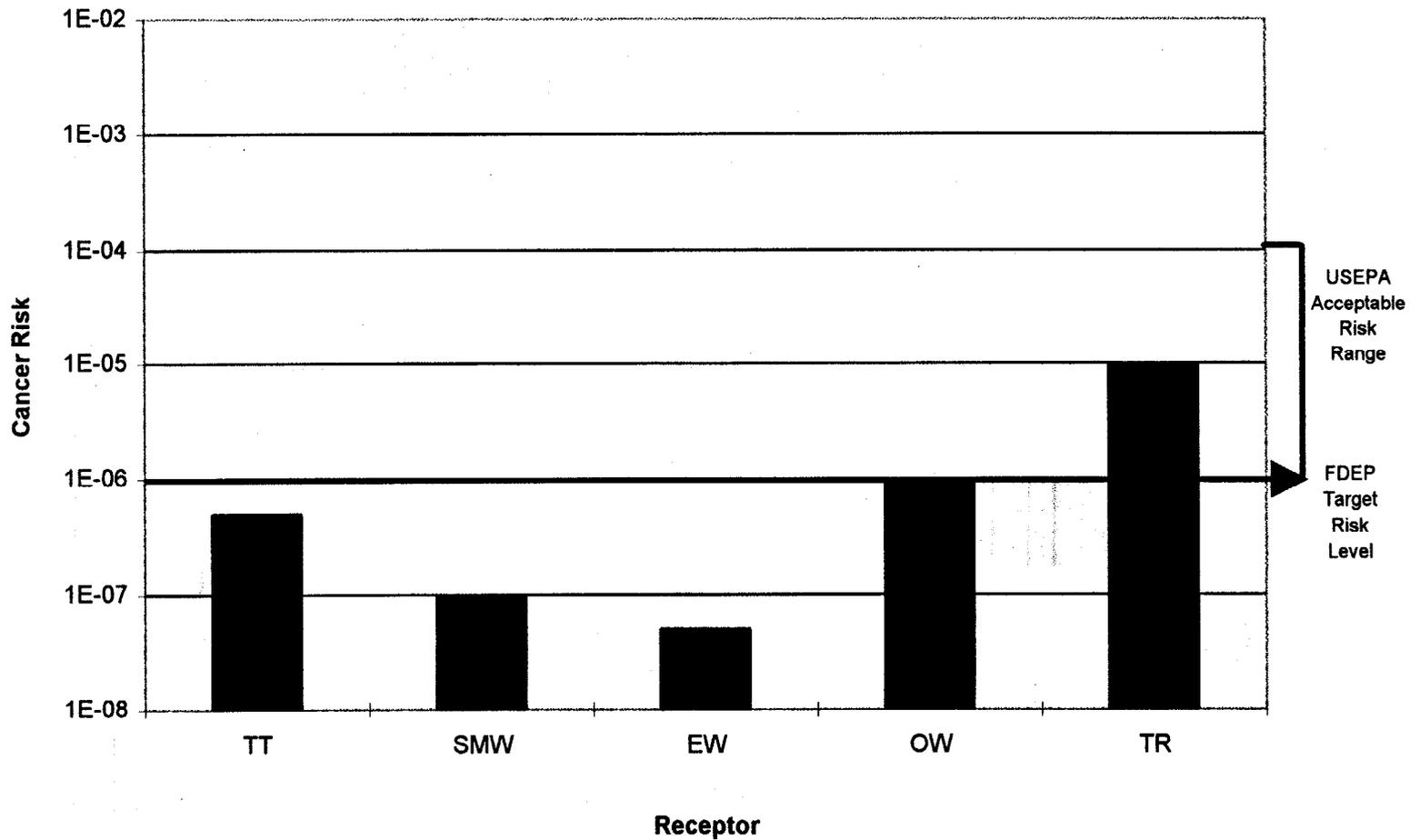
USEPA = U.S. Environmental Protection Agency
FDEP = Florida Department of Environmental Protection
ADT = Adult trespasser
AT = Adolescent trespasser
SMW = Site maintenance worker

**FIGURE 6-3
NONCANCER RISK SUMMARY
CURRENT LAND USE FOR SURFACE
SOIL AT SITE 1**



**REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST DISPOSAL AREA**

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



NOTES:

USEPA = U.S. Environmental Protection Agency
FDEP = Florida Department of Environmental Protection
TT = Total trespasser
SMW = Site maintenance worker
EW = Excavation worker
OW = Occupational worker
TR = Total resident

**FIGURE 6-4
CANCER RISK SUMMARY
FUTURE LAND USE FOR SURFACE
SOIL AT SITE 1**



**REMEDIAL INVESTIGATION REPORT
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**NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA**

The noncancer risks associated with surface soil ingestion, dermal contact, and fugitive dust inhalation for all evaluated receptors are at or below USEPA's and FDEP's target HI of 1. The noncancer risk associated with a child resident soil ingestion and dermal contact is 1. This HI is at the USEPA's and FDEP's target HI of 1. Major contributors to the risk for child resident are aluminum (HQ=0.2), arsenic (HQ=0.2), and iron (HQ=0.7). If the medium-specific HIs exceed USEPA's and FDEP's target of 1, the HQs can be segregated by target organ effects to determine if the target organ-specific HIs exceed 1. The individual aluminum, arsenic, and iron HQs do not exceed 1. Figure 6-5 presents a summary of HIs associated with exposure scenarios under future land use.

6.5.2 Site 1 Groundwater The risk calculations for groundwater exposure are shown in Tables E-24 and E-25 in Appendix E to this report. Currently, there are no potable supply wells at the site; thus, there is no human exposure to groundwater. Therefore, risk was not evaluated for the current land use scenario.

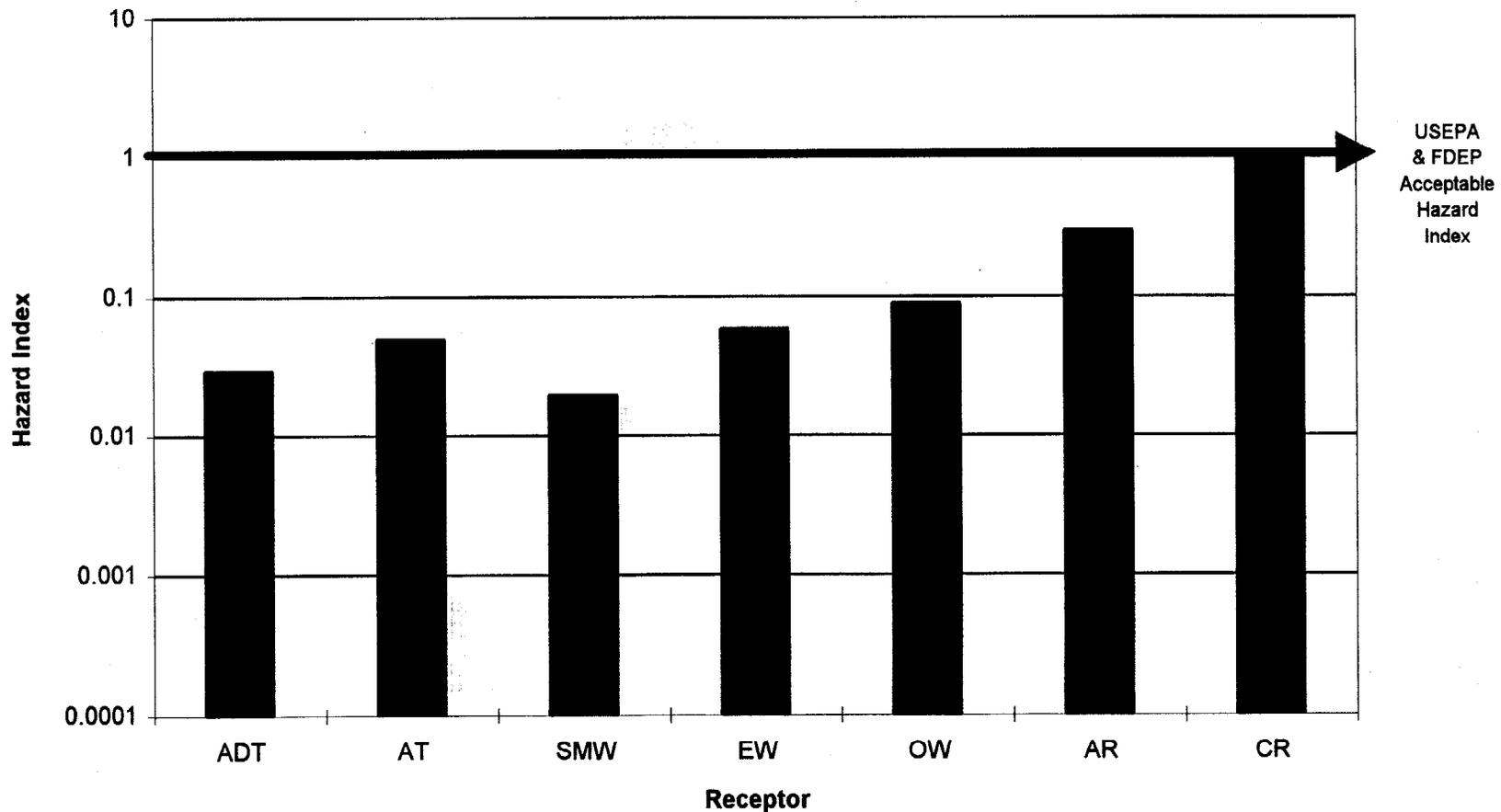
Under potential future land use, the noncancer risks associated with groundwater ingestion are 0.07 for the adult resident and 0.1 for the child resident. The HIs for these two chemicals are less than USEPA's and FDEP's target HI of 1. Figure 6-6 presents a summary of the noncancer risk to potential future residents.

No carcinogenic HHCPs were selected for groundwater; therefore, carcinogenic risk to potential future receptors was not evaluated.

6.5.3 Site 1 Cumulative USEPA Region IV guidance requires an assessment of a cumulative receptor risk. In this HHRA, only the potential future residential receptor could potentially be exposed to both surface soils and groundwater. The cumulative risk to potential future residential receptors is equal to the soil risk because there were no carcinogenic HHCPs in groundwater. The cumulative noncancer risk to potential future residential receptors is also approximately equal to the risk from soil.

6.6 UNCERTAINTY ANALYSIS. General uncertainties associated with the collection, analysis, and evaluation of data; exposure assessment; toxicity assessment; and the risk estimation process are discussed in Paragraph 2.5.5.1 of the GIR (ABB-ES, 1998). Site-specific uncertainties that are important for the interpretation of the calculated risk estimates for surface soil, subsurface soil, and groundwater at Site 1 are discussed below.

- The lack of inhalation reference doses for the HHCPs in surface soil may have resulted in underestimates of the HIs associated with exposure to surface soil at Site 1; however, these noncancer risks due to inhalation exposure are not likely to be significant when compared to oral risks (as is indicated by the carcinogenic inhalation evaluation) that are fully characterized.
- Noncancer risks to potential future residential child receptors may be overestimates because none of the HHCPs exceed the target HI of 1 individually. This is especially true because iron contributes 70 percent of the total noncarcinogenic risk (HQ of 0.7) and is an essential nutrient. The maximum iron concentration detected in surface



NOTES:

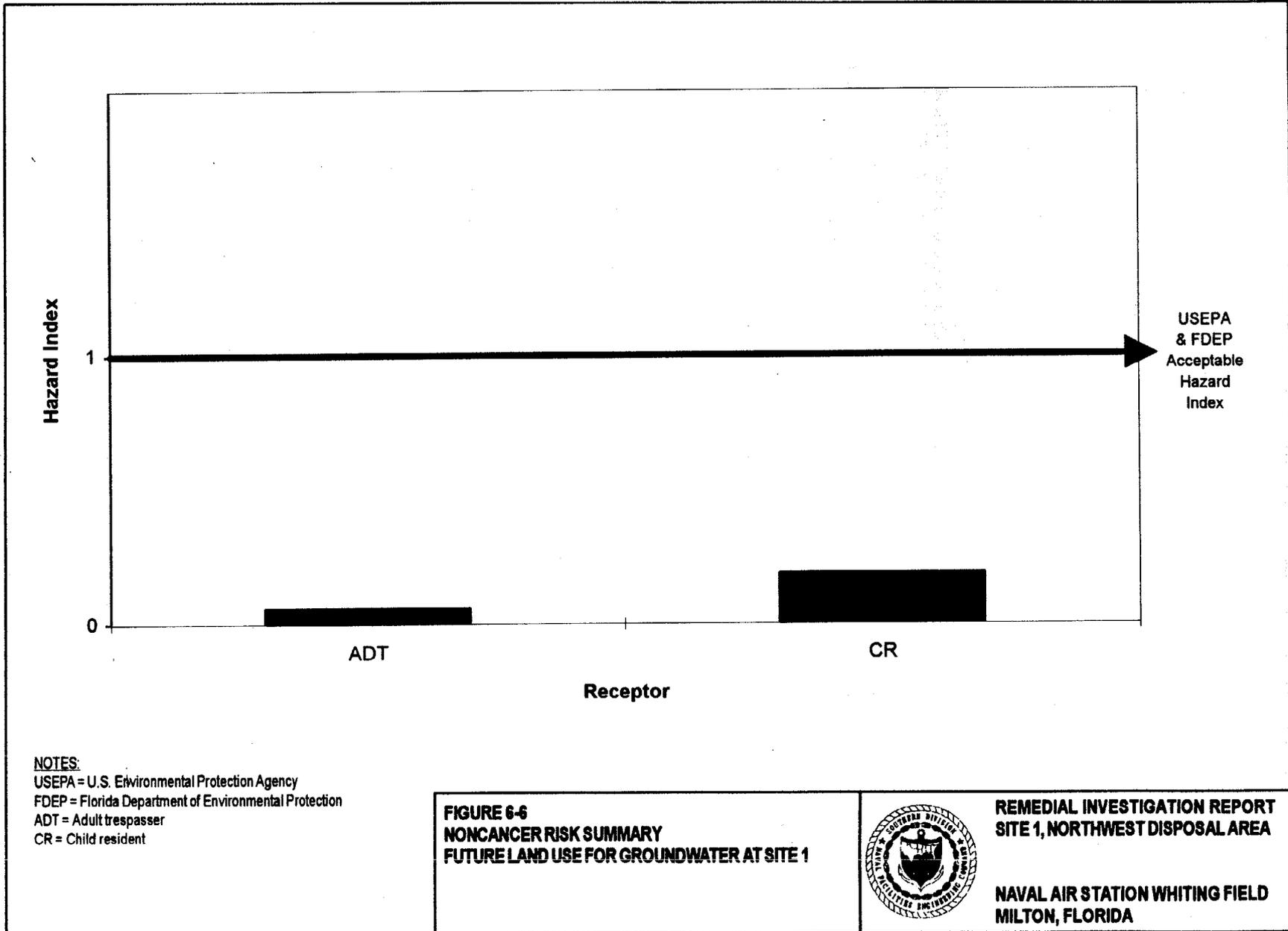
USEPA = U.S. Environmental Protection Agency
 FDEP = Florida Department of Environmental Protection
 ADT = Adult trespasser
 AT = Adolescent trespasser
 SMW = Site maintenance worker
 EW = Excavation worker
 OW = Occupational worker
 AR = Adult resident
 CR = Child resident

**FIGURE 6-5
 NONCANCER RISK SUMMARY
 FUTURE LAND USE FOR SURFACE
 SOIL AT SITE 1**



**REMEDIAL INVESTIGATION REPORT
 SITE 1, NORTHWEST DISPOSAL AREA**

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



soils (11,800 mg/kg) does not exceed the calculated nutrient value of 47,824 mg/kg. (Please refer to Appendix C of the GIR [ABB-ES, 1998].)

- The surface soil carcinogenic risk is driven by a metal (arsenic) that is consistent with site background (see Table 5-3). It is uncertain whether or not the risk from arsenic to potential future residents and occupational workers is actually due to past site operations. The arsenic may actually be at naturally occurring levels or due to other anthropogenic sources such as pesticides.

Three arsenic concentrations exceed the background screening value (01S00101, 01S00301, and 01S00501), and these values exceed by less than a factor of 2. Therefore, these exceedances may be due to heterogeneous concentrations.

Risks associated with background screening levels of arsenic (3.1 mg/kg) also exceed the FDEP acceptable levels (0.8 mg/kg) and would result in a risk of 7.5×10^{-6} . Therefore, the risks associated with site-related arsenic may be overestimated considering arsenic concentration detected in site soil samples related to background.

- The central tendency of carcinogenic risk from the potential future receptors that exceed Florida levels of concern was evaluated. According to the methodology described in Paragraph 2.5.3.3 of the GIR (ABB-ES, 1998), the central tendency evaluation coupled with the mean concentration and reasonable but less conservative exposure parameters is designed to provide a probable risk level (USEPA, 1995b).

The central tendency carcinogenic risk results for potential future residential receptors using average exposure parameters are presented in Table E-26 and E-27 in Appendix E of this report. The central tendency parameters differ from the reasonable maximum exposure (RME) scenario by using the mean concentration of all samples and a 50 percentile ingestion rate, dermal surface area, exposure frequency, and exposure duration. The central tendency aggregate residential risk is 1×10^{-6} , which meets the residential Florida target risk level. The potential future occupational worker receptor was not evaluated using a central tendency exposure because it was at the Florida target level and, therefore, would necessarily result in a risk of less than the FDEP target risk value.

The risk range 1×10^{-5} to 1×10^{-6} presented by the RME and central tendency exposure scenarios for potential future residential receptors are useful as information to provide perspective for risk management and compliance with USEPA guidance (USEPA, 1995a).

- SQLs were compared to the USEPA risk-based screening criteria and State regulatory guidelines for analytes not selected as HHCPs. This assessment was proposed to assess whether or not the detection limits were adequate to detect analytes at levels of concern (SQLs of analytes with 100 percent frequency of detection were not evaluated). The only analyte with an SQL that exceeds its screening criteria is bis(2-ethylhexyl)phthalate in groundwater.

Although the bis(2-ethylhexyl)phthalate SQL exceeded the screening criteria, the detected concentration was less than the SQL. Because the analytical equipment methodology was able to detect bis(2-ethylhexyl)phthalate at a concentration less than the SQL, it was assumed that the SQL for bis(2-ethylhexyl)phthalate was adequate for this HHRA. Additionally, bis(2-ethylhexyl)phthalate is a common plasticizer for resins and is therefore likely to be present in sampling and laboratory equipment. Detection of bis(2-ethylhexyl)phthalate in environmental samples is often attributed to contamination during sample collection or analysis (USEPA, 1991b).

- Some uncertainty is associated with the representativeness of the groundwater data. Generally, because the low-flow method was used, turbidity in the unfiltered groundwater samples was minimal. However, the analytical results from some of the unfiltered samples may be biased high for inorganic concentrations as a result of suspended solids. (see Subsection 5.5.2)

6.7 REMEDIAL GOAL OPTIONS (RGOs). RGOs for each HHCP are presented for each medium with a total excess lifetime cancer risk (ELCR) greater than 1×10^{-4} or an HI greater than 0.1 per FDEP and USEPA guidance, and for media with chemicals whose EPCs exceed Florida standards. RGOs are developed for each chemical with a total ELCR greater than 1×10^{-6} or an HQ greater than 0.1. Analytes whose EPCs exceed Florida standards are also presented in the RGO tables.

RGOs and available Federal regulatory and FDEP risk-based criteria are intended to provide the basis for the development of remedial alternatives in the FS. The RGO values are not actual or proposed cleanup levels, but are provided to assist risk-management decision making in the FS.

RGOs are presented for aluminum, arsenic, and iron based on cancer risks (arsenic only) for the combined resident and noncancer risks for the child resident. Table 6-9 presents the RGOs for these analytes.

RGOs were not developed for groundwater because risks for potential future residential receptors were below target risk levels.

RGOs were not developed for subsurface soils because no HHCPs were identified.

6.8 SUMMARY AND CONCLUSIONS FOR THE HHRA WHITING FIELD SITE 1. HHCPs were identified and risks were estimated for surface soil and groundwater associated with Site 1. No HHCPs were identified for subsurface soils; therefore, no additional evaluations were performed.

The following conclusions were drawn based on this HHRA:

- The HHCPs in surface soil and groundwater do not pose unacceptable carcinogenic or noncarcinogenic risks to the receptors evaluated, according to USEPA guidelines and target risk ranges.

Table 6-9
Summary of Remedial Goal Options for
Surface Soil from Site 1

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station, Whiting Field
Milton, Florida

Analyte	Range of Detected Concentrations	Exposure Point Concentration	Total Excess Lifetime Cancer Risk (Based on Risk to Resident-adult and child)			Total Hazard Index (Based on Risk to Child Resident)			Florida Soil Cleanup Goal (Residential) ¹	Florida Soil Cleanup Goals (Industrial)	Florida Soil Cleanup Goal (Leaching) ²	Background Screening Concentration
			10 ⁻⁴	10 ⁻⁵	10 ⁻⁶	3	1	0.1				
Inorganic Analytes (mg/kg)												
Aluminum	4,530 to 15,200	15,200	NA	NA	NA	NR	NR	7,600	75,000	1,000,000	NSC	12,700
Arsenic	1.3 to 4.2	4.2	NR	4.2	0.42	NR	NR	2.1	0.8	³ 4.62	NSC	2.9
Iron	2,980 to 11,800	11,800	NA	NA	NA	NR	NR	1,690	NSC	NSC	NSC	7,780
¹ Values are for residential soil, from Florida Department of Environmental Protection memoranda titled "Soil Cleanup Goals for Florida," dated September 29, 1995a, and "Applicability of Soil Cleanup Goals for Florida," dated January 19, 1996. ² Values are from the Florida Department of Environmental Protection memorandum titled "Soil Cleanup Goals for Florida," dated September 29, 1995. ³ Value is an FDEP-approved site-specific soil cleanup goal for Florida (FDEP, 1998).												
Notes: mg/kg = milligrams per kilogram. NA = not applicable. NR = not reported because the calculated remedial goal option exceeds the exposure point concentration. NSC = no screening criteria available.												

- The total ELCR associated with ingestion of soil by a potential future resident (1×10^{-5}) and occupational worker (1×10^{-6}) did meet or exceed Florida's target risk level (1×10^{-6}) (due to arsenic). However, arsenic was detected at concentrations below an FDEP-approved site-specific soil cleanup goal (FDEP, 1998).
- The central tendency risks to a potential future resident met the Florida target risk level (1×10^{-6}). Central tendency and RME residential risks provide the risk managers and decision makers with a perspective of the potential risk ranges.
- The noncancer hazards associated with ingestion and direct contact of soil by potential future child residents did slightly exceed USEPA's target HI of 1; however, none of the analytes segregated by target organ effects exceed an HI of 1.
- Noncancer risk in surface soil is primarily from iron. Iron was detected at concentrations orders of magnitude less than acceptable essential nutrient levels (Appendix C to the GIR [ABB-ES, 1998]).

Based on the carcinogenic and noncancer assessment of risks in this HHRA, it is unlikely that either soil or groundwater at Site 1 poses an unacceptable hazard to current or potential future receptors.

7.0 ECOLOGICAL RISK ASSESSMENT

The ERA evaluates actual and potential adverse effects to ecological receptors associated with exposure to chemicals from Site 1, the Northwestern Disposal Area, at NAS Whiting Field. The ERA for Site 1 follows the methodologies described in the NAS Whiting Field GIR (ABB-ES, 1998) and current guidance materials for ERAs at Superfund sites, including the following:

- *Framework for Ecological Risk Assessment* (USEPA, 1992c)
- *Supplemental Guidance to RAGS: Ecological Risk Assessment. Region 4 Bulletins* (USEPA, 1995c)
- *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA, 1997b)

Recent risk assessment guidance documents, including the USEPA "Eco Update" bulletins issued since 1991 (USEPA, 1991c), and recent publications (e.g., Maughan, 1993, Suter, 1993) were also consulted.

This ERA was conducted to determine if ecological receptors are potentially exposed to contaminants from the site at concentrations that could cause adverse health effects. The Site 1 ERA consists of eight sections:

- Site Characterization (Section 7.1) describes current ecological conditions at the site,
- Problem Formulation (Section 7.2) establishes the goals and focus of the assessment and identifies major factors to be considered,
- Selection of Ecological Contaminants of Potential Concern (ECPCs) (Section 7.3) identifies chemicals present at the site that may pose ecological risks,
- Exposure Assessment (Section 7.4) identifies complete exposure pathways and quantifies the magnitude and frequency of exposure,
- Ecological Effects Assessment (Section 7.5) identifies a dose-response for each ECPC and potential receptor,
- Risk Characterization (Section 7.6) integrates exposure and concentration-toxicity response information to derive a likelihood estimate of adverse effects,
- Uncertainties (Section 7.7) identifies assumptions of the ERA process that may influence the risk assessment conclusions, and
- Summary (Section 7.8) summarizes the findings of the ERA.

7.1 SITE CHARACTERIZATION. Site 1 is located near the northwest corner of the north runway (see Figure 1-2) along the base perimeter road. The site is

approximately 700 feet from the runway. The installation maintains the area around the runways, including Site 1, as a noise and safety buffer.

Site 1 consists of an inactive landfill that covers approximately 5 acres. The landfill debris consisted primarily of refuse, waste paints, waste oils, and hydraulic fluids. These wastes were covered with native fill. A discussion of the general site history and layout is provided in Chapters 1.0 and 2.0 of this report.

The vegetative communities at Site 1 are best characterized as planted pine flatwoods covering the outer edge of the site and an old-field community in the center. Most onsite pine trees are less than 6 inches in diameter and less than 20 feet tall. The old-field center is an open area approximately 40 feet in diameter and vegetated with grasses and other herbaceous plants. Figure 3-13 of the GIR (ABB-ES, 1998) provides an overview of the vegetative cover habitats present at the different NAS Whiting Field sites, including Site 1.

NAS Whiting Field maintains a program for planting and harvesting of pine trees, primarily longleaf and slash pines (*Pinus palustris* and *P. elliotii*, respectively). The area surrounding Site 1 consists of planted pine forest. The adjacent areas are subject to controlled burns and timber harvesting activities. These forestry management activities provide a variety of habitats and food sources that are subject to change every few years depending on the forester's activities. Currently the area adjacent to the site is reaching a mature status with a well-developed canopy and an open understory typical of uplands pine forest found in the southeastern United States.

It is likely that the terrestrial invertebrate biomass at Site 1 serves as a forage base for a variety of wildlife species, including amphibians, reptiles, small birds, and small mammals. Small reptiles, mammals, and birds may use the open portions for foraging, then return to the adjacent forested area for protection. The pine flatwoods in and surrounding Site 1 are likely to host such an assemblage. Predatory birds and mammals that inhabit the surrounding pine flatwoods areas may be attracted to the site in search of prey. The adjacent forest area is sufficiently large to provide cover and feeding habitat for larger predatory animals (e.g., foxes, owls, and hawks).

Mammals that may occur in pine flatwoods include the rabbit (*Sylvilagus floridanus*), the hispid cotton rat (*Sigmodon hispidus*), and cotton mouse (*Peromyscus gossypinus*), as well as the armadillo (*Dasypus novemcinctus*) and white-tailed deer (*Odocoileus virginianus*). Predatory mammals such as the red fox (*Vulpes vulpes*) and gray fox (*Urocyon cinereoargenteus*) may feed on small mammals in these areas.

A large open concrete ditch ("E" ditch) forms the site's southern boundary. The ditch has been excavated and straightened to facilitate stormwater runoff from the adjacent area. The ditch contains water only during and following periods of rainfall and is dry throughout most of the year. Consequently, neither the site nor the immediately adjacent ditch provide for an aquatic habitat.

Wildlife access to surface water is limited in the area. No standing water exists at the site; however, standing-water pools will exist in the bottom of some of the ditches in the surrounding area. These pools may exist for a few

days or weeks after a rain. A few of these transient pools exist within a thousand feet of the site.

Groundwater is approximately 65 to 80 feet bls. A discussion of the hydrogeology is presented in Chapter 5.0 of this report. Based on potentiometric maps, groundwater is not expected to discharge to surface water within several thousand feet of the site. Therefore, discharge of groundwater to surface water was not evaluated as part of the ERA for Site 1. The groundwater is approximately 60 to 85 feet bls, preventing direct exposure of ecological receptors to chemicals in the saturated groundwater zone. Based on potentiometric maps, groundwater is not expected to discharge to surface water within several thousand feet of the site. The great travel distance provides an opportunity for chemical attenuation to occur prior to groundwater discharge to surface water. Because of the chemicals identified in the groundwater and the great travel distance to a discharge point, discharge of groundwater to surface water was not evaluated in the Site 1 ERA. A list of chemicals detected in groundwater is presented in Table 5-6.

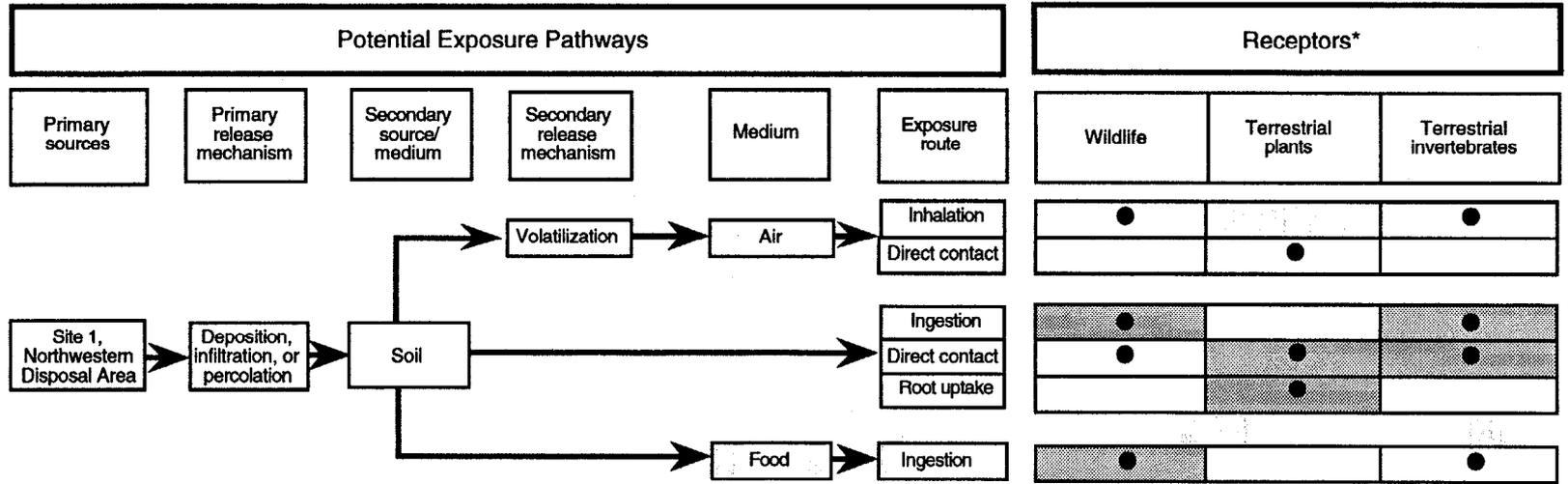
7.2 PROBLEM FORMULATION. Problem formulation is the initial step of the ERA process. The problem formulation section identifies the processes used to evaluate the impact of potential exposure and is based on the site characterization and available information on potential ecological receptors and likely exposure pathways.

7.2.1 Identification of Receptors The types of ecological receptors that may be exposed are dependent on the contaminated media present at the site. Surface soil is the primary exposure medium at Site 1. Receptors likely to encounter surface soil include terrestrial plants, terrestrial invertebrates, and wildlife (i.e., reptiles, amphibian, birds, and mammals). Aquatic receptors were not evaluated in the ERA because no aquatic habitats exist at the site.

Certain species that potentially reside on NAS Whiting Field are protected by Federal and/or State laws. A list of State or federally protected species is provided in Appendix G of the GIR (ABB-ES, 1998). Observations made during an ecological survey of NAS Whiting Field indicate that no State or federally listed rare, threatened, or endangered species or species of concern are known to inhabit Site 1 (Nature Conservancy, 1997).

7.2.2 Identification of Exposure Pathways A complete exposure pathway includes a source of contamination, an exposure route, and a receptor. A conceptual model of the exposure pathways from a source at Site 1 to ecological receptors is depicted in the contaminant pathway model on Figure 7-1.

All potential routes of exposure are considered in the ERA and are presented in the contaminant pathway model. The model differentiates between those exposure routes that are quantitatively evaluated and those that are qualitatively discussed. This limitation is necessary to focus the risk evaluation on those pathways for which contaminant exposures are the highest and most likely to occur. Those pathways that cannot be qualitatively evaluated due to a lack of toxicological information are qualitatively discussed and addressed as uncertainties. The general approach used to identify exposure pathways for the four groups of receptors is explained below.



NOTES:
 NAS = Naval Air Station
 ERA = ecological risk assessment

* Shading indicates the exposure pathways that are quantitatively evaluated for receptors in the Site 1 ERA. Nonshaded pathways are not evaluated due to the lack of toxicity information or because they are not considered significant pathways.

**FIGURE 7-1
 SITE 1, CONTAMINANT PATHWAY MODEL FOR
 ECOLOGICAL RECEPTORS**



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Terrestrial Wildlife. Terrestrial wildlife may be exposed to contaminants in surface soil and food items that are contaminated as a result of ingestion, dermal adsorption, and inhalation of fugitive dust and volatile emissions. Because surface water is not present at Site 1, only terrestrial wildlife exposures associated with ingestion of surface soil and potentially contaminated food are evaluated in the Site 1 ERA.

Dermal adsorption is considered to be a negligible exposure pathway because the presence of fur and feathers is likely to prevent contamination from coming in direct contact with the skin (personal communication with Ted Simon, USEPA Region IV, September 1997). In addition, soil trapped in the fur or feathers is likely to be ingested during grooming or preening activities, which are evaluated as part of the indirect ingestion exposure pathway.

Exposure via inhalation of fugitive dust is also not likely to be a significant exposure pathway because the vegetation at Site 1 would limit the release of fugitive dust. Exposures associated with VOCs are not evaluated because only one VOC, xylene, was detected in the surface soil at Site 1. Xylene was detected in only two out of eight samples at a maximum concentration of 2 ug/kg. In addition, no evidence of burrowing animals and/or burrows was observed at Site 1 during the 1995 site characterization.

Potential contaminant exposures for reptiles and adult amphibians exist at NAS Whiting Field; however, ingestion toxicity data and bioaccumulation factors are generally not available for these receptors. Therefore, potential risks associated with ingestion of affected surface soil and food to reptiles and amphibians will be qualitatively addressed in the Uncertainties Section of the ERA.

Terrestrial Plants and Invertebrates. Terrestrial plants and soil invertebrates may be exposed to chemicals in surface soil by direct contact with and root uptake (plants) or ingestion (invertebrates) of soil. The ingestion exposure route includes the ingestion of soil and food items containing chemicals accumulated from Site 1 surface soil.

7.2.3 Identification of Endpoints The assessment and measurement endpoints selected for the Site 1 ERA are listed in Table 7-1. Assessment endpoints represent the ecological component to be protected, whereas the measurement endpoints approximate or provide a measure of the achievement of the assessment endpoint. The assessment endpoint selected for the Site 1 ERA is the survival and maintenance of receptor populations and communities at Site 1. The specific objectives of the Site 1 assessment are to determine whether or not the chemical concentrations in surface soil at Site 1 are likely to result in population decline of ecological species. The measurement endpoints used to gauge the likelihood of population- and community-level effects are chemical-specific toxicological benchmark values reported in the literature that are based on laboratory-measured survival, growth, and reproductive effects.

The analytes detected included three groups of chemicals: VOCs, pesticides, and inorganic analytes.

Most VOCs do not bioaccumulate, therefore the primary exposure of higher trophic levels are through direct exposure pathways and not through ingestion of food items. Because toxicity of VOCs is usually related to direct contact, plant and

Table 7-1
Endpoints Selected for
Ecological Risk Assessment, Site 1

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Medium	Receptor	Assessment Endpoint	Measurement Endpoint
Surface Soil	Terrestrial plants	Probability of a 25 percent decline in biomass of forage material.	Chemical concentrations (mg/kg) in surface soil that result in adverse effects on growth, reproduction, or survival of terrestrial plants.
Surface Soil	Terrestrial invertebrates	Probability of a 25 percent decline in abundance of earthworms.	Chemical concentrations (mg/kg) in surface soil that result in adverse effects on survival (i.e., LC ₅₀ studies) of terrestrial invertebrates or measured adverse effects on reproduction and growth.
Surface Soil	Wildlife	Survival and maintenance of wildlife populations.	Oral chemical doses (mg/kg BW/day) based on measured adverse effects on growth, reproduction, or survival (i.e., LD ₅₀ studies) of mammalian or avian laboratory test populations.

Notes: mg/kg = milligrams per kilogram.
 BW/day = body weight per day.
 LD₅₀ = lethal dose to 50 percent of a test population.

invertebrate benchmark concentrations should be protective for other species including higher trophic groups like wildlife species.

Dieldrin was the only pesticide detected in surface soil at Site 1. Dieldrin was sold as a broad-spectrum insecticide, and consequently most invertebrate species are likely to be sensitive. The invertebrate benchmark concentration should be protective of most invertebrates present at the site. Dieldrin accumulates in the tissues of both invertebrates and wildlife species (ATSDR, 1992). The ERA used models to estimate the cumulative concentration resulting from multiple exposure to dieldrin.

Inorganic chemicals may occur at a site from naturally or anthropogenic sources. Plants, invertebrates, and wildlife tolerate low doses of inorganics. Toxicity resulting from selected inorganic exposure may result in a reduction of a specific species of plants, or a shift of predominance from one plant species to another resulting in changes to invertebrate or wildlife populations that are dependent on a specific plant or invertebrate species. Most inorganic analytes do not concentrate in tissues at rates greater than the surrounding soil. Therefore, toxicity effects resulting from direct exposure pathways are more likely to result in effects to an individual than to higher trophic levels.

The ERA developed three hypotheses to gauge the toxicity effects that may result from exposure to Site 1 surface soil. These hypotheses are designed for multiple species and trophic levels and represent both individual and community dynamics. Hypotheses for the Site 1 ERA include the following:

1. Are ECPCs present in the surface soil at concentrations sufficiently high to reduce plant or soil biomass or plant cover availability such that small mammals and birds populations could be affected.

2. Are ECPCs present in plants and invertebrates at concentrations sufficiently high to adversely affect small animal or bird populations.
3. Are bioaccumulating chemicals sufficiently high to reduce survivability or reproduction effects in top predators (i.e., foxes and owls).

7.3 SELECTION OF ECPCs. ECPCs are analytes detected in environmental media (i.e., surface soil) that are considered in the ERA and could present a potential risk for ecological receptors. The process for selecting ECPCs is depicted on Figure 7-2. Additional details regarding the ECPC selection process are provided in Subsection 2.4.2 of the GIR (ABB-ES, 1998). Analytical data for Site 1 were evaluated for use in risk assessment pursuant to national guidance, *Guidance for Data Useability in Risk Assessment (Parts A and B)* (USEPA, 1992c).

Inorganic chemicals representative of background conditions were not selected as ECPCs. In accordance with USEPA Region IV guidance (USEPA, 1991d), an analyte was not selected as an ECPC if the maximum detected concentration of an inorganic analyte detected in surface soil was less than two times the average inorganic concentration detected in background samples.

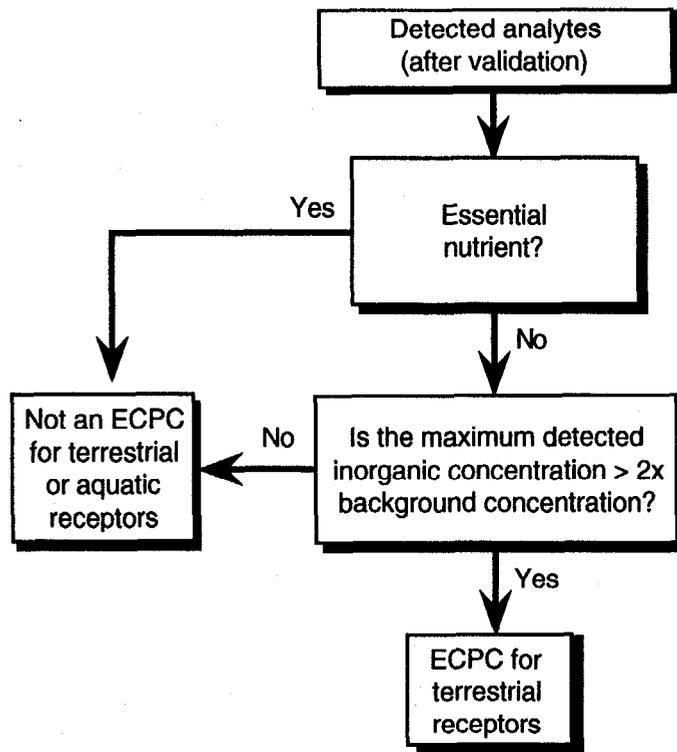
A background investigation was conducted at NAS Whiting Field, and the findings are presented in Section 5.3 of this report. The background study used for Site 1 consisted of eight surface soil locations (BKG-SL-02, BKG-SL-06, BKG-SL-07, BKG-SL-08, BKS00101, BKS00201, BKS00401, and BKS00501) and one duplicate background sample (BKS00201D).

The essential nutrients (e.g., calcium, iron, magnesium, potassium, and sodium) are considered toxic to ecological receptors only at extremely elevated concentrations. The rationale for eliminating essential nutrients as ECPCs is provided in the GIR (ABB-ES, 1998).

Figure 3-2 shows the eight surface soil sample locations ((01-SL-01, 01-SL-02, 01S00101 through 01S00501) collected. Table 7-2 presents the analytical data along with the following statistical information: frequency of detection, range of detection limits, range of detected concentrations, average of detected concentrations, and background screening concentrations.

Analytes detected in concentrations greater than background screening concentrations (inorganic analytes only) and not identified as nutrients were retained as ECPCs. ECPCs selected for the surface soil samples collected at Site 1 include one VOC [xylenes (total)], one pesticide (dieldrin) and six inorganic constituents (cadmium, chromium, cyanide, lead, mercury, and vanadium).

7.4 EXPOSURE ASSESSMENT. An exposure assessment is the process of estimating or measuring the amount of an ECPC to which an ecological receptor may be exposed. The following sections briefly describe how contaminant exposures are estimated or measured for wildlife, terrestrial plants, and invertebrates at Site 1. The contaminant pathway model (Figure 7-1) provides a summary of the potential exposure pathways that exist at Site 1 for each group of receptors. Additional detail regarding exposure assessment is provided in the GIR (ABB-ES, 1998).



NOTES:

NAS = Naval Air Station
ECPC = ecological contaminant of potential concern
> = greater than
x = times

**FIGURE 7-2
ECOLOGICAL CONTAMINANT OF POTENTIAL
CONCERN SELECTION PROCESS,
SITE 1**



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Table 7-2
Selection of Ecological Chemicals of Potential Concern
for Surface Soil Associated with Site 1

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Analyte	Frequency of Detection ¹	Range of Detection Limits	Range of Detected Concentration ²	Average of Detected Concentrations ³	Background Screening Concentration ⁴	Chemical of Ecological Concern	Exposure Point Concentration
Volatiles Organic Compounds (µg/kg)							
Xylenes (total)	2/8	6 to 11	1 to 2*	1.5	ND	Yes	2
Pesticides and PCBs (µg/kg)							
Dieldrin	1/8	3.6 to 19	1.5	1.5	ND	Yes	1.5
Inorganic Analytes (mg/kg)							
Aluminum	8/8	40	4,530 to 15,200	10,600	15,848	No ⁶	
Arsenic	8/8	2	1.3 to 4.2	2.9	3.2	Yes	
Barium	8/8	40	5.4 to 18	12.6	23.2	No ⁶	
Beryllium	8/8	1	0.05 to 0.17	0.12	0.36	No ⁶	
Cadmium	1/8	1	0.71	0.71	0.58	Yes	0.71
Calcium	2/8	1,000	264 to 321	293	396	No ^{5,6}	
Chromium	8/8	2	3.8 to 30.0*	12.6	11.0	Yes	30.0
Cobalt	5/8	10	0.72 to 1.3	0.99	3.0	No ⁶	
Copper	5/8	5	4.4 to 7.1	5.5	9.4	No ⁶	
Cyanide	3/8	0.5 to 1	0.13 to 1.1	0.51	0.28	Yes	1.1
Iron	8/8	20	2,980 to 11,800*	7,780	8,832	No ⁵	
Lead	7/8	0.6 to 1	3.5 to 44	10.8	11.4	Yes	44
Magnesium	8/8	1,000	61.1 to 293	167	268	No ⁵	
Manganese	8/8	3	5.6 to 85	38.4	392	No ⁶	
Mercury	5/8	0.1	0.01 to 0.195*	0.05	0.12	Yes	0.195
Nickel	1/8	8	3.5*	3.5	7.2	No ⁶	
Potassium	4/8	1,000	141 to 329*	240	177	No ⁵	
See notes at end of table.							

Table 7-2 (Continued)
Selection of Ecological Chemicals of Potential Concern
for Surface Soil Associated with Site 1

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Analyte	Frequency of Detection ¹	Range of Detection Limits	Range of Detected Concentration ²	Average of Detected Concentrations ³	Background Screening Concentration ⁴	Chemical of Ecological Concern	Exposure Point Concentration
Inorganic Analytes (mg/kg) (Continued)							
Sodium	2/8	1,000	185 to 219	202	406	No ^{5,6}	
Vanadium	8/8	10	8.1 to 33.6	21.7	21.8	Yes	33.6
Zinc	7/8	4	3.9 to 11.5*	7.1	15.4	No ⁶	

¹ Frequency of detection is the number of samples in which the analyte was detected in relation to the total number of samples analyzed (excluding rejected values).

² The value indicated by an asterisk is the average of a sample and its duplicate. For duplicate samples having one nondetect value, one-half of the contract required quantification limit/contract required detection limit is used as a surrogate concentration for the sample having no reported concentration.

³ The average of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples with "R", "U", or "UU" validation qualifiers.

⁴ The background screening value is twice the average of detected concentrations for inorganic analytes in background samples. Organic analyte values are one times the average of detected concentrations. Organic values are included for comparison purposes only.

⁵ Analyte is an essential nutrient and not considered toxic except at high concentrations. Based on professional judgement, this nutrient will not be evaluated further.

⁶ The maximum detected concentration is less than the background screening concentration.

⁷ FDEP has approved a site-specific soil cleanup goal for arsenic of 4.62 µg/kg (Appendix G, FDEP, 1998).

Notes: The average of a sample and its duplicate is used for all table calculations.

Samples : 01-SL-01, 01-SL-02, 01-SL-03, 01S00101, 01S00201, 01S00301, 01S00401, 01S00501

Duplicate samples : 01-SL-03A

Background samples: BKG-SL-02, BKG-SL-06, BKG-SL-07, BKG-SL-08, BKS00101, BKS00201, BKS00401, BKS00501

Background duplicate samples: BKS00201D

* = average of a sample and its duplicate.

µg/kg = micrograms per kilogram.

ND = not detected in any background sample.

PCB = polychlorinated biphenyl.

mg/kg = milligrams per kilogram.

7.4.1 Calculation of EPCs EPC is a representative concentration used for evaluating risks throughout this ERA. An EPC was chosen for each ECPC in surface soil. The EPC used for screening represents the highest average concentration that could reasonably be expected to occur at the site. Because less than 10 samples were collected, USEPA guidance recommends using the maximum detected concentration as the EPC (USEPA, 1992b). EPCs are presented in Table 7-2 for each selected ECPC.

7.4.2 Terrestrial Wildlife Exposure routes for wildlife receptors include direct and indirect ingestion of soil and ingestion of food containing site-related chemicals. The actual amount of an ECPC taken in by a wildlife species (i.e., ingestion dose in mg/kg-day) depends on a number of factors. A potential dietary exposure (PDE) model was used to estimate exposure to representative wildlife species. The PDE (or body dose) is calculated for each ECPC in each medium using the equations in Table 7-3 and the methodologies described in the GIR (ABB-ES, 1998).

Wildlife species from different trophic guilds present at the site were selected for the PDE model. The model uses species' specific feeding and habitat characteristics to estimate chemical exposures to wildlife species respective to their position in the food chain. Terrestrial receptors chosen represent the trophic levels typically found in southeastern flatwoods and disturbed upland communities. Below is a listing of the representative wildlife species (summarized in Table 7-4) selected for evaluation in the food-chain exposures.

- **Cotton mouse** (*Peromyscus gossypinus*). This species could potentially be exposed to chemicals in soil and in plant tissue (accumulated from the soils). Herbivorous small mammals could receive relatively high exposure to inorganics, which may be translocated from the soil into plant tissues and then to the herbivore. The cotton mouse home range is estimated at 0.147 acre, and the mouse could reside entirely on the site. The cotton mouse represents the small mammal herbivore guild at Site 1.
- **Short-tailed shrew** (*Blarina brevicauda*). The short-tailed shrew finds suitable habitat in forests, fields, marshes, and brush. It primarily feeds on earthworms, snails, centipedes, insects, small vertebrates, and slugs (DeGraaf and Rudis, 1986). Insectivorous species may receive relatively high chemical doses of bioaccumulating compounds as a result of their voracious appetites. The shrew represents small omnivorous mammals found in wooded and old-field portions of Site 1.
- **Eastern meadowlark** (*Sturnella magna*). The eastern meadowlark is most commonly found in open pastures, prairies, farms, and meadows and has a home range of approximately 5 acres. The meadowlark feeds primarily on invertebrates, although its diet is supplemented with plants. The meadowlark represents insectivorous avian receptors found in open areas (DeGraaf and Rudis, 1986).
- **Mourning Dove** (*Zenaida macroura*). The mourning dove forages by ground-gleaning in railroad right-of-ways, roadsides, and open fields with scattered shrubs and trees. It feeds almost entirely on seeds; however, it is also known to occasionally eat insects, snails, and gravel to facilitate seed digestion (Terres, 1980). The mourning dove

Table 7-3
Estimation of Potential Chemical
Exposures for Representative Wildlife Species

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Estimation of Chemical Exposures Related to Surface Soil

Scope Estimates the amount (dose) of a chemical ingested and accumulated by a species via incidental ingestion of surface soil and food items containing site-related chemicals.

Soil Chemical Concentration The maximum detected concentration of the ecological chemicals of potential concern (ECPCs) because the sample size is ≤ 9 .

Soil Exposure Concentration

$$\text{Soil Exposure (mg/kg)} = \left(\frac{\% \text{ of Diet as Soil}}{\text{mg/kg}} \times \text{Soil Concentration (mg/kg)} \right)$$

Primary Prey Item Concentration (T_N)

$$\text{Primary Prey Item Concentration (mg/kg)} = \left(\text{BAF}_{\text{inv or plant}} \times \text{Soil Concentration (mg/kg)} \right)$$

Secondary Prey Item Concentration (T_N)

$$\text{Secondary Prey Item Concentration (mg/kg)} = \left(\text{BAF}_{\text{mam or bird}} \times \text{Tissue Concentration of Prey Items (mg/kg)} \right)$$

where BAF = bioaccumulation factor or mg/kg fresh weight tissue over mg/kg dry weight soil for invertebrates and plants, and mg/kg fresh weight tissue over mg/kg fresh weight food for small mammals and small birds.

* For a discussion of the weighted chemical concentration in prey items, see explanation of the PDE term below, and the General Information Report (ABB Environmental Services, Inc., 1998).

Total Exposure Related to Surface Soil

$$\text{PDE (mg/kgBW-day)} = \frac{[P_1 \times T_1 + \dots + P_N \times T_N + \text{soil exposure}] \times \text{IR}_{\text{Diet}} \times \text{SFF} \times \text{ED}}{\text{BW}}$$

where PDE = potential dietary exposure (mg/kg BW-day),
 P_N = percent of diet composed of food item N,
 T_N = tissue concentration in food item N (mg/kg),
 IR_{Diet} = food ingestion rate of receptor (kg of food or dietary item per day),
 BW = body weight (kg) of receptor,
 SFF = site foraging frequency (site area [acres] divided by home range [acres]), assumed to be equal to 1 for lethal exposure scenario, and
 ED = exposure duration (fraction of year species is expected to occur onsite).

Notes: mg/kg = milligrams per kilogram. mg/kg BW-day = milligrams per kilograms of body weight per day.
 kg/day = kilograms per day. \leq = less than or equal to.
 kg = kilograms. \geq = greater than or equal to.
 % = percent.

**Table 7-4
Ecological Receptors Evaluated
for Surface Soil**

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Milton, Florida

Receptor Evaluated		Method of Evaluation
Common Name	Scientific Name	
Terrestrial Plants		Benchmark comparison
Terrestrial Invertebrate		Benchmark comparison
Cotton mouse	<i>Peromyscus gossypinus</i>	Food-web model
Short-tailed shrew	<i>Blarina brevicauda</i>	Food-web model
Eastern meadowlark	<i>Sturnella magna</i>	Food-web model
Mourning dove	<i>Zenaida macroura</i>	Food-web model
Red fox	<i>Vulpes vulpes</i>	Food-web model
Great horned owl	<i>Bubo virginianus</i>	Food-web model

will nest in a variety of man-made or natural structures, and its estimated home range is 5 acres. The dove represents herbivorous avian receptors found in the old field habitat at Site 1.

- **Red fox (*Vulpes vulpes*)**. This omnivorous mammal prefers open woodlands and grassy fields and is most active at night and during crepuscular periods. It is an opportunistic forager, feeding on small mammals, birds, amphibians, reptiles, and invertebrates, as well as berries and other fruits (Burt and Grossenheider, 1976). The red fox has an estimated home range of approximately 250 acres. The red fox represents the large predatory mammal guild at Site 1.
- **Great horned owl (*Bubo virginianus*)**. The great horned owl is primarily a nocturnal hunter of small mammals. Its habitat includes deep woods and heavily wooded swamps, often near open country where it may hunt for its primary prey items consisting of small mammals and birds (DeGraaf and Rudis, 1986). The Great horned owl home range is approximately 15 acres. The owl represents the predatory avian carnivores of both open areas and forested areas.

Parameters for quantitatively evaluating exposures to wildlife include body weights, food ingestion rates, and relative consumption of food items. Exposure assumptions for each of the representative wildlife species for Site 1 are provided in Table 7-5. In addition to these parameters, the species foraging habits and bioaccumulation in food items were considered.

The Site Foraging Frequency (SFF) considers the frequency with which a receptor feeds within the site area by estimating the acreage of the site relative to the receptor's home range, and by considering the fraction of the year the receptor would be exposed to site-related chemicals. All representative receptors for Site 1 ERA are assumed to be year-round residents at the site.

**Table 7-5
Exposure Parameters for Representative Wildlife Species**

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Representative Wildlife Species	Body Weight (kg)	Reported Diet	Assumed Diet for Terrestrial Exposure Assessment (% of diet)	Food Ingestion Rate (kg/day)	Home Range (acres)
Cotton mouse [a] (<i>Peromyscus gossypinus</i>)	0.021 [b]	Seeds and some insects. [c]	88% Plants 10% Invertebrates 2% Soil [d]	0.0029 [e]	0.147 [f]
Short-tailed shrew (<i>Blarina brevicauda</i>)	0.017 [g]	Earthworms, slugs and snails, fungi, insects, and vegetation. [c]	78% Invertebrates 12% Plants 10% Soil [c]	0.0024 [e]	0.96 ± 0.09 [c]
Eastern meadowlark (<i>Sturnella magna</i>)	0.087 [h]	Insects, weed seeds and grass seeds, 75% of diet is invertebrates (beetles, grubs, bugs, grasshoppers, crickets, ants, and spiders. [h]	75% Invertebrates 20% Plants 5% Soil [h]	0.0119 [j]	5 [h]
Mourning dove <i>Zenaida macroura</i>	0.13 [h]	Seeds, some insects, weed seeds, waste grain of agriculture, occasionally takes some snail [i]	94% Plants 1% Invertebrates 5% soil [h]	0.0154 [j]	5 [i]
Red fox (<i>Vulpes vulpes</i>)	4.69 [c]	Small mammals, birds, and invertebrates, as well as berries and other fruits. [c]	57% Small mammals 20% Invertebrates 10% Small birds 10% Plants 3% Soil [c]	0.24 [e]	250 [c]
Great horned owl (<i>Bubo virginianus</i>)	1.50 [i]	Mostly rabbits, mice, rats, squirrels, birds, bats, snakes, frog, crayfish, and grasshoppers. [i]	80% Small mammals 19% Birds 1% Soil [c]	0.079 [j]	15 [k]

References:

- [a] Values for the deer mouse were used for the cotton mouse (U.S. Environmental Protection Agency [USEPA], 1993b).
- [b] Average of adult male and female deer mice in North America (USEPA, 1993b).
- [c] Wildlife Exposure Factors Handbook (USEPA, 1993b).
- [d] Deer mouse value used for cotton mouse based on similarities in diet. Other values were based on diet composition (USEPA 1993b).
- [e] Calculated using the mammal equation based on body weight (Wt.) in kg. Food ingestion (kg/day) = 0.0687 × Wt^{0.822} (kg) (USEPA, 1993b).
- [f] Average for male and female deer mice, Virginia/mixed deciduous forest (USEPA, 1993b).
- [g] Mean of means reported for male and female shrews in summer and fall (USEPA, 1993b).
- [h] Terres (1980).
- [i] DeGraaf and Rudis (1986).
- [j] Calculated using the bird equation based on body weight (Wt.) in kg. Food ingestion (kg/day) = 0.0582 × Wt^{0.651} (kg) (USEPA, 1993b).
- [k] Great horned owl home range taken from low end of range in SE Madison County, NY (Hager, 1957).

Notes: kg = kilograms.

% = percent.

± = plus or minus.

kg/day = kilograms per day.

By definition, the SFF value cannot exceed 1. The SFF value for the short-tailed shrew and cotton mouse is 1 because the area of Site 1 (approximately 5 acres) is larger than the home range, and both receptors are expected to actively forage at the site year round.

Bioaccumulation factors (BAFs) were employed in the wildlife exposure models to estimate the transfer of chemicals between soil and plants or soil invertebrates, and between these organisms and primary consumer species. To estimate the PDE, tissue concentrations of ECPCs in prey items were estimated using BAFs for surface soil. BAFs for most receptors were extrapolated from literature values or estimated using regression equations from scientific literature. Based on the lack of scientific data for VOC bioaccumulation and evidence provided in several reference materials (Suter, 1993; Maughan, 1993), an assumption was made that VOCs do not bioaccumulate in prey tissue. The general approach used to select BAFs for Site 1 is summarized in Table 7-6.

BAFs for invertebrate and plant prey are defined as the ratio of the ECPC concentration in plant or invertebrate tissue (mg chemical/kg tissue wet weight) to the ECPC concentration in surface soil (mg chemical/kg dry weight soil). BAFs reported in the scientific literature for avian and mammalian receptors are defined as the reported ratios of ECPC concentrations in the tissues of these receptors (mg chemical/kg tissue wet weight) to the concentrations of ECPCs in their food items (mg chemical/kg tissue wet weight). BAFs for each of the ECPCs evaluated at Site 1 are included in Appendix F, Table F-1.

7.4.3 Terrestrial Plants and Invertebrates Terrestrial plants and invertebrates may be exposed to ECPCs via direct contact between soil and root uptake (plants) or ingestion (invertebrates).

For the purpose of the Site 1 ERA, exposures to terrestrial plants and invertebrates are assumed to occur within the top 1-foot interval of surface soil. Exposure of terrestrial plants to groundwater is not evaluated because the depth to the water table is approximately 60 to 85 feet bls (see hydrogeological discussion in Chapter 5.0 of this report).

7.5 ECOLOGICAL EFFECTS ASSESSMENT. The ecological effects assessment describes the potential adverse effects associated with each ECPC. The assessment endpoints of the ERA are the survival and maintenance of ecological receptor populations at Site 1. The measurement endpoints used to gauge the success of the assessment endpoints and the methods used for identifying and characterizing ecological effects for ECPCs in surface soil are described in the following sections, and in greater detail in the GIR (ABB-ES, 1998).

Wildlife receptors, terrestrial plants, and terrestrial invertebrates are potentially exposed to ECPCs detected in surface soil at Site 1. The measures of adverse ecological effects for these receptors are discussed separately.

Terrestrial Wildlife. Because no long-term wildlife population data are available at NAS Whiting Field, a direct measurement of the survival and maintenance of wildlife populations at Site 1 is not possible. The literature derived results of laboratory toxicity studies that relate the dose of a chemical in an oral exposure with an adverse response to growth, reproduction, or survival of a test population (avian or mammalian species) were used as a measure of the

**Table 7-6
Estimation of Bioaccumulation Factors for the Site 1**

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Receptor Group	Nature of Approach	General Approach
<u>Terrestrial Receptors</u>		
Plants		
Unit: mg/kg wet tissue per mg/kg dry soil	Literature Values	When available, literature values were used to estimate plant BAFs. Evidence from the literature (Levine et al., 1989) suggests that lead does not bioaccumulate in plant tissue; therefore, a BAF of zero was assigned (i.e., a zero does not imply that literature information is lacking).
	SAR	When literature values were not available, plant BAFs for semivolatile organic compounds (SVOCs) were calculated using a regression equation based on the uptake of organic chemicals into plant tissue from Travis and Arms (1988). ¹
	Extrapolation and Empirical Data	When literature values were not available, plant BAFs for inorganic compounds were obtained from Baes et al. (1984). ²
	Assumption	Although evidence suggests that plants may transport organic analytes with log K_{ow} s < 5 (i.e., volatile organic compounds [VOCs]) from the roots into leafy portions (Briggs et al., 1982; Briggs et al., 1983), bioaccumulation data for VOCs are generally lacking in the scientific literature. In addition, evidence in the literature (Suter, 1993; Maughan, 1993) suggests that analytes with log K_{ow} s < 3.5 are not bioaccumulated into animal tissue. Therefore, it was assumed that transfer of VOCs from plant tissue to animal tissue does not occur.
<u>Terrestrial Invertebrates</u>		
Unit: mg/kg wet tissue per mg/kg dry soil	Literature Values	When no site-specific values were available, literature values were used to estimate BAFs for invertebrates.
	Assumption	Earthworm data were used to represent all invertebrates.
	Empirical Data and Assumption	A single BAF for PAHs was calculated using data presented in Beyer (1990); dry weight was converted to wet weight assuming earthworms are 80 percent water.
	Assumption	Bioaccumulation data for VOCs are generally lacking in the scientific literature. In addition, evidence in the literature (Suter, 1993; Maughan, 1993) suggests that analytes with log K_{ow} s < 3.5 are not bioaccumulated into animal tissue. Therefore, it was assumed that soil invertebrates do not bioaccumulate VOCs.
See notes at end of table.		

Table 7-6 (Continued)
Estimation of Bioaccumulation Factors for the Site 1

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Receptor Group	Nature of Approach	General Approach
Small Mammals		
Unit: mg/kg wet tissue per mg/kg wet food	Literature Values	When available, literature values were used to estimate BAFs for small mammals.
	SAR	When literature values were not available for SVOCs, BAFs for small mammals were estimated using a regression equation based on the uptake of organic chemicals into beef tissue from Travis and Arms (1988) ³ .
	Extrapolation and Empirical Data	When literature values were not available, BAFs for small mammals for inorganics were derived from ingestion-to-beef biotransfer factors (BTFs) presented in Baes et al. (1984) ⁴ .
	Assumption	Bioaccumulation data for VOCs are generally lacking in the scientific literature. In addition, evidence in the literature (Suter, 1993; Maughan, 1993) suggests that analytes with log K _{ow} s < 3.5 are not bioaccumulated into animal tissue. Therefore, it was assumed that small mammals do not bioaccumulate VOCs.
Small Birds		
Unit: mg/kg wet tissue per mg/kg wet food	Literature Values	When available, literature values were used to estimate BAFs for small birds.
	No Information	BAFs were not obtained for SVOCs or for inorganic compounds as there is little bioaccumulation data available for birds. It was assumed that small birds do not accumulate VOCs.

¹ Plant BAFs were calculated using the following Travis and Arms (1988) regression:

$$\log \text{BAF} = 1.588 + 0.578 \log K_{ow}$$

² BAFs derived from Baes et al. (1984). Values are based on analysis of literature references, correlations with other chemical and physical parameters, or comparisons of observed and predicted elemental concentrations in vegetative and reproductive plant material and soil. Data are based on dry weight and were converted to a fresh weight basis assuming that plants are 80 percent water. This is generally consistent with the water content of berries (82 to 87 percent water) and leafy vegetables (87 to 95 percent water), presented in Suter (1993). Grains contain a much lower percentage of water (approximately 10 percent); therefore, this assumption likely underestimates exposure to graminivores.

³ Small mammal BAFs were calculated using the following Travis and Arms (1988) regression:

$$\log \text{BTF} = \log K_{ow} - 7.6$$

where BTF = biotransfer factor (mg/kg tissue divided by mg chemical ingested per day).

⁴ BTFs were converted to a BAF (mg/kg tissue divided by mg/kg food) by multiplying by a food ingestion rate of 12 kg (dry weight) per day (average intake for lactating and nonlactating cattle reported in Travis and Arms, 1988).

Notes: mg/kg = milligrams per kilogram.

BAFs = bioaccumulation factors.

SAR = Structural Activity Relationship.

K_{ow} = octanol-water partition coefficient.

< = less than.

PAH = polynuclear aromatic hydrocarbons.

assessment endpoint. The ERA used the lowest reported toxicity value for a taxonomic group to represent the dose-response concentration for an ECPC. This value, termed a toxicity reference value (TRV), is used as a threshold effect concentration. Exposures to concentrations below the TRV are unlikely to result in adverse effects. The TRVs are body-weight normalized values.

The toxicity studies endpoints were divided into lethal and sublethal effects. Both a lethal and a sublethal TRV were identified using the process described below. Lethal TRV represents the threshold level where higher concentrations are likely to result in lethal effects. The lethal TRV is based on a lowest observable adverse effect level (LOAEL) from an acute study for a closely related test species. If no LOAEL study were found in the literature, then one-fifth of the lowest reported oral lethal dose to 50 percent of test population (LD₅₀) (oral dose [in mg/kg body weight-day] lethal to 50 percent of a test population) would be used as a surrogate lethal TRV. This is considered to be protective against lethal effects for 99.9 percent of individuals in a test population (USEPA, 1986b).

Sublethal TRV represents a threshold level for adverse effects related to reproduction or growth. Sublethal TRV is the lowest no observable effects level (NOAEL) from a chronic or subchronic study conducted on a closely related test species. If no chronic or subchronic NOAEL study was found in the literature, then one-fifth of a LOAEL (study for reproduction or growth) was used as a surrogate sublethal TRV. Table F-2 in Appendix F presents the acute and chronic studies available. A summary of lethal and sublethal TRVs selected from the ingestion toxicity data are provided in Table F-3 of Appendix F. More details regarding how these TRVs are derived are provided in the GIR (ABB-ES, 1998).

If either the lethal or sublethal toxicity information was not available for a taxonomic group, no TRVs were identified and risks associated with the predicted exposure for the respective ECPC was not quantitatively evaluated. However, the absence of specific data for a taxonomic group does not imply that "no toxicological effect" is anticipated. In the absence of specific dose-response data for a taxonomic group, a qualitative discussion of potential for risks is presented in the Risk Characterization (Section 7.6).

Terrestrial Plants and Invertebrates. Site-specific toxicity data for plants and invertebrates were not available for Site 1. A literature search was performed for each ECPC. Toxicity-response studies with toxicity endpoints of adverse growth, reproduction, or survival effects to a test population were identified and summarized in Appendix F, Table F-4 (plants) and Table F-5 (invertebrates).

7.6 RISK CHARACTERIZATION. Potential risks associated with exposures to ECPCs in surface soil at Site 1 are discussed separately for wildlife, terrestrial plants, and soil invertebrates. Risks to wildlife are characterized by comparing PDE dose estimates for each surface soil ECPC with a respective TRV. The potential for adverse effects to terrestrial plants and to soil invertebrates is evaluated by comparing toxicity benchmarks to the highest chemical concentration detected in surface soil.

Terrestrial Wildlife. An HQ approach was employed to quantify risks for the representative wildlife species associated with ingestion and bioaccumulation of ECPCs in surface soil and prey items. HQs are calculated for each ECPC by

dividing the PDE concentration by the selected lethal and sublethal TRV. When the estimated PDE is less than the TRV (i.e., the HQ is less than 1), it is assumed that chemical exposures are not associated with adverse effects to receptors and no risks to wildlife populations exist. For instance, if the PDE is less than the lethal TRV, then it is assumed that adverse effects are unlikely to occur. Similarly, if the PDE is less than the sublethal TRV, then it is assumed that adverse effects related to growth and reproduction are unlikely to occur. HQs greater than 1 suggest the possibility of adverse effects of reproduction and survival. As the HQ increases, the likelihood that an adverse effect will occur also increases.

HIIs are determined for each receptor by summing the HQs for all ECPCs. HIIs greater than 1 suggest the possibility of adverse effects. As the HI increases, the likelihood that an adverse effect will occur also increases. When an HI is greater than 1, a discussion of the ecological significance of the HQs comprising the HI is completed and risks from exposure to average concentrations of ECPCs are evaluated.

This HRS evaluates potential ecological effects to individual organisms and does not evaluate potential population-wide effects. Chemicals may cause population reductions by affecting birth and mortality rates, immigration, and emigration (USEPA, 1989c). In many circumstances, lethal or sublethal effects may occur to individual organisms with little population or community-level impacts; however, as the number of individual organisms experiencing toxic effects increases, the probability that population effects will occur also increases. The number of affected individuals in a population presumably increases with increasing HQ or HI values; therefore, the likelihood of population-level effects occurring is generally expected to increase with higher HQ or HI values.

The lethal and sublethal HQs and HIIs are calculated for each ECPC and each representative wildlife species. Appendix F, Tables F-6 through F-9, contain the HQ and HI calculations and assumptions. Table 7-7 provides a summary of risks to representative wildlife receptors. Using the highest detected concentration for each ECPC, all wildlife receptors had calculated HIIs of less than 1 for lethal exposure. Therefore, lethal risks are not predicted for these receptors (i.e., bioaccumulating chemicals are not sufficiently high to reduce survivability in terrestrial wildlife populations at Site 1).

The sublethal HI for the mourning dove of 1.9 slightly exceeds 1 based on maximum detected exposure concentrations from Site 1. The primary contributor to the sublethal HI is associated with ingestion of cadmium that has bioaccumulated in plant tissue. Because the HI value only slightly exceeds 1, population-level sublethal impacts to the mourning dove are unlikely. In addition, the distribution of cadmium in surface soil at Site 1 shows that this analyte was detected in only one of eight samples.

In summary, the results of the food-web modeling suggest that reductions in the survivability, growth, and reproduction of terrestrial wildlife populations at Site 1 are not expected to occur.

**Table 7-7
Ecological Risk for Wildlife for Surface Soil¹**

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Media Evaluated Ecological Receptors	Lethal Effects from Exposure to EPCs	Sublethal Effects from Exposure to EPCs	Primary Risk Contributors
Surface Soil			
Cotton mouse	2.0E-01	7.6E-01	NE
Eastern meadowlark	2.2E-01	9.7E-01	NE
Short-tailed shrew	1.6E-01	4.0E-01	NE
Mourning dove	6.1E-01	1.9E+00	Cadmium
Red fox	1.1E-03	6.8E-03	NE
Great horned owl	2.6E-03	2.2E-01	NE

¹ The information listed is a summary of Tables F-6 through F-9 in Appendix F.

Notes: EPC = exposure point concentration.

NE = not evaluated; risk was not predicted from exposure to maximum EPCs.

Terrestrial Plants. Risks for terrestrial plants were evaluated by comparing the selected phytotoxicity TRV to the EPC.

Table 7-8 compares the EPC for chemicals detected in surface soil at Site 1 to the plant TRVs. The highest detected concentrations of xylene(total), dieldrin, arsenic, cadmium, lead, and mercury were below their respective benchmark values. Only chromium and vanadium exceeded their benchmark values. No plant TRV for cyanide was available; therefore, potential risks associated with cyanide were not quantified.

A discussion of the potential toxicity effect to plants from exposure to chromium and vanadium is presented below.

Chromium. Plant exposure to chromium occurs mainly by absorption through their roots. Chromium compounds have been detected in both roots and leaves suggesting that translocation of chromium compounds occurs (Foy et al., 1978). Symptoms of toxicity include stunted growth, poorly developed roots, and leaf curling. Chromium may interfere with carbon, nitrogen, phosphorus, iron, molybdenum metabolism, and some enzyme reactions. The hexavalent form is more soluble and available to plants than the trivalent form and is considered the more toxic form (Kabata-Pendias and Pendias, 1986). The toxicity studies used to derive the benchmark values were based on hexavalent chromium exposure. Benchmark values derived from hexavalent chromium studies may overestimate the risk at sites containing trivalent chromium.

The phytotoxicity benchmark for chromium was obtained from Will and Suter (1994), and represents the 10th percentile of the lowest observed effects concentrations

**Table 7-8
 Ecological Risk for Plants and Invertebrates in Site 1 Surface Soil**

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Analytical Parameter	Exposure Point Concentrations	TRV		TRV Exceeded?	
		Plant ¹	Invertebrate ²	Plant	Invertebrate
<u>Volatile Organic Compounds (mg/kg)</u>					
Xylenes (total)	0.002	> 1000	21	No	No
<u>Pesticides and PCBs (mg/kg)</u>					
Dieldrin	0.0015	12.5	6	No	No
<u>Inorganic Analytes (mg/kg)</u>					
Cadmium	0.71	3	50	No	No
Chromium	30	1	50	Yes	No
Cyanide	1.1	NA	NA	NA	NA
Lead	44	50	1,190	No	No
Mercury	0.195	0.3	36	No	No
Vanadium	33.6	2	NA	Yes	NA

¹ Plant TRVs are from Table F-3 in Appendix F. Generally, the plant TRVs are the lowest observed effect concentration from among plant growth studies on plants in solid media.

² Invertebrate TRVs are presented in Table F-4 in Appendix F. Generally, invertebrate TRVs are the lowest LC₅₀ (14-day soil test on *Eisenia foetida*) from among chemicals in the same chemical class (applies to organic compounds). A conservative factor of 0.2 was applied to invertebrate TRVs; the resultant value should be protective of 99.9 percent of the population from lethal effects (U.S.Environmental Protection Agency, 1986b).

Notes: TRV = toxicity reference value.
 mg/kg = milligrams per kilogram.
 NA = not available.
 [shaded box] = shading indicates exceedances.
 LC₅₀ = lethal concentration to 50 percent of the population.

(LOECs) for growth and yield endpoints. Since the number of chromium studies included in the authors' review was less than 10 (n=7), the phytotoxicity benchmark is equal to the lowest LOEC, and a confidence level of "low" was assigned by the authors. Furthermore, some of the plants used in the laboratory studies for chromium are particularly sensitive species (e.g., lettuce, tomato, oats, soybean). Will and Suter (1994) suggest that the derived benchmarks are conservative; using these benchmarks may overestimate population- or community-level impacts.

Chromium concentrations for surface soil samples collected at Site 1 ranged from 3.8 to 30 mg/kg (30 mg/kg was an average of a sample and its duplicate). The eight surface soil samples had an average concentration of 12.6 mg/kg. Further evaluation of background surface soil collected from NAS Whiting Field shows that chromium was detected at concentrations ranging from 2.4 to 16.3 mg/kg. Therefore, soil collected from both Site 1 and from background samples contained concentrations of chromium well above the 1 mg/kg benchmark value. In addition, no areas of stressed vegetation were observed at Site 1 during the site characterization.

Given the low confidence level assigned to the phytotoxicity benchmark for chromium, exceedance of the benchmark by background levels of chromium, and the lack of visual evidence of stressed vegetation at Site 1, it is unlikely that plant biomass and/or plant cover would be reduced over the entire area of Site 1 such that small mammal and bird populations would be affected.

Vanadium. Vanadium exposure is primarily through root sorption. After uptake, most vanadium remains in the root system in insoluble form with calcium. Toxicity symptoms include chlorosis, dwarfing, and inhibited root growth. Vanadium inhibits various enzyme systems while stimulating others, the overall effect on plant growth being negligible (Will and Suter, 1994).

Vanadium detected in surface soil samples collected from Site 1 may be from natural or anthropogenic sources. Vanadium was detected in all eight samples at concentrations ranging from 8.1 to 33.6 mg/kg (average concentration of 21.7 mg/kg). Further evaluation of background surface soil collected from NAS Whiting Field shows that vanadium was detected at concentrations ranging from 6 to 31.9 mg/kg. The Site 1 EPC for vanadium of 33.6 mg/kg only slightly exceeds the maximum background concentration of 31.6 mg/kg. Although both values exceed the phytotoxicity benchmark of 2 mg/kg, it appears that detected concentrations of vanadium at Site 1 may be representative of background conditions. Therefore, reductions in plant biomass and/or plant cover are not predicted at Site 1.

Terrestrial Invertebrates. Risks for terrestrial invertebrates were evaluated by comparing invertebrate toxicity benchmark values to the highest detected concentration for each ECPC. The results of this evaluation for Site 1 surface soil are presented in Table 7-8. Invertebrate toxicity benchmark values are not available for cyanide and vanadium.

Maximum EPCs of ECPCs are well below the available invertebrate toxicity benchmark values; therefore, it is unlikely that the assessment endpoint including invertebrate biomass and/or abundance would be reduced such that small mammal and bird populations would be affected at Site 1.

7.7 UNCERTAINTY ANALYSIS. The objective of the uncertainty analysis is to discuss the assumptions of the ERA process that may influence the risk assessment results and conclusions. Table 2-5 of the GIR presents several general uncertainties inherent in the risk assessment process (ABB-ES, 1998).

Specific uncertainties associated with exposure to surface soil at Site 1 include the following:

- The dermal exposure pathway is not evaluated in the Site 1 ERA because it is generally considered insignificant due to protective fur and feathers. It is assumed that soil trapped in the fur or feathers is likely to be ingested during grooming or preening activities, which are evaluated as part of the indirect exposure pathway. If contaminants in surface soil are absorbed through the fur and feathers prior to grooming activities or other exposed areas, such as the foot pads or nose, risks to terrestrial wildlife may be underestimated.
- Inhalation of fugitive dust and volatile emissions are not evaluated in the Site 1 ERA. It is assumed that the vegetation at Site 1 would limit the release of fugitive dust. Only one VOC, xylene, was detected in the surface soil at a low frequency and concentration; therefore, inhalation of VOCs is unlikely. In addition, there is no evidence of the presence of burrowing animals at Site 1. If inhalation exposure pathways do exist at Site 1, risks to terrestrial wildlife may be underestimated.
- Risks to adult amphibians and reptiles species were not estimated for surface soil ECPCs because bioaccumulation and toxicity data for this taxonomic group are generally lacking in the literature. As a result, potential risks associated with ECPCs are uncertain for these species. Intertaxonomic surrogates were not used to calculate dietary risks to reptiles because of the uncertainty associated with extrapolation of data from endothermic to essentially ectothermic species.
- Risks to avian species may have been underestimated because bioaccumulation and toxicity data for this taxonomic group are generally lacking in the literature. As a result, potential lethal risks associated with cadmium and sublethal risks associated with xylene and dieldrin were not evaluated for avian species. If the toxicological and contaminant transport data obtained from studies conducted on mammals were used to estimate risks to avian species, then risk estimates for birds would be higher. However, there is also uncertainty in assuming that the metabolic functions of mammals and birds are similar enough to use intertaxonomic surrogates.
- TRVs for chromium, lead, and mercury were selected assuming that these inorganic constituents are present in their most toxic form at Site 1. Although chemical speciation of these ECPCs was not conducted, the available evidence suggests that site conditions are unlikely to result in the conversion of these metals to their most toxic forms. Therefore, risks to terrestrial wildlife may be overestimated.

Conversion of trivalent to hexavalent chromium is not likely at Site 1 because the more toxic, hexavalent form of chromium usually occurs in

aqueous environments, particularly for sediment with strong redox potentials. Similarly, it is unlikely that mercury exists in its most toxic form, methylmercury, because methylation of inorganic mercury also occurs in aquatic environments via biological processes. Review of disposal practices at Site 1 also supports the assumption that these metals are not present in their most toxic form. There is no history of disposal of tetraethyl lead at the site. Given that paints were one of the waste types disposed of at Site 1, it is likely that both lead and mercury were disposed of in the less toxic, inorganic form.

- Bioaccumulation factors for plant material are based on the assumption that plants are 80 percent water. This assumption applies to berries and leafy vegetables, but does not apply to grains, which have a moisture content of only 10 percent. Since the diets of the mouse and the mourning dove consist primarily of grains, the risks to these receptors may be underestimated.
- There is uncertainty associated with the ingestion toxicity data derived from the IRIS and Registry of Toxic Effects of Chemical Substances (RTECS) database. The IRIS and RTECS data were obtained in 1993 and 1995, respectively, and the primary literature citation was not provided; therefore, the primary literature for these studies were not reviewed. This may have resulted in the selection of TRVs that may overestimate or underestimate potential risks to wildlife receptors. TRVs for xylene and dieldrin were obtained from IRIS, and the TRV for cadmium was obtained from RTECS.
- Site-specific toxicity data for Site 1 surface soil is not available. Phytotoxicity and invertebrate benchmark values used in the risk assessment were designed for risk screening purposes only and may not be relevant to the specific conditions of the surface soil at Site 1. The conservative nature of these screening tools may overestimate the actual risk to terrestrial plants and invertebrates at Site 15. However, invertebrate benchmark values for several analytes are not available, potentially resulting in an underestimation of risk for terrestrial invertebrates.

7.8 SUMMARY OF ECOLOGICAL ASSESSMENT FOR SITE 1. Potential risks for ecological receptors including terrestrial wildlife, terrestrial plants, and soil invertebrates were evaluated for ECPCs in surface soil at Site 1.

Risks associated with exposure to ECPCs in Site 1 surface soil were evaluated for terrestrial wildlife based on a model that estimates the amount of contaminant exposure obtained via the diet and incidental ingestion of surface soil. Comparison of estimated doses for wildlife species with reference toxicity doses representing thresholds for lethal and sublethal effects is the basis of the wildlife risk evaluation. Although the sublethal HI for the mourning dove slightly exceeds 1, population-level sublethal impacts are not predicted. The primary contributor to the sublethal HI for the mourning dove is associated with ingestion of cadmium that has bioaccumulated in plant tissue. Distribution of cadmium in surface soil shows that this analyte was detected in only one of eight samples. Therefore, reductions in the survivability, growth, or reproduction of

small mammal and bird populations associated with exposure to ECPCs in Site 1 surface soil are not expected to occur.

Risks to terrestrial plants and soil invertebrates were evaluated by comparing exposure concentrations for surface soil with toxicity benchmarks. Based on this comparison, maximum EPCs of chromium and vanadium exceed their respective phytotoxicity benchmarks. However, background screening concentrations of chromium and vanadium, which are similar to site-related concentrations, also exceed the phytotoxicity benchmarks. Therefore, reductions in plant biomass and/or plant cover are not predicted at Site 1. Maximum EPCs of ECPCs are well below available invertebrate toxicity benchmark values; therefore, it is unlikely that invertebrate biomass and/or abundance would be reduced such that small mammal and bird populations would be affected.

In summary, the results of the ERA suggest that risks are not predicted for ecological receptors at Site 1.

8.0 CONTAMINANT FATE AND TRANSPORT

This chapter discusses the fate and transport of human health and ecological chemicals of potential concern (CPCs) detected in soil and groundwater samples at Site 1. Fate, in the context of this chapter, refers to the ultimate disposition of a given CPCs following its release into the environment. Transport refers to the mechanism(s) by which a given chemical released into the environment will arrive at its fate. Explanation of the fate and transport of chemicals in the environment can be very complicated or very simple, depending on the physical, chemical, and biological characteristics of the compound or metal considered and the environment into which that compound is released.

Several organic compounds and inorganics were detected in soil and groundwater sampled at Site 1. Because of the number of potential chemicals detected and the myriad fate and transport scenarios possible for those chemicals in the media, this discussion will focus only on those chemicals that may pose adverse risk to human or ecological receptors, as identified by the HHRA (Chapter 6.0) and the ERA (Chapter 7.0) in this report.

The following discussion of contaminant fate and transport is divided into two sections. Section 8.1 discusses potential migration routes of a chemical(s) in the media evaluated and does not focus specifically on media found to be of concern at Site 1. The site-specific persistence, fate, and transport of those compounds and elements found to pose a potential risk to human health or the environment are discussed in Section 8.2.

8.1 POTENTIAL ROUTES OF MIGRATION. Several routes of migration are possible for a contaminant in the various media: air, soil, surface water, groundwater, and biota. These routes are summarized below.

Air. Gases and particulate material can be transported in the atmosphere. Organic compounds, metals, and metal complexes that exist as gases at surface temperature and pressure may disperse or diffuse into the air and particulates may become entrained in air and thereby migrate. The extent to which gaseous constituents and particulate material remain airborne is a function of the level of excitation of the air (wind and temperature) and fate processes acting on the constituent and, for particulates, their density. Particulate material as discussed herein consists of organic compounds and inorganic material that would otherwise not be present in a gaseous medium under atmospheric conditions.

Soil. The primary agents of migration acting on soil include wind, rainwater, running water, biological activity, and human activity. Wind commonly transports soil in the form of particulate material. Rainwater may cause soil to migrate either by washing soil particles downward into the subsurface or by carrying soil particles overland to surface water bodies or other areas of deposition. The amount and type of vegetative cover and surface disturbance affects the degree to which wind and water cause soil to migrate.

Surface Water. The mechanisms for migration of constituents in surface water are dissolution and suspension. Several organic compounds and metals are soluble in water and can be transported in the aqueous phase. Other organic compounds and elements are not soluble in water, but may be transported by surface water via

suspension. The amount of suspended particulate material in surface water is largely a function of the water's energy; as that energy decreases, suspended material will settle and become part of the soil or sediment. Colloidal material may remain in suspension (by electrochemical forces) in water of very low energy (e.g., standing water).

Sediment. Saltation, traction, suspension, biological action, and human action are the primary mechanisms of migration for sediment. Physical, chemical, and biological processes affecting a constituent will determine where and how migration from sediment will occur.

Groundwater. Groundwater is a liquid medium capable of transporting constituents as colloidal forms, as complexes, as pure phase liquids, or as dissolved-phase liquids. Organic compounds and elements generally reach groundwater either by being placed directly into the water table (e.g., disposal pits) or by being leached from soil or solid waste to the water table by physical or chemical processes. Groundwater may discharge to the land surface, surface water bodies, other aquifers, or pumping wells. The migration of constituents from groundwater upon discharge depends on the chemical and/or physical processes acting upon that individual constituent in the medium to which it is discharged.

Biota. Biota may be considered a medium for migration of certain organic compounds and inorganics. Several compounds and elements are known to accumulate in the tissues of organisms at various levels in the food chain. As these organisms are consumed by other organisms, compounds and elements are accumulated in their tissue and passed on to organisms higher in the food chain. In this manner, contaminants may be transported by biota. Additionally, some organisms disturb bed sediments in streams and rivers. This disturbance can cause organic compounds and elements to be transported downstream as suspended material in surface water.

8.2 CONTAMINANT PERSISTENCE AND FATE. The discussion of contaminant persistence and fate in the environment is divided into three subsections. Subsection 8.2.1 discusses the processes that control the persistence and fate of organic compounds and inorganics in the environment. Subsection 8.2.2 discusses the primary persistence and fate characteristics of the constituents detected at Site 1. Subsection 8.2.3 discusses contaminant transport for Site 1.

8.2.1 Processes The persistence and fate of chemical constituents in the environment depends on various chemical, physical, and biological processes. The predominant processes affecting the environmental persistence and fate of chemical constituents include solubility, photolysis, volatilization, hydrolysis, oxidation, chemical speciation, complexation, precipitation or co-precipitation, cationic exchange, sorption, biodegradation or biotransformation, and bioaccumulation. These processes are briefly summarized below.

Solubility. The solubility of chemical constituents in water is important in assessing their mobility in the environment. This is particularly important for the transport and ultimate fate of chemicals from soil and sediment to water (i.e., groundwater and/or surface water). Generally for organic compounds, aqueous solubility is a function of molecular size, molecular polarity, temperature, and the presence of other dissolved organic co-solvents. For metals and other inorganic parameters, solubility is generally controlled by chemical

speciation, pH, Eh (redox potential), oxygen content, and the presence of dissolved and/or colloidal organic compounds (e.g., humic and fulvic acids) or other inorganic ion species (e.g., hydroxides and sulfates) (USEPA, 1979). Increased solubility is usually directly related to increased environmental mobility with groundwater and/or surface water being the principal transport medium. Therefore, solubility is a significant factor affecting the fate of a compound or element in the water environment.

Photolysis. Many chemical constituents, particularly organic compounds, are susceptible to photolytic degradation either directly or indirectly. Direct photolysis involves a splitting of the chemical compound by light, whereas indirect photolysis occurs when another compound is transformed by light into a reactive species (i.e., usually an hydroxyl radical) that reacts with and modifies the original compound. In general, photolysis primarily occurs within the atmosphere, although it may also occur to a limited extent in surface water and/or soil under certain environmental conditions (USEPA, 1979).

Volatilization. Volatilization of organic chemicals from soil or water to the atmosphere is an important pathway for chemicals with high vapor pressures. For organic compounds, volatilization is a function of partial pressure gradients, temperature, and molecular size and is more likely to occur for compounds with low molecular weights. In addition, certain metals such as mercury, arsenic, and lead are capable of undergoing biologically mediated transformation (i.e., alkylation) that form volatile end products. Volatilization is important for the transport of certain chemical constituents from surface soil (i.e., vadose zone), sediment, and surface water and is evaluated using Henry's law and other associated chemical-specific rate constants.

Hydrolysis. Hydrolysis involves the decomposition of a chemical compound by its reaction with water. The rate of reaction may be promoted by acid (hydronium ion, $[H_3O^+]$) and/or base (hydroxyl ion, $[OH^-]$) compounds. In general, most organic compounds are resistant to hydrolytic reactions unless they contain a functional group (or groups) capable of reacting with water. Metallic compounds, however, generally dissociate readily in water depending upon the aqueous environmental conditions (e.g., pH and ionic strength). For metals, hydrolytic dissociation is an indirect process that affects the primary fate and transport mechanism of aqueous solubility.

Oxidation. The direct oxidation of organic compounds in natural environmental matrices may occur but this is generally a slow, insignificant transformation mechanism of minimal importance (USEPA, 1979). However, some inorganic compounds may be rapidly oxidized under naturally occurring environmental conditions when the surrounding environment changes from anaerobic to aerobic conditions.

Chemical Speciation. Chemical speciation is important primarily for metals that may exist in multiple forms in the environment, particularly within aqueous matrices. In general, the aqueous speciation of metals depends primarily upon the relative stabilities of individual valence states (which are element specific), oxygen content, pH and Eh condition, and the presence of available complexing agents and/or other cations and anions (USEPA, 1979). Because various metallic species exhibit differential aqueous solubilities and differential mobilities within soils and/or sediments (USEPA, 1979), the particular speciation of an individual metal will greatly affect its environmental mobility.

Complexation. For metals, complexation with various ligands is an important process because these complexes may be highly soluble in water. Complexation may, therefore, greatly enhance mobility within environmental matrices, particularly in groundwater and surface water, depending upon the aqueous solubility of the resulting complex. Complexation depends upon numerous factors such as pH, Eh, type and concentration of complexing ligands, and other ions present (USEPA, 1979).

Most metals are capable of forming numerous organic and/or inorganic complexes in the natural environment (USEPA, 1979). Metals may form organo-metallic complexes, especially with naturally occurring organic acids (i.e., humic and fulvic acids). In some cases, these metallic species may exhibit varying affinities for different organic ligands (i.e., mercury and arsenic for amino acids and their derivatives) (USEPA, 1979). Metals may also form metallo-inorganic complexes with inorganic ligands such as carbonate, halogens (usually chlorine), hydroxyl, and sulfate (USEPA, 1979). However, organo-metallic complex formation is usually favored over metallo-inorganic complexes.

Precipitation and Co-precipitation. Both chemical precipitation and co-precipitation are important removal mechanisms, particularly for metals and metallo-cyanides in the environment. Precipitation and/or co-precipitation reactions depend on numerous aqueous environmental conditions such as pH, Eh, organic ligands present, oxygen content, and cationic and anionic species present (USEPA, 1979). Depending on the specific conditions, the removal of aqueous metallic species and metallo-cyanides from groundwater and/or surface water can greatly affect a metal's environmental mobility and, hence, its ultimate fate and transport.

Cation Exchange. Cation exchange is important primarily for metals and other ions that may substitute with other cations of similar charge and size within the lattice structure of clay minerals in soil and/or sediment (USEPA, 1979). This process, therefore, can significantly affect the mobility of an aqueous metal cation by removing it from solution under certain environmental conditions.

Sorption. The sorption of chemical constituents by inorganic particulate matter (i.e., soil or sediment) and organic compounds is an important process that affects mobility in the environment. This process is particularly important for the fate and transport of chemicals from soil or sediment to water (i.e., groundwater and surface water). In general, most metals exhibit a potential for adsorption to inorganic particulate matter and organic compounds (USEPA, 1979). Organic compounds also exhibit sorptive capability, but show greater variability in their ability to sorb to particulate or organic matter. The tendency for organic compounds to sorb to soils or sediment is reflected in their organic carbon partitioning coefficients (K_{oc}). K_{oc} is a measure of relative adsorption potential. The normal range of K_{oc} values is from 1 to 10^7 with higher values indicating greater sorption potential. Actual adsorption is chemical specific and is largely dependent on the organic content of the soil. The fraction of organic carbon, f_{oc} , in soil times the K_{oc} is defined as the distribution coefficient, K_d . The K_d is a ratio of the concentration adsorbed to the concentration partitioned to water.

Regardless of chemical class, sorption is a reversible process whereby desorption can be favored over sorption under certain environmental conditions (e.g., low pH for metals). For organic compounds in general, as the molecular weight

increases and the aqueous solubility decreases (i.e., low polarity and high hydrophobicity), the sorptive binding affinity increases (i.e., K_{oc} increases). The tendency for chemical constituents to adsorb to inorganic particulate and/or organic compounds is a particularly important process because sorption to soils and/or sediments can effectively reduce a chemical constituent's mobility.

Biodegradation or Biotransformation. Biodegradation is a result of the enzyme-catalyzed transformation of chemicals. Organisms require energy, carbon, and essential nutrients from the environment for their growth and maintenance. In the process, chemicals from the environment will be transformed by enzymes into a form that can be used by the organism. The biodegradation rate is the rate by which contaminants will be degraded. The rate is a function of microbial biomass and a chemical's concentration under given environmental conditions. When a pollutant is introduced into the environment, there is often a lag time before biodegradation begins while the organism generates an enzyme capable of digesting the chemical. Co-metabolism occurs when a pollutant can be biotransformed only in the presence of another compound that serves as a carbon and energy source (USEPA, 1979).

Bioaccumulation. Bioconcentration and bioaccumulation data are important when evaluating the impact of chemicals in the aquatic environment. The process is characterized by hydrophobic chemicals that can be partitioned into fat and lipid tissues and inorganic chemicals that can be partitioned into bone marrow. The bioconcentration factor is a measure of the concentration of a chemical in tissue (on a dry-weight basis) divided by the concentration in water, and is a commonly used parameter to quantify bioconcentration (USEPA, 1979). The process is significant because bioaccumulation magnifies up through the food chain.

8.2.2 Persistence and Fate of Site 1 CPCs This section discusses the persistence and fate characteristics for CPCs detected at Site 1. To focus the discussion of persistence and fate characteristics, only those constituents that were (1) identified by the human health or ERAs (presented in Chapters 6.0 and 7.0, respectively) as CPCs and (2) those constituents that were present above relevant standards will be addressed. These constituents are summarized below by medium for Site 1.

Human Health Assessment Constituents

- Surface soil: aluminum, arsenic, and iron
- Groundwater: aluminum and iron

Ecological Assessment Constituents

- Surface soil: chromium and vanadium

The fate and persistence characteristics of these constituents are summarized below by analytical fraction.

Inorganics. Aluminum is the third most common element in the environment, though not generally found in elevated concentrations in groundwater. Aluminum is known to complex readily, however, and high concentrations present in groundwater are generally due to silt-sized particles of aluminum-containing compounds often present as clays or aluminum hydroxides. Complexing and polymerization of the

most common valence state of aluminum, Al^{+3} , represents the predominant transport mechanism for aluminum in the environment.

Arsenic has two stable forms in solution in groundwater, arsenate (As^{5+}) and arsenite (As^{3+}). In groundwater with pH ranging from 3 to 7, the monovalent arsenate anion $H_2AsO_4^-$ is the dominant form. Upon entering surface water, via groundwater discharge, arsenic may partition to sediment from solution by hydrous iron oxide adsorption and/or co-precipitation (or a combination of both) with sulfides in the sediment. The Eh and pH conditions of the surface water and sediment govern the effectiveness of these mechanisms (adsorption and co-precipitation) as a sink for arsenic. These mechanisms appear to be the major inorganic factors controlling arsenic concentrations in surface water (Hem, 1992).

Arsenic may be very mobile in the aquatic environment, cycling through the water column, sediment, biota, and air. Most arsenic released into the environment (on the earth's surface) eventually ends up either in sediments (in stream beds or lakes) or in the oceans. Eh and pH conditions largely govern the fate of arsenic (USEPA, 1979).

Chromium is present in minerals predominantly as Cr^{3+} . Dissolved chromium may be present as trivalent cations or as anions in which the oxidation state is Cr^{6+} (hexavalent). Six different ionic forms of chromium are considered to be stable in aqueous systems. The reduced forms are Cr^{3+} , $CrOH^{2+}$, $Cr(OH)_2^+$, and $Cr(OH)_3$. Anionic forms present under oxidizing conditions include dichromate $Cr_2O_7^{2-}$ and chromate CrO_4^{2-} . The dissolved forms that predominate in reduced systems between pH 5 and pH 9 probably are $CrOH^{2+}$ and $Cr(OH)_2^+$. Concentrations of chromium in natural waters that have not been affected by waste disposal are commonly less than $10 \mu g/l$ (Hem, 1992).

Iron is the second most abundant element in the environment though dissolved concentrations present in groundwater are generally low. The chemical behavior of iron and its solubility depend upon the oxidation intensity and pH of the environmental system in which it is found. Iron exists in two valence states, Fe^{2+} and Fe^{3+} , with the Fe^{2+} or ferrous form the most common form of iron found in solution in the reducing conditions within the groundwater environment. Dissolved iron generally sorbs to sediment and may precipitate as iron hydroxide or may oxidize to form iron oxides and iron oxyhydroxides (USEPA, 1979). Iron also may complex with organic molecules, especially fluvic and humic acids. Aerated or flowing water with a pH in the range of 6.5 to 8.5 should contain little dissolved iron.

Vanadium commonly exists in the V^{3+} , V^{4+} , and V^{5+} valence states. Its aqueous chemistry is quite complex, but overall concentrations seem to be controlled more by availability of a vanadium source, rather than equilibrium considerations. Bioconcentration of vanadium by vegetation has been reported by several researchers.

8.2.3 Transport of Contaminants This section discusses the transport of chemicals in various media at Site 1. All media, surface soil, subsurface soil, surface water, sediment, and groundwater will be discussed.

Surface Soil. Transport of the CPCs in soil is dependent on several factors, as discussed in Section 8.1. The primary agents of migration acting on soil include

wind, water, and human activity. Soil can also act as a source medium from which the CPCs are transported to other media. Transport of the CPCs from soil via wind is not expected to be a major transport mechanism because of the heavy vegetation present at Site 1. Vegetative cover is an effective means of limiting wind erosion of soil. Humans are effective at moving soil and can greatly affect the transport of soil-bound chemicals at hazardous waste sites. Under the current use of Site 1, human activity is not a major transport mechanism for the CPCs in soils. This condition may change based on the future use of Site 1.

Water can cause the transport of soil and, therefore, the CPCs in soil, via the mechanisms of physical transport of soil or the leaching of constituents from the soil to groundwater. Soil erosion, the physical transport of soil via surface water runoff, is currently not considered a major mechanism for the transport of the CPCs in soil at Site 1 because of (1) the low grade (slope) of the land surface at the site, (2) the heavy vegetation at the site, and (3) the nature of the constituents remaining in the soil at the site.

During the period of reported active disposal at the Site 1, from 1943 to 1965, the potential for physical transport of both soil and CPCs via runoff could have been a potentially significant mechanism for transport. If pits were excavated into the soil and waste materials were dumped into the pits, heavy precipitation events could have easily moved the unvegetated soil around the pits. Additionally, the possibility exists that the pits overflowed during heavy rain storms, because they were not covered during their operation. The pits are presumed to be backfilled following their periods of use, and the area revegetated. No significant transport of surface soil is expected since revegetation of the Site 1 area.

The majority of the analytes detected in the soil at Site 1 are likely to remain attached to the soil because most metal analytes adsorb readily to or are natural constituents of clays and other minerals.

Surface Water. There are no permanent surface water bodies associated with Site 1. Transport of the water-borne CPCs from Site 1 may occur during heavy rain events as surface runoff and enter drainage ditch "E" southwest of the site. This drainage ditch is concrete lined in the vicinity of the site but it is unlined west of Site 1. Surface water runoff is directed west (approximately 1,500 feet) toward an unnamed tributary of Clear Creek. Water is present in the ditch and tributary only during heavy rain events, and infiltration directly into the soil in the unlined portion of the drainage ditch is presumed to occur during all but the heaviest rain events.

Currently, transport of the CPCs at Site 1 via runoff is not considered an important transport mechanism because of (1) the low slope of the land surface at the site, (2) high infiltration capacity of soil at the site, (3) the heavy vegetation at Site 1, and (4) the tendency of the surface soil contaminants at the sites to remain attached to clays in the soil.

When Site 1 was an active disposal area, transport of the CPCs via surface water runoff may have been a more significant means of contaminant transport. If disposal pits were open to rainfall during their operation, it is possible that intense precipitation could have caused the pits (if they existed) to overflow. Transport of the CPCs via surface water runoff is not considered important now that the site is vegetated.

Sediment. The transport of sediment at Site 1 by the action of humans is not currently a significant transport mechanism, as very little human activity occurs in the drainage ditch. Saltation, traction, and suspension are possible means of sediment transport in water at Site 1 during heavy rain events.

Normally there is no flow of water in the drainage ditch and unnamed tributary of Clear Creek. Drainage ditch "E" is concrete lined south of the site and is also separated by a berm. During heavy rain events, sediment may become suspended in surface water runoff and enter the drainage ditch southwest of the site where the berm ends and the ditch is unlined. It is believed that the sediment would not remain in suspension long enough to reach the tributary of Clear Creek because most of the surface water would infiltrate rapidly into the ground.

Groundwater. As discussed in Section 5.5, the observed concentrations of the inorganics in unfiltered groundwater at Site 1 was affected by turbidity in the groundwater samples at the time of collection. The groundwater samples collected in 1996 (during Phase IIB) are thought to be more representative of groundwater conditions at the site. It is probable that particulate material of larger than colloidal sizes does not easily move through the matrix of the aquifer. Colloid-sized material may be transported through the aquifer matrix at flow rates present in the surficial aquifer system at Site 1.

Hydrogeology at Site 1 is discussed in Section 5.6 of this report. The aquifer present at the site is the surficial (sand and gravel) aquifer. The CPCs identified for groundwater are associated with the surficial aquifer system. Recharge of the surficial aquifer at Site 1 occurs primarily by rainfall on the site and in the area north of the site. Groundwater flow direction in the surficial aquifer at Site 1 is primarily to the south-southwest. Clear Creek acts as a point of discharge approximately 5,000 feet south of the site.

Hydraulic data from the well cluster (WHF1-1 and WHF1-1S) completed in the southwest part of the site indicate that vertical gradient in this area is downward. The upper (approximately) 100 feet of material is a sand with varying amounts of silt and clay and likely act as a single hydraulic unit.

It is important to note that the presence of upward or downward vertical hydraulic gradients does not mean that flow is actually occurring, only that flow, if it were to occur, would be in a horizontal direction with an upward or downward component. Lithologies present at a site, such as clay or clayey sands, may retard the vertical flow. Vertical hydraulic gradients should be viewed as indicative of a potential, not necessarily as an actual transport route.

Horizontal hydraulic gradient estimates have been developed for the Site 1 area. The gradient was calculated for the period between September 1993 and November 1996 and averaged (Table 5-9). The average hydraulic gradient in the surficial aquifer is 0.0039 ft/ft in a south-southwest direction.

Hydraulic conductivity testing was completed on monitoring well WHF1-1S at Site 1. The average hydraulic conductivity value for the site is 0.0135 feet per minute or 19.47 ft/day (Table 5-11).

Horizontal groundwater seepage velocity calculations have been completed for the surficial aquifer system at Site 1 using available hydraulic information

(Section 5.6). A seepage velocity of 62 ft/yr was calculated using the average hydraulic conductivity from monitoring wells WHF-1-2 and WHF-1-1S at Site 1 (0.17 ft/day), an average horizontal gradient of 0.0039 ft/ft for these monitoring wells, and an estimated effective porosity of 0.35. Disposal activities at Site 1 may have begun releasing contaminants to the aquifer approximately 50 years ago. Using the seepage velocity calculated above and a 50-year timeframe, the total distance of potential contaminant migration was estimated to be approximately 3,100 feet.

The calculated estimate of 3,100 feet of migration relies on hydraulic conductivity values derived from slug test data. Slug tests provide a rough estimate of hydraulic conductivity that can be more accurately measured using pumping tests. Slug data may differ by up to a factor of 10 (Bouwer and Rice, 1989). If the hydraulic conductivity value used in the calculation were decreased by an order of magnitude, a total migration of only 310 feet would be expected for the 50-year history of the site.

Clear Creek is the final point of discharge for groundwater from the surficial aquifer at Site 1. Clear Creek is located approximately 5,000 feet southwest of Site 1. Surface water and sediment samples collected during Phase I of the RI from sampling locations located upstream and downstream of the expected groundwater discharge points from Site 1 do not conclusively support any impact to surface water quality of Clear Creek from past Site 1 activities (ABB-ES, 1992b). The results of surface water and sediment sampling are presented in Technical Memorandum No. 4, Surface Water and Sediments, May 1992 (ABB-ES, 1992b) and will also be presented in the concurrent Remedial Investigation Report for Site 39, Clear Creek Flood Plain.

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 CONCLUSIONS. The following is a summary based on the RI at Site 1, Northwest Disposal Area, NAS Whiting Field.

- Geophysical surveys conducted during the RI did not reveal any evidence of landfilling.
- The test pit sampling conducted during the RI did not reveal any evidence of landfilling within the location and depth explored.
- Neither methane nor VOCs were detected at concentrations above the 1 part per million IDL during the soil gas survey conducted during the Phase IIB assessment.
- Neither SVOCs nor PCBs were detected at concentrations exceeding detection limits in surface soil samples collected at Site 1. One VOC (xylenes) was detected in two surface soil samples. One pesticide compound (dieldrin) was detected in one sample. None of the detected concentrations exceeded USEPA Region III RBCs or Florida soil cleanup goals.
- Twenty inorganic analytes were detected in the surface soil samples. Eleven inorganic analytes exceeded the background screening values. Detected concentrations of arsenic exceeded the residential and industrial values of the USEPA Region III RBCs and the residential values of the Florida soil cleanup goals. However, the concentrations did not exceed the FDEP-approved site-specific industrial-use soil cleanup goal for covered landfill sites at NAS Whiting Field (Appendix G, FDEP, 1998).
- Detected concentrations of arsenic exceed the residential and industrial values of the USEPA Region III RBCs and the residential values of the Florida soil cleanup goals. However, the concentrations did not exceed the FDEP-approved site-specific industrial use soil cleanup goal for covered landfill sites at NAS Whiting Field.
- Neither SVOCs, pesticides, nor PCBs were detected at concentrations exceeding detection limits in the subsurface soil sample collected at Site 1. One VOC (acetone) was detected in the sample; however, acetone is a common field or laboratory derived contaminant. Sixteen inorganic analytes were detected in the subsurface soil sample. Only Mercury slightly exceeded the background screening value. No inorganic analytes detected in the subsurface soil sample exceeded the Florida soil cleanup goal for industrial soils.
- VOCs, SVOCs, or PCBs were not detected in groundwater samples at concentrations exceeding Federal or State MCLs. One pesticide compound (beta-benzene hexachloride) was detected in two samples; however, no applicable standard currently exists (Appendix G, FDEP, 1998).

- Two inorganic analytes, aluminum and iron, were detected in two groundwater samples collected from shallow monitoring wells at concentrations exceeding Federal and State MCLs.
- None of the inorganic analytes detected in the groundwater samples collected from the intermediate monitoring well exceeded Federal or State MCLs.
- The pH values of the groundwater samples collected from monitoring wells were below the lower range for the Federal and State Secondary MCLs but were within the range of pH values observed in background groundwater samples collected at NAS Whiting Field.
- The groundwater flow direction is to the south-southwest and discharges at Clear Creek; the creek is located approximately 5,000 feet southwest of the site.
- The HHRA determined exposure to chemicals detected in soil and groundwater samples at Site 1 are not likely to pose an unacceptable carcinogenic risk or noncancer hazard to a current or hypothetical future receptor at of the site based on USEPA guidelines and target risk values.
- The total ELCR associated with ingestion of soil by a hypothetical future resident (1×10^{-5}) and occupational worker (1×10^{-6}) did meet or exceed FDEP's target level of concern (1×10^{-6}) due to arsenic. However, arsenic was detected at concentrations below an FDEP-approved site-specific soil cleanup goal (FDEP, 1998).
- The noncancer hazards associated with ingestion and direct contact of soil by a hypothetical future child resident slightly exceeded USEPA's target HI of 1; however, no individual analyte exceeded 1.
- Noncancer risk in surface soil is primarily from iron. Iron was detected in surface soil samples at concentrations of an order of magnitude less than acceptable essential nutrient levels.
- The ERA suggests two inorganic analytes (chromium and vanadium) detected in the surface soil samples could have potential adverse effects for plants; however, both chromium and vadium were detected at concentrations below their respective regional averages for surface soil concentrations.
- Soil and food items containing chemicals from Site 1 are unlikely to have lethal effects to wildlife receptors.
- Sublethal exposures are unlikely to result in adverse effects to reproduction and survival except for the herbivore mammal. The cotton mouse had a calculated HI of 2, suggesting a potential for adverse effects to reproduction and survival. The primary contributor of sublethal risk to wildlife is arsenic (HQ=1.4).

9.2 RECOMMENDATIONS. Based on the interpretation of findings from the remedial investigation activities a focused feasibility study is proposed for Site 1, Northwest Disposal Area.

10.0 PROFESSIONAL REVIEW CERTIFICATION

The work and professional opinions rendered in this report were conducted or developed in accordance with commonly accepted procedures consistent with applied standards of practice. This report is based on the geologic investigation and associated information detailed in the text and appended to this report. If conditions are determined to exist that differ from those described, the undersigned geologist should be notified to evaluate the effects of any additional information on the assessment described in this report. The remedial investigation for Site 1, Northwest Disposal Area, was developed for NAS Whiting Field in Milton, Florida, and should not be construed to apply for any other purpose to any other site.

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June 11, 1998

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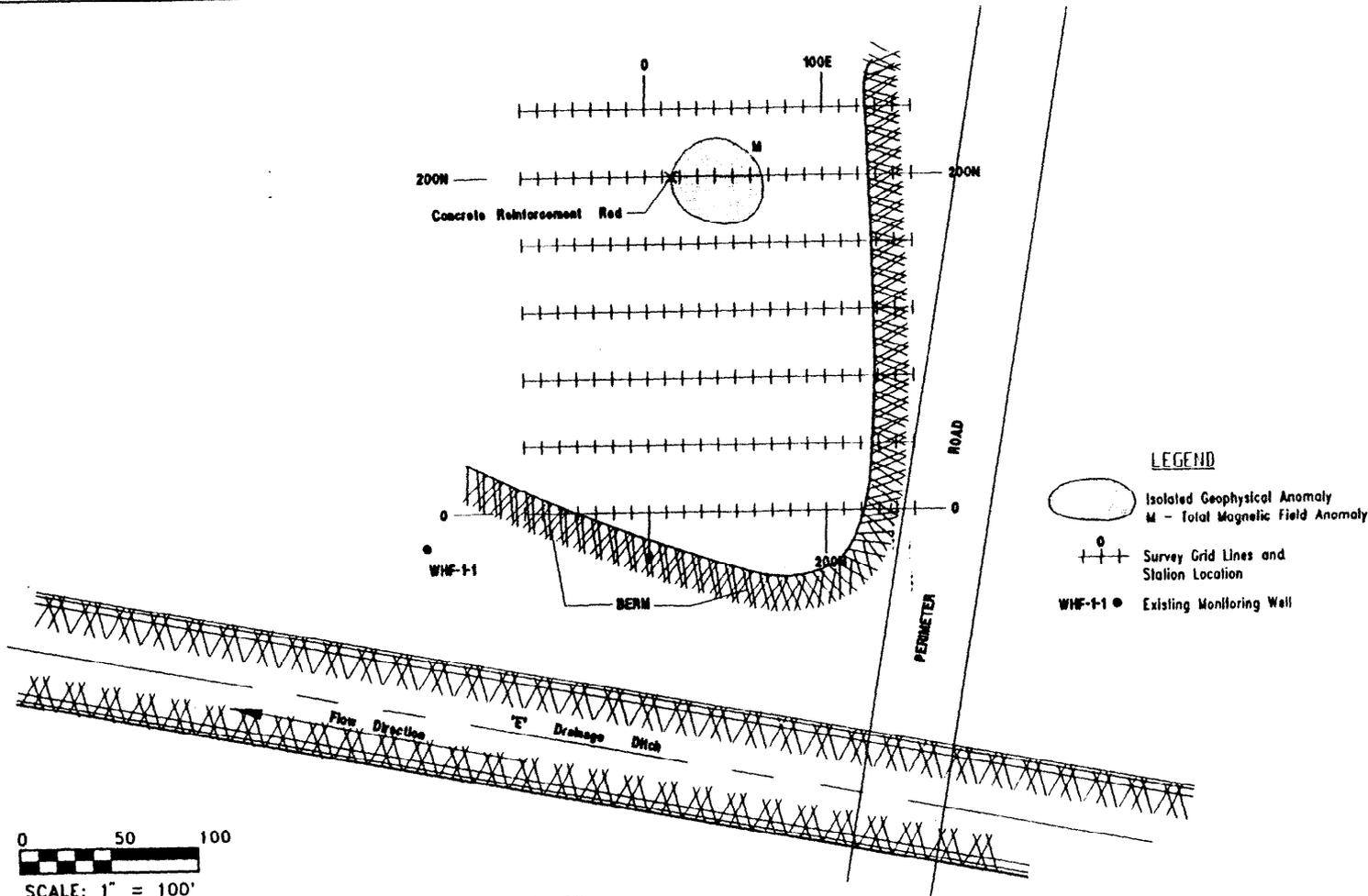
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APPENDIX A
GEOPHYSICAL DATA



Source: Blackhawk Geosciences, Inc. 1992

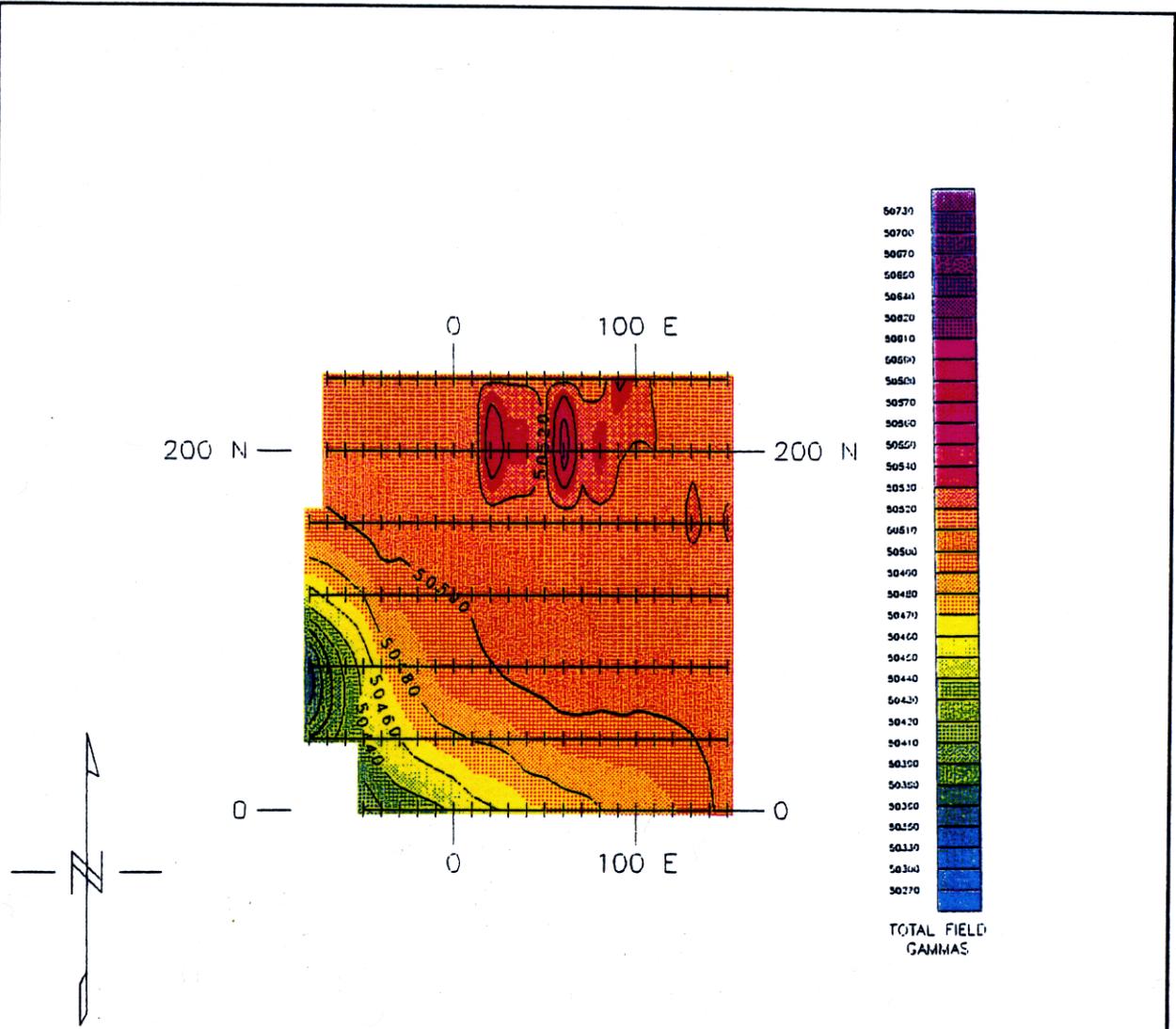
FIGURE A-1
SITE 1
GEOPHYSICAL SURVEY GRID LINES
AND INTERPRETED ANOMALY LOCATIONS



REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST
DISPOSAL AREA

NAS WHITING FIELD
MILTON, FLORIDA

NOTES:
 NAS = Naval Air Station



NOTE:
 NAS = Naval Air Station

SOURCE: Blackhawk Geosciences, Inc. 1992

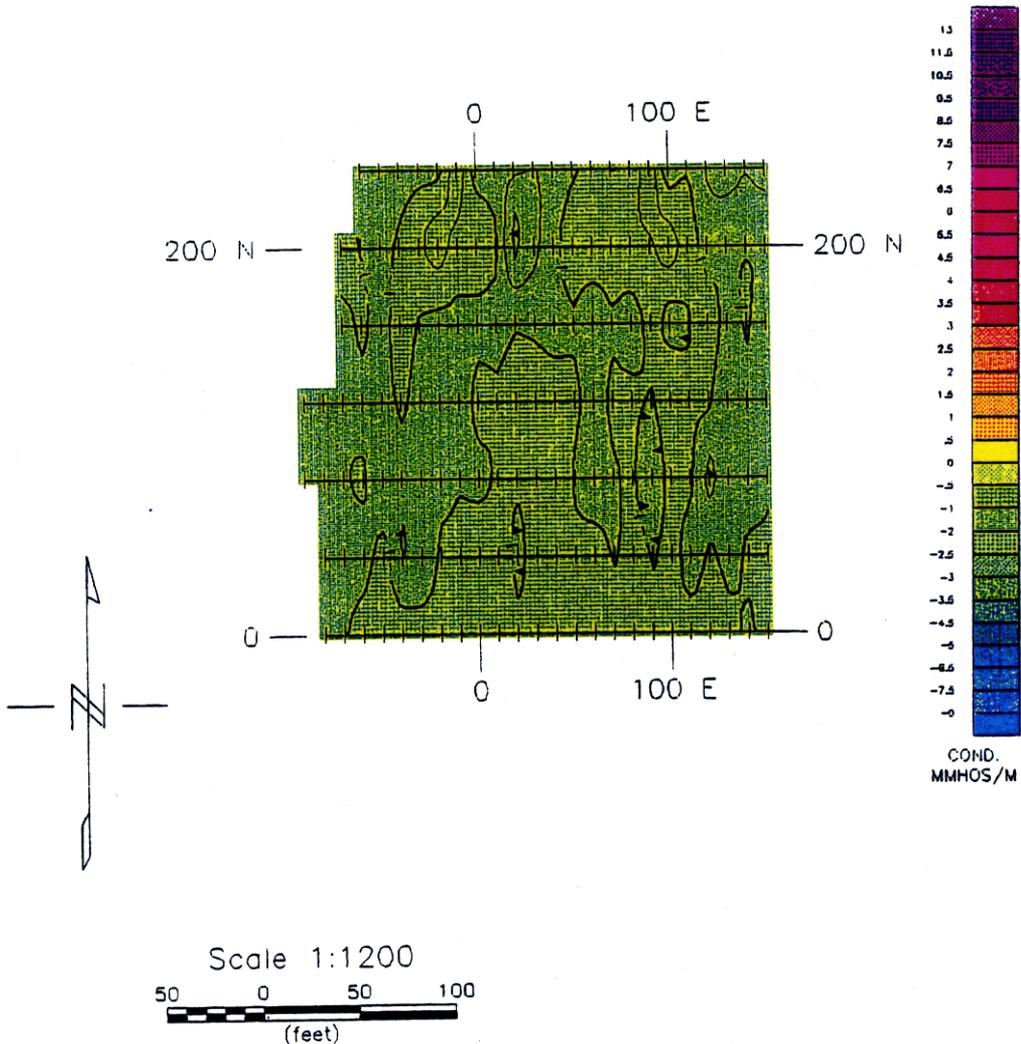
FIGURE A-2
SITE 1
TOTAL MAGNETIC FIELD
ISOPLETH MAP



REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST
DISPOSAL AREA

NAS WHITING FIELD
MILTON, FLORIDA

00739FB3V



NOTE:
 NAS = Naval Air Station

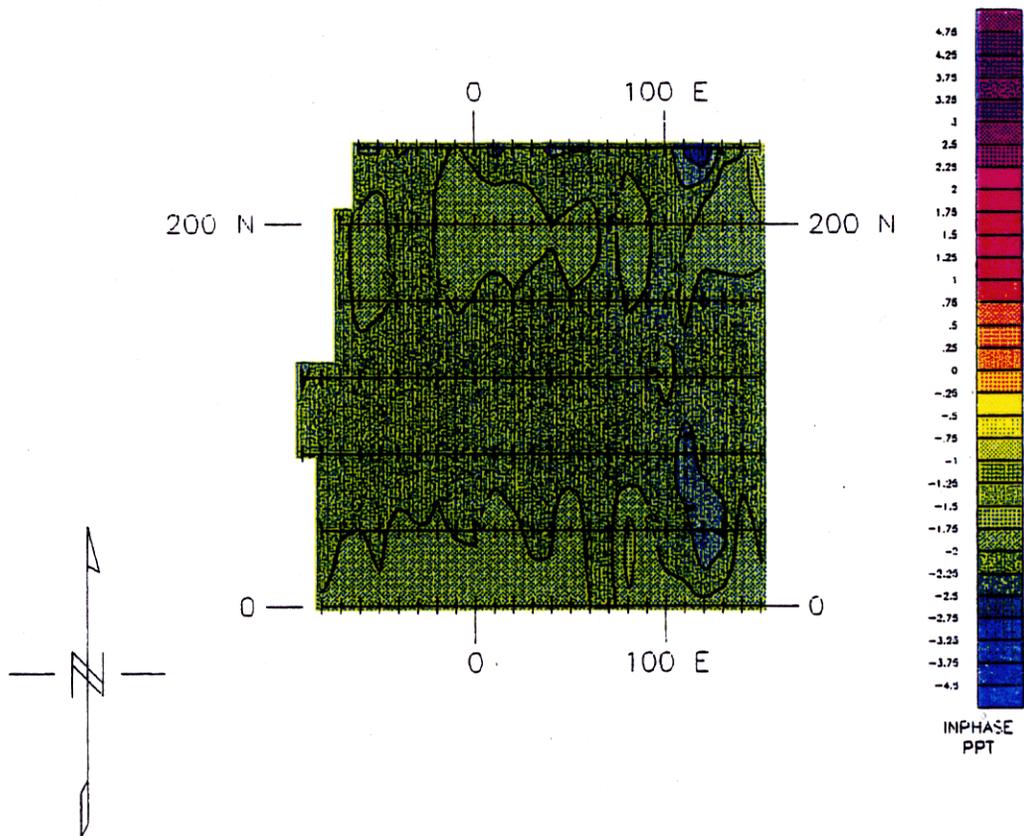
SOURCE: Blackhawk Geosciences, Inc. 1992

**FIGURE A-3
 SITE 1
 EM-31 CONDUCTIVITY
 ISOPLETH MAP**



**REMEDIAL INVESTIGATION REPORT
 SITE 1, NORTHWEST
 DISPOSAL AREA**

**NAS WHITING FIELD
 MILTON, FLORIDA**



NOTE:
 NAS = Naval Air Station

SOURCE: Blackhawk Geosciences, Inc. 1992

FIGURE A-4
SITE 1
EM-31 INPHASE
ISOPLETH MAP



REMEDIAL INVESTIGATION REPORT
SITE 1, NORTHWEST
DISPOSAL AREA

NAS WHITING FIELD
MILTON, FLORIDA

APPENDIX B

QUALITY CONTROL DATA

Naval Air Station Whiting Field, Milton, Florida
Site 1 Quality Control Sample Data

Lab Sample Number:	G8876013	G8876012	G8864001	RB887005
Site	WHITING	WHITING	WHITING	WHITING
Locator	01F00101	01R00101	01T00101	01R01101
Collect Date:	06-DEC-95	06-DEC-95	05-DEC-95	23-JUL-96

	VALUE	QUAL	UNITS	DL												
CLP VOLATILES 90-SOW ug/l																
Chloromethane	10	U	ug/l	10	10	U	ug/l	10	10	UJ	ug/l	10	10	U	ug/l	10
Bromomethane	10	U	ug/l	10												
Vinyl chloride	10	U	ug/l	10												
Chloroethane	10	U	ug/l	10	10	U	ug/l	10	10	U	ug/l	10	10	UJ	ug/l	10
Methylene chloride	10	U	ug/l	10	10	U	ug/l	10	10	U	ug/l	10	10	UJ	ug/l	10
Acetone	12	U	ug/l	12	11	U	ug/l	11	9	J	ug/l	10	10	UJ	ug/l	10
Carbon disulfide	10	U	ug/l	10	10	U	ug/l	10	10	U	ug/l	10	10	UJ	ug/l	10
1,1-Dichloroethene	10	U	ug/l	10												
1,1-Dichloroethane	10	U	ug/l	10												
1,2-Dichloroethene (total)	10	U	ug/l	10												
Chloroform	10	U	ug/l	10												
1,2-Dichloroethane	10	U	ug/l	10												
2-Butanone	2	J	ug/l	10	10	U	ug/l	10	10	U	ug/l	10	10	U	ug/l	10
1,1,1-Trichloroethane	10	U	ug/l	10												
Carbon tetrachloride	10	U	ug/l	10												
Bromodichloromethane	10	U	ug/l	10												
1,2-Dichloropropane	10	U	ug/l	10												
cis-1,3-Dichloropropene	10	U	ug/l	10												
Trichloroethene	10	U	ug/l	10												
Dibromochloromethane	10	U	ug/l	10												
1,1,2-Trichloroethane	10	U	ug/l	10												
Benzene	10	U	ug/l	10												
trans-1,3-Dichloropropene	10	U	ug/l	10												
Bromoform	10	U	ug/l	10												
4-Methyl-2-pentanone	10	U	ug/l	10												
2-Hexanone	10	U	ug/l	10												
Tetrachloroethene	10	U	ug/l	10												
Toluene	10	U	ug/l	10												
1,1,2,2-Tetrachloroethane	10	U	ug/l	10												
Chlorobenzene	10	U	ug/l	10												
Ethylbenzene	10	U	ug/l	10												
Styrene	10	U	ug/l	10												
Xylenes (total)	10	U	ug/l	10												
CLP SEMIVOLATILES 90-SOW ug/l																
Phenol	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
bis(2-Chloroethyl) ether	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
2-Chlorophenol	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
1,3-Dichlorobenzene	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
1,4-Dichlorobenzene	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
1,2-Dichlorobenzene	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
2-Methylphenol	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
2,2-oxybis(1-Chloropropane)	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
4-Methylphenol	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
N-Nitroso-di-n-propylamine	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
Hexachloroethane	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
Nitrobenzene	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
Isophorone	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
2-Nitrophenol	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10
2,4-Dimethylphenol	10	U	ug/l	10	10	U	ug/l	10	-	-	ug/l	10	10	U	ug/l	10

Naval Air Station Whiting Field, Milton, Florida
Site 1 Quality Control Sample Data

Lab Sample Number:	G8876013	G8876012	G8864001	RB887005
Site	WHITING	WHITING	WHITING	WHITING
Locator	01F00101	01R00101	01T00101	01R01101
Collect Date:	06-DEC-95	06-DEC-95	05-DEC-95	23-JUL-96

	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL
bis(2-Chloroethoxy) methane	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,4-Dichlorophenol	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
1,2,4-Trichlorobenzene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Naphthalene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
4-Chloroaniline	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Hexachlorobutadiene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
4-Chloro-3-methylphenol	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2-Methylnaphthalene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Hexachlorocyclopentadiene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,4,6-Trichlorophenol	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,4,5-Trichlorophenol	25 U	ug/l	25	25 U	ug/l	25	-	ug/l		25 U	ug/l	25
2-Chloronaphthalene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2-Nitroaniline	25 U	ug/l	25	25 U	ug/l	25	-	ug/l		25 U	ug/l	25
Dimethylphthalate	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Acenaphthylene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,6-Dinitrotoluene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
3-Nitroaniline	25 U	ug/l	25	25 U	ug/l	25	-	ug/l		25 U	ug/l	25
Acenaphthene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,4-Dinitrophenol	25 UJ	ug/l	25	25 UJ	ug/l	25	-	ug/l		25 U	ug/l	25
4-Nitrophenol	25 U	ug/l	25	25 U	ug/l	25	-	ug/l		25 U	ug/l	25
Dibenzofuran	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,4-Dinitrotoluene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Diethylphthalate	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
4-Chlorophenyl-phenylether	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Fluorene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
4-Nitroaniline	25 U	ug/l	25	25 U	ug/l	25	-	ug/l		25 UJ	ug/l	25
4,6-Dinitro-2-methylphenol	25 U	ug/l	25	25 U	ug/l	25	-	ug/l		25 U	ug/l	25
N-Nitrosodiphenylamine	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
4-Bromophenyl-phenylether	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Hexachlorobenzene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Pentachlorophenol	25 U	ug/l	25	25 U	ug/l	25	-	ug/l		25 U	ug/l	25
Phenanthrene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Anthracene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Carbazole	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Di-n-butylphthalate	15	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Fluoranthene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Pyrene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Butylbenzylphthalate	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
3,3-Dichlorobenzidine	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Benzo (a) anthracene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Chrysene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 UJ	ug/l	10
bis(2-Ethylhexyl) phthalate	10 U	ug/l	10	2	ug/l	10	-	ug/l		10 U	ug/l	10
Di-n-octylphthalate	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Benzo (b) fluoranthene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Benzo (k) fluoranthene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Benzo (a) pyrene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Indeno (1,2,3-cd) pyrene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Dibenzo (a,h) anthracene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Benzo (g,h,i) perylene	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		10 U	ug/l	10
CLP PESTICIDES/PCBS 90-SOW	ug/l											
alpha-BHC	.05 UJ	ug/l	.05	.05 UJ	ug/l	.05	-	ug/l		.05 U	ug/l	.05

Naval Air Station Whiting Field, Milton, Florida
Site 1 Quality Control Sample Data

Lab Sample Number:	G8876013			G8876012			G8864001			R8887005		
Site	WHITING			WHITING			WHITING			WHITING		
Locator	01F00101			01R00101			01T00101			01R01101		
Collect Date:	06-DEC-95			06-DEC-95			05-DEC-95			23-JUL-96		
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL
beta-BHC	.05 U	ug/l	.05	.05 U	ug/l	.05	-	ug/l		.05 U	ug/l	.05
delta-BHC	.05 U	ug/l	.05	.05 U	ug/l	.05	-	ug/l		.05 U	ug/l	.05
gamma-BHC (Lindane)	.05 U	ug/l	.05	.05 U	ug/l	.05	-	ug/l		.05 U	ug/l	.05
Heptachlor	.05 U	ug/l	.05	.05 U	ug/l	.05	-	ug/l		.05 U	ug/l	.05
Aldrin	.05 U	ug/l	.05	.05 U	ug/l	.05	-	ug/l		.05 U	ug/l	.05
Heptachlor epoxide	.05 U	ug/l	.05	.05 U	ug/l	.05	-	ug/l		.05 U	ug/l	.05
Endosulfan I	.05 U	ug/l	.05	.05 U	ug/l	.05	-	ug/l		.05 U	ug/l	.05
Dieldrin	.1 U	ug/l	.1	.1 U	ug/l	.1	-	ug/l		.1 U	ug/l	.1
4,4-DDE	.1 U	ug/l	.1	.1 U	ug/l	.1	-	ug/l		.1 U	ug/l	.1
Endrin	.1 U	ug/l	.1	.1 U	ug/l	.1	-	ug/l		.1 U	ug/l	.1
Endosulfan II	.1 U	ug/l	.1	.1 U	ug/l	.1	-	ug/l		.1 U	ug/l	.1
4,4-DDD	.1 U	ug/l	.1	.1 U	ug/l	.1	-	ug/l		.1 U	ug/l	.1
Endosulfan sulfate	.1 U	ug/l	.1	.1 U	ug/l	.1	-	ug/l		.1 U	ug/l	.1
4,4-DDT	.1 U	ug/l	.1	.1 U	ug/l	.1	-	ug/l		.1 U	ug/l	.1
Methoxychlor	.5 U	ug/l	.5	.5 U	ug/l	.5	-	ug/l		.5 U	ug/l	.5
Endrin ketone	.1 U	ug/l	.1	.1 U	ug/l	.1	-	ug/l		.1 U	ug/l	.1
Endrin aldehyde	.1 U	ug/l	.1	.1 U	ug/l	.1	-	ug/l		.1 U	ug/l	.1
alpha-Chlordane	.05 U	ug/l	.05	.05 U	ug/l	.05	-	ug/l		.05 U	ug/l	.05
gamma-Chlordane	.05 U	ug/l	.05	.05 U	ug/l	.05	-	ug/l		.05 U	ug/l	.05
Toxaphene	5 U	ug/l	5	5 U	ug/l	5	-	ug/l		5 U	ug/l	5
Aroclor-1016	1 U	ug/l	1	1 U	ug/l	1	-	ug/l		1 U	ug/l	1
Aroclor-1221	2 U	ug/l	2	2 U	ug/l	2	-	ug/l		2 U	ug/l	2
Aroclor-1232	1 U	ug/l	1	1 U	ug/l	1	-	ug/l		1 U	ug/l	1
Aroclor-1242	1 U	ug/l	1	1 U	ug/l	1	-	ug/l		1 U	ug/l	1
Aroclor-1248	1 U	ug/l	1	1 U	ug/l	1	-	ug/l		1 U	ug/l	1
Aroclor-1254	1 U	ug/l	1	1 U	ug/l	1	-	ug/l		1 U	ug/l	1
Aroclor-1260	1 U	ug/l	1	1 U	ug/l	1	-	ug/l		1 U	ug/l	1
CLP METALS AND CYANIDE	ug/l											
Aluminum	200 U	ug/l	200	200 U	ug/l	200	-	ug/l		13.3 J	ug/l	
Antimony	60 U	ug/l	60	60 U	ug/l	60	-	ug/l		8.6 U	ug/l	
Arsenic	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		.5 U	ug/l	
Barium	200 U	ug/l	200	200 U	ug/l	200	-	ug/l		1.7 U	ug/l	
Beryllium	5 U	ug/l	5	5 U	ug/l	5	-	ug/l		.3 U	ug/l	
Cadmium	5 U	ug/l	5	5 U	ug/l	5	-	ug/l		1.2 U	ug/l	
Calcium	5000 U	ug/l	5000	178 J	ug/l	5000	-	ug/l		47.9 U	ug/l	
Chromium	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		2 U	ug/l	
Cobalt	50 U	ug/l	50	50 U	ug/l	50	-	ug/l		2.3 U	ug/l	
Copper	25 U	ug/l	25	25 U	ug/l	25	-	ug/l		1.1 U	ug/l	
Iron	100 U	ug/l	100	100 U	ug/l	100	-	ug/l		10.8 U	ug/l	
Lead	3 U	ug/l	3	3 U	ug/l	3	-	ug/l		.5 U	ug/l	
Magnesium	5000 U	ug/l	5000	5000 U	ug/l	5000	-	ug/l		19.7 U	ug/l	
Manganese	15 U	ug/l	15	15 U	ug/l	15	-	ug/l		1 U	ug/l	
Mercury	.2 U	ug/l	.2	.2 U	ug/l	.2	-	ug/l		.1 U	ug/l	
Nickel	40 U	ug/l	40	40 U	ug/l	40	-	ug/l		7.3 U	ug/l	
Potassium	5000 U	ug/l	5000	5000 U	ug/l	5000	-	ug/l		316 U	ug/l	
Selenium	5 U	ug/l	5	5 U	ug/l	5	-	ug/l		.6 U	ug/l	
Silver	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		2.5 U	ug/l	
Sodium	5000 U	ug/l	5000	5000 U	ug/l	5000	-	ug/l		23.6 U	ug/l	
Thallium	10 U	ug/l	10	10 U	ug/l	10	-	ug/l		.6 U	ug/l	
Vanadium	50 U	ug/l	50	50 U	ug/l	50	-	ug/l		1.2 U	ug/l	
Zinc	20 U	ug/l	20	2.9 J	ug/l	20	-	ug/l		1.2 U	ug/l	

Naval Air Station Whiting Field, Milton, Florida
 Site 1 Quality Control Sample Data

	Lab Sample Number:	G8876013		G8876012		G8864001		RB887005	
	Site	WHITING		WHITING		WHITING		WHITING	
	Locator	01F00101		01R00101		01T00101		01R01101	
	Collect Date:	06-DEC-95		06-DEC-95		05-DEC-95		23-JUL-96	
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL
Cyanide	10 U	ug/l	10	10 U	ug/l	10	-	2.6 J	ug/l

Naval Air Station Whiting Field, MILTON, Florida
 Site 1 Quality Control Sample Data

Lab Sample Number: RB887001
 Site: WHITING
 Locator: 01T01201
 Collect Date: 22-JUL-96

VALUE QUAL UNITS DL

CLP VOLATILES 90-SOW	ug/l			
Chloromethane	10 U	ug/l		10
Bromomethane	10 U	ug/l		10
Vinyl chloride	10 U	ug/l		10
Chloroethane	10 U	ug/l		10
Methylene chloride	10 U	ug/l		10
Acetone	10 UJ	ug/l		10
Carbon disulfide	10 U	ug/l		10
1,1-Dichloroethene	10 U	ug/l		10
1,1-Dichloroethane	10 U	ug/l		10
1,2-Dichloroethene (total)	10 U	ug/l		10
Chloroform	10 U	ug/l		10
1,2-Dichloroethane	10 U	ug/l		10
2-Butanone	10 U	ug/l		10
1,1,1-Trichloroethane	10 U	ug/l		10
Carbon tetrachloride	10 U	ug/l		10
Bromodichloromethane	10 U	ug/l		10
1,2-Dichloropropane	10 U	ug/l		10
cis-1,3-Dichloropropene	10 U	ug/l		10
Trichloroethene	10 U	ug/l		10
Dibromochloromethane	10 U	ug/l		10
1,1,2-Trichloroethane	10 U	ug/l		10
Benzene	10 U	ug/l		10
trans-1,3-Dichloropropene	10 U	ug/l		10
Bromoform	10 U	ug/l		10
4-Methyl-2-pentanone	10 U	ug/l		10
2-Hexanone	10 U	ug/l		10
Tetrachloroethene	10 U	ug/l		10
Toluene	10 U	ug/l		10
1,1,2,2-Tetrachloroethane	10 U	ug/l		10
Chlorobenzene	10 U	ug/l		10
Ethylbenzene	10 U	ug/l		10
Styrene	10 U	ug/l		10
Xylenes (total)	10 U	ug/l		10
CLP SEMIVOLATILES 90-SOW	ug/l			
Phenol	-	ug/l		
bis(2-Chloroethyl) ether	-	ug/l		
2-Chlorophenol	-	ug/l		
1,3-Dichlorobenzene	-	ug/l		
1,4-Dichlorobenzene	-	ug/l		

Naval Air Station Whiting Field, Milton, Florida
 Site 1 Quality Control Sample Data

Lab Sample Number: RB887001
 Site WHITING
 Locator 01T01201
 Collect Date: 22-JUL-96

VALUE QUAL UNITS DL

	VALUE	QUAL UNITS	DL
1,2-Dichlorobenzene	-	ug/l	
2-Methylphenol	-	ug/l	
2,2-oxybis(1-Chloropropane)	-	ug/l	
4-Methylphenol	-	ug/l	
N-Nitroso-di-n-propylamine	-	ug/l	
Hexachloroethane	-	ug/l	
Nitrobenzene	-	ug/l	
Isophorone	-	ug/l	
2-Nitrophenol	-	ug/l	
2,4-Dimethylphenol	-	ug/l	
bis(2-Chloroethoxy) methane	-	ug/l	
2,4-Dichlorophenol	-	ug/l	
1,2,4-Trichlorobenzene	-	ug/l	
Naphthalene	-	ug/l	
4-Chloroaniline	-	ug/l	
Hexachlorobutadiene	-	ug/l	
4-Chloro-3-methylphenol	-	ug/l	
2-Methylnaphthalene	-	ug/l	
Hexachlorocyclopentadiene	-	ug/l	
2,4,6-Trichlorophenol	-	ug/l	
2,4,5-Trichlorophenol	-	ug/l	
2-Chloronaphthalene	-	ug/l	
2-Nitroaniline	-	ug/l	
Dimethylphthalate	-	ug/l	
Acenaphthylene	-	ug/l	
2,6-Dinitrotoluene	-	ug/l	
3-Nitroaniline	-	ug/l	
Acenaphthene	-	ug/l	
2,4-Dinitrophenol	-	ug/l	
4-Nitrophenol	-	ug/l	
Dibenzofuran	-	ug/l	
2,4-Dinitrotoluene	-	ug/l	
Diethylphthalate	-	ug/l	
4-Chlorophenyl-phenylether	-	ug/l	
Fluorene	-	ug/l	
4-Nitroaniline	-	ug/l	
4,6-Dinitro-2-methylphenol	-	ug/l	
N-Nitrosodiphenylamine	-	ug/l	
4-Bromophenyl-phenylether	-	ug/l	
Hexachlorobenzene	-	ug/l	
Pentachlorophenol	-	ug/l	
Phenanthrene	-	ug/l	
Anthracene	-	ug/l	
Carbazole	-	ug/l	
Di-n-butylphthalate	-	ug/l	
Fluoranthene	-	ug/l	
Pyrene	-	ug/l	
Butylbenzylphthalate	-	ug/l	
3,3-Dichlorobenzidine	-	ug/l	
Benzo (a) anthracene	-	ug/l	
Chrysene	-	ug/l	
bis(2-Ethylhexyl) phthalate	-	ug/l	

Naval Air Station Whiting Field, Milton, Florida
 Site 1 Quality Control Sample Data

Lab Sample Number: RB887001
 Site WHITING
 Locator 01T01201
 Collect Date: 22-JUL-96

	VALUE	QUAL UNITS	DL
Di-n-octylphthalate	-	ug/l	
Benzo (b) fluoranthene	-	ug/l	
Benzo (k) fluoranthene	-	ug/l	
Benzo (a) pyrene	-	ug/l	
Indeno (1,2,3-cd) pyrene	-	ug/l	
Dibenzo (a,h) anthracene	-	ug/l	
Benzo (g,h,i) perylene	-	ug/l	
CLP PESTICIDES/PCBS 90-SOW	ug/l		
alpha-BHC	-	ug/l	
beta-BHC	-	ug/l	
delta-BHC	-	ug/l	
gamma-BHC (Lindane)	-	ug/l	
Heptachlor	-	ug/l	
Aldrin	-	ug/l	
Heptachlor epoxide	-	ug/l	
Endosulfan I	-	ug/l	
Dieldrin	-	ug/l	
4,4-DDE	-	ug/l	
Endrin	-	ug/l	
Endosulfan II	-	ug/l	
4,4-DDD	-	ug/l	
Endosulfan sulfate	-	ug/l	
4,4-DDT	-	ug/l	
Methoxychlor	-	ug/l	
Endrin ketone	-	ug/l	
Endrin aldehyde	-	ug/l	
alpha-Chlordane	-	ug/l	
gamma-Chlordane	-	ug/l	
Toxaphene	-	ug/l	
Aroclor-1016	-	ug/l	
Aroclor-1221	-	ug/l	
Aroclor-1232	-	ug/l	
Aroclor-1242	-	ug/l	
Aroclor-1248	-	ug/l	
Aroclor-1254	-	ug/l	
Aroclor-1260	-	ug/l	
CLP METALS AND CYANIDE	ug/l		
Aluminum	-	ug/l	
Antimony	-	ug/l	
Arsenic	-	ug/l	
Barium	-	ug/l	
Beryllium	-	ug/l	
Cadmium	-	ug/l	
Calcium	-	ug/l	
Chromium	-	ug/l	
Cobalt	-	ug/l	
Copper	-	ug/l	
Iron	-	ug/l	
Lead	-	ug/l	
Magnesium	-	ug/l	

Naval Air Station Whiting Field, Milton, Florida
Site 1 Quality Control Sample Data

Lab Sample Number: RB887001
Site WHITING
Locator 01T01201
Collect Date: 22-JUL-96

VALUE QUAL UNITS DL

Manganese	-	ug/l	
Mercury	-	ug/l	
Nickel	-	ug/l	
Potassium	-	ug/l	
Selenium	-	ug/l	
Silver	-	ug/l	
Sodium	-	ug/l	
Thallium	-	ug/l	
Vanadium	-	ug/l	
Zinc	-	ug/l	
Cyanide	-	ug/l	

APPENDIX C

SOIL SAMPLE ANALYTICAL DATA

Naval Air Station Whiting Field, Milton, Florida
Site 1 Surface and Subsurface Soil data

Lab Sample Number:	S22454011	22454011	S22454012	22454012								
Site	WHITING	WHITING	WHITING	WHITING								
Locator	01-SL-01	01-SL-01	01-SL-02	01-SL-02								
Collect Date:	11-AUG-92	11-AUG-92	11-AUG-92	11-AUG-92								
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL

CLP VOLATILES 90-SOW

ug/kg

Chloromethane	-	ug/kg	11 U	ug/kg	11	-	ug/kg	12 U	ug/kg	12
Bromomethane	-	ug/kg	11 U	ug/kg	11	-	ug/kg	12 U	ug/kg	12
Vinyl chloride	-	ug/kg	11 U	ug/kg	11	-	ug/kg	12 U	ug/kg	12
Chloroethane	-	ug/kg	11 U	ug/kg	11	-	ug/kg	12 U	ug/kg	12
Methylene chloride	-	ug/kg	11 UJ	ug/kg	6	-	ug/kg	6 UJ	ug/kg	6
Acetone	-	ug/kg	11 U	ug/kg	11	-	ug/kg	12 UJ	ug/kg	12
Carbon disulfide	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
1,1-Dichloroethene	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
1,1-Dichloroethane	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
1,2-Dichloroethene (total)	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
Chloroform	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
1,2-Dichloroethane	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
2-Butanone	-	ug/kg	11 U	ug/kg	11	-	ug/kg	12 U	ug/kg	12
1,1,1-Trichloroethane	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
Carbon tetrachloride	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
Bromodichloromethane	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
1,2-Dichloropropane	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
cis-1,3-Dichloropropene	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
Trichloroethene	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
Dibromochloromethane	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
1,1,2-Trichloroethane	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
Benzene	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
trans-1,3-Dichloropropene	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
Bromoform	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
4-Methyl-2-pentanone	-	ug/kg	11 U	ug/kg	11	-	ug/kg	12 U	ug/kg	12
2-Hexanone	-	ug/kg	11 U	ug/kg	11	-	ug/kg	12 U	ug/kg	12
Tetrachloroethene	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
Toluene	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
1,1,2,2-Tetrachloroethane	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
Chlorobenzene	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
Ethylbenzene	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
Styrene	-	ug/kg	6 U	ug/kg	6	-	ug/kg	6 U	ug/kg	6
Xylenes (total)	-	ug/kg	1 J	ug/kg	6	-	ug/kg	6 U	ug/kg	6

CLP SEMIVOLATILES 90-SOW

ug/kg

Phenol	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
bis(2-Chloroethyl) ether	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
2-Chlorophenol	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
1,3-Dichlorobenzene	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
1,4-Dichlorobenzene	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
1,2-Dichlorobenzene	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
2-Methylphenol	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
2,2-oxybis(1-Chloropropane)	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
4-Methylphenol	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
N-Nitroso-di-n-propylamine	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
Hexachloroethane	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
Nitrobenzene	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
Isophorone	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
2-Nitrophenol	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390
2,4-Dimethylphenol	-	ug/kg	370 U	ug/kg	370	-	ug/kg	390 U	ug/kg	390

Naval Air Station Whiting Field, Milton, Florida
Site 1 Surface and Subsurface Soil data

Lab Sample Number:	S22454011	22454011	S22454012	22454012
Site	WHITING	WHITING	WHITING	WHITING
Locator	01-SL-01	01-SL-01	01-SL-02	01-SL-02
Collect Date:	11-AUG-92	11-AUG-92	11-AUG-92	11-AUG-92

	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
bis(2-Chloroethoxy) methane	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
2,4-Dichlorophenol	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
1,2,4-Trichlorobenzene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Naphthalene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
4-Chloroaniline	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Hexachlorobutadiene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
4-Chloro-3-methylphenol	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
2-Methylnaphthalene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Hexachlorocyclopentadiene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
2,4,6-Trichlorophenol	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
2,4,5-Trichlorophenol	-		ug/kg		1800	U	ug/kg		1800	-	ug/kg		1900	U	ug/kg	1900
2-Chloronaphthalene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
2-Nitroaniline	-		ug/kg		1800	UJ	ug/kg		1800	-	ug/kg		1900	UJ	ug/kg	1900
Dimethylphthalate	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Acenaphthylene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
2,6-Dinitrotoluene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
3-Nitroaniline	-		ug/kg		1800	UJ	ug/kg		1800	-	ug/kg		1900	UJ	ug/kg	1900
Acenaphthene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
2,4-Dinitrophenol	-		ug/kg		1800	U	ug/kg		1800	-	ug/kg		1900	U	ug/kg	1900
4-Nitrophenol	-		ug/kg		1800	UJ	ug/kg		1800	-	ug/kg		1900	UJ	ug/kg	1900
Dibenzofuran	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
2,4-Dinitrotoluene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Diethylphthalate	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
4-Chlorophenyl-phenylether	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Fluorene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
4-Nitroaniline	-		ug/kg		1800	UJ	ug/kg		1800	-	ug/kg		1900	UJ	ug/kg	1900
4,6-Dinitro-2-methylphenol	-		ug/kg		1800	U	ug/kg		1800	-	ug/kg		1900	U	ug/kg	1900
N-Nitrosodiphenylamine	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
4-Bromophenyl-phenylether	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Hexachlorobenzene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Pentachlorophenol	-		ug/kg		1800	U	ug/kg		1800	-	ug/kg		1900	U	ug/kg	1900
Phenanthrene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Anthracene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Carbazole	-		ug/kg		-		ug/kg		-	-		ug/kg		-		ug/kg
Di-n-butylphthalate	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Fluoranthene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Pyrene	-		ug/kg		370	UJ	ug/kg		370	-	ug/kg		390	UJ	ug/kg	390
Butylbenzylphthalate	-		ug/kg		370	UJ	ug/kg		370	-	ug/kg		390	UJ	ug/kg	390
3,3-Dichlorobenzidine	-		ug/kg		750	U	ug/kg		750	-	ug/kg		790	U	ug/kg	790
Benzo (a) anthracene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Chrysene	-		ug/kg		370	UJ	ug/kg		370	-	ug/kg		390	UJ	ug/kg	390
bis(2-Ethylhexyl) phthalate	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Di-n-octylphthalate	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Benzo (b) fluoranthene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Benzo (k) fluoranthene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Benzo (a) pyrene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Indeno (1,2,3-cd) pyrene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Dibenzo (a,h) anthracene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
Benzo (g,h,i) perylene	-		ug/kg		370	U	ug/kg		370	-	ug/kg		390	U	ug/kg	390
CLP PESTICIDES/PCBS 90-SOW	ug/kg															
alpha-BHC	-		ug/kg		9.1	U	ug/kg		9.1	-	ug/kg		9.5	U	ug/kg	9.5

Naval Air Station Whiting Field, Milton, Florida
Site 1 Surface and Subsurface Soil data

Lab Sample Number:	S22454011	22454011	S22454012	22454012					
Site	WHITING	WHITING	WHITING	WHITING					
Locator	01-SL-01	01-SL-01	01-SL-02	01-SL-02					
Collect Date:	11-AUG-92	11-AUG-92	11-AUG-92	11-AUG-92					
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL

beta-BHC	-	ug/kg		9.1 U	ug/kg	9.1	-	ug/kg	9.5 U	ug/kg	9.5
delta-BHC	-	ug/kg		9.1 U	ug/kg	9.1	-	ug/kg	9.5 U	ug/kg	9.5
gamma-BHC (Lindane)	-	ug/kg		9.1 U	ug/kg	9.1	-	ug/kg	9.5 U	ug/kg	9.5
Heptachlor	-	ug/kg		9.1 U	ug/kg	9.1	-	ug/kg	9.5 U	ug/kg	9.5
Aldrin	-	ug/kg		9.1 U	ug/kg	9.1	-	ug/kg	9.5 U	ug/kg	9.5
Heptachlor epoxide	-	ug/kg		9.1 U	ug/kg	9.1	-	ug/kg	9.5 U	ug/kg	9.5
Endosulfan I	-	ug/kg		9.1 U	ug/kg	9.1	-	ug/kg	9.5 U	ug/kg	9.5
Dieldrin	-	ug/kg		1.5 J	ug/kg	18	-	ug/kg	19 U	ug/kg	19
4,4-DDE	-	ug/kg		18 U	ug/kg	18	-	ug/kg	19 U	ug/kg	19
Endrin	-	ug/kg		18 U	ug/kg	18	-	ug/kg	19 U	ug/kg	19
Endosulfan II	-	ug/kg		18 U	ug/kg	18	-	ug/kg	19 U	ug/kg	19
4,4-DDD	-	ug/kg		18 U	ug/kg	18	-	ug/kg	19 U	ug/kg	19
Endosulfan sulfate	-	ug/kg		18 U	ug/kg	18	-	ug/kg	19 U	ug/kg	19
4,4-DDT	-	ug/kg		18 U	ug/kg	18	-	ug/kg	19 U	ug/kg	19
Methoxychlor	-	ug/kg		91 U	ug/kg	91	-	ug/kg	95 U	ug/kg	95
Endrin ketone	-	ug/kg		18 U	ug/kg	18	-	ug/kg	19 U	ug/kg	19
Endrin aldehyde	-	ug/kg		-	ug/kg	-	-	ug/kg	-	ug/kg	-
alpha-Chlordane	-	ug/kg		91 U	ug/kg	91	-	ug/kg	95 U	ug/kg	95
gamma-Chlordane	-	ug/kg		91 U	ug/kg	91	-	ug/kg	95 U	ug/kg	95
Toxaphene	-	ug/kg		180 U	ug/kg	180	-	ug/kg	190 U	ug/kg	190
Aroclor-1016	-	ug/kg		91 U	ug/kg	91	-	ug/kg	95 U	ug/kg	95
Aroclor-1221	-	ug/kg		91 U	ug/kg	91	-	ug/kg	95 U	ug/kg	95
Aroclor-1232	-	ug/kg		91 U	ug/kg	91	-	ug/kg	95 U	ug/kg	95
Aroclor-1242	-	ug/kg		91 U	ug/kg	91	-	ug/kg	95 U	ug/kg	95
Aroclor-1248	-	ug/kg		91 U	ug/kg	91	-	ug/kg	95 U	ug/kg	95
Aroclor-1254	-	ug/kg		180 U	ug/kg	180	-	ug/kg	190 U	ug/kg	190
Aroclor-1260	-	ug/kg		180 U	ug/kg	180	-	ug/kg	190 U	ug/kg	190

CLP METALS AND CYANIDE

mg/kg

Aluminum	5700	mg/kg	40	-	mg/kg	10500	mg/kg	40	-	mg/kg
Antimony	2.8 U	mg/kg	12	-	mg/kg	2.9 U	mg/kg	12	-	mg/kg
Arsenic	1.3 J	mg/kg	2	-	mg/kg	1.8 J	mg/kg	2	-	mg/kg
Barium	9.6 J	mg/kg	40	-	mg/kg	14.7 J	mg/kg	40	-	mg/kg
Beryllium	.1 J	mg/kg	1	-	mg/kg	.15 J	mg/kg	1	-	mg/kg
Cadmium	.62 U	mg/kg	1	-	mg/kg	.71 J	mg/kg	1	-	mg/kg
Calcium	321 J	mg/kg	1000	-	mg/kg	264 J	mg/kg	1000	-	mg/kg
Chromium	5.5	mg/kg	2	-	mg/kg	17.8	mg/kg	2	-	mg/kg
Cobalt	1.3 J	mg/kg	10	-	mg/kg	1.2 J	mg/kg	10	-	mg/kg
Copper	5.6 J	mg/kg	5	-	mg/kg	7.1	mg/kg	5	-	mg/kg
Iron	3960	mg/kg	20	-	mg/kg	10400	mg/kg	20	-	mg/kg
Lead	8.9 J	mg/kg	1	-	mg/kg	3.5 J	mg/kg	1	-	mg/kg
Magnesium	84.8 J	mg/kg	1000	-	mg/kg	193 J	mg/kg	1000	-	mg/kg
Manganese	85	mg/kg	3	-	mg/kg	5.6	mg/kg	3	-	mg/kg
Mercury	.07 U	mg/kg	.1	-	mg/kg	.09 U	mg/kg	.1	-	mg/kg
Nickel	2.4 U	mg/kg	8	-	mg/kg	2.5 U	mg/kg	8	-	mg/kg
Potassium	135 U	mg/kg	1000	-	mg/kg	141 U	mg/kg	1000	-	mg/kg
Selenium	.42 U	mg/kg	1	-	mg/kg	.44 U	mg/kg	1	-	mg/kg
Silver	.33 U	mg/kg	2	-	mg/kg	.35 U	mg/kg	2	-	mg/kg
Sodium	185 J	mg/kg	1000	-	mg/kg	219 J	mg/kg	1000	-	mg/kg
Thallium	.46 U	mg/kg	2	-	mg/kg	.48 U	mg/kg	2	-	mg/kg
Vanadium	9.9 J	mg/kg	10	-	mg/kg	33.6	mg/kg	10	-	mg/kg
Zinc	8 J	mg/kg	4	-	mg/kg	8.3 J	mg/kg	4	-	mg/kg

Naval Air Station Whiting Field, Milton, Florida
 Site 1 Surface and Subsurface Soil data

Lab Sample Number:	S22454011		22454011		S22454012		22454012		
Site	WHITING		WHITING		WHITING		WHITING		
Locator	01-SL-01		01-SL-01		01-SL-02		01-SL-02		
Collect Date:	11-AUG-92		11-AUG-92		11-AUG-92		11-AUG-92		
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL

Cyanide	.25 U	mg/kg	1	-	mg/kg		.26 U	mg/kg	1	-	mg/kg
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Naval Air Station Whiting Field, Milton, Florida
Site 1 Surface and Subsurface Soil data

Lab Sample Number:	22457001	22457002	22935005	22935005RE					
Site	WHITING	WHITING	WHITING	WHITING					
Locator	01-SL-03	01-SL-03A	01SS0101	01SS0101RE					
Collect Date:	11-AUG-92	11-AUG-92	08-OCT-92	08-OCT-92					
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL

CLP VOLATILES 90-SOW

ug/kg

Chloromethane	11 U	ug/kg	11	11 U	ug/kg	11	11 U	ug/kg	11	-	ug/kg
Bromomethane	11 U	ug/kg	11	11 U	ug/kg	11	11 U	ug/kg	11	-	ug/kg
Vinyl chloride	11 U	ug/kg	11	11 U	ug/kg	11	11 U	ug/kg	11	-	ug/kg
Chloroethane	11 U	ug/kg	11	11 U	ug/kg	11	11 U	ug/kg	11	-	ug/kg
Methylene chloride	11 UJ	ug/kg	6	11 UJ	ug/kg	6	11 UJ	ug/kg	11	-	ug/kg
Acetone	11 UJ	ug/kg	11	11 U	ug/kg	11	51 J	ug/kg	11	-	ug/kg
Carbon disulfide	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
1,1-Dichloroethene	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
1,1-Dichloroethane	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
1,2-Dichloroethene (total)	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
Chloroform	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
1,2-Dichloroethane	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
2-Butanone	11 U	ug/kg	11	11 U	ug/kg	11	11 U	ug/kg	11	-	ug/kg
1,1,1-Trichloroethane	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
Carbon tetrachloride	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
Bromodichloromethane	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
1,2-Dichloropropane	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
cis-1,3-Dichloropropene	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
Trichloroethene	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
Dibromochloromethane	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
1,1,2-Trichloroethane	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
Benzene	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
trans-1,3-Dichloropropene	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
Bromoform	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
4-Methyl-2-pentanone	11 U	ug/kg	11	11 U	ug/kg	11	11 U	ug/kg	11	-	ug/kg
2-Hexanone	11 U	ug/kg	11	11 U	ug/kg	11	11 U	ug/kg	11	-	ug/kg
Tetrachloroethene	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
Toluene	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
1,1,2,2-Tetrachloroethane	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
Chlorobenzene	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
Ethylbenzene	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
Styrene	6 U	ug/kg	6	6 U	ug/kg	6	11 U	ug/kg	11	-	ug/kg
Xylenes (total)	2 J	ug/kg	6	2 J	ug/kg	6	11 U	ug/kg	11	-	ug/kg

CLP SEMIVOLATILES 90-SOW

ug/kg

Phenol	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg
bis(2-Chloroethyl) ether	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg
2-Chlorophenol	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg
1,3-Dichlorobenzene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg
1,4-Dichlorobenzene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg

Naval Air Station Whiting Field, Milton, Florida
Site 1 Surface and Subsurface Soil data

Lab Sample Number:	22457001	22457002	22935005	22935005RE								
Site	WHITING	WHITING	WHITING	WHITING								
Locator	01-SL-03	01-SL-03A	01SS0101	01SS0101RE								
Collect Date:	11-AUG-92	11-AUG-92	08-OCT-92	08-OCT-92								
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL
1,2-Dichlorobenzene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
2-Methylphenol	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
2,2-oxybis(1-Chloropropane)	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
4-Methylphenol	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
N-Nitroso-di-n-propylamine	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Hexachloroethane	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Nitrobenzene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Isophorone	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
2-Nitrophenol	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
2,4-Dimethylphenol	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
bis(2-Chloroethoxy) methane	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
2,4-Dichlorophenol	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
1,2,4-Trichlorobenzene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Naphthalene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
4-Chloroaniline	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Hexachlorobutadiene	380 U	ug/kg	380	380 U	ug/kg	380	370 UJ	ug/kg	370	-	ug/kg	
4-Chloro-3-methylphenol	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
2-Methylnaphthalene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Hexachlorocyclopentadiene	380 U	ug/kg	380	380 U	ug/kg	380	370 UJ	ug/kg	370	-	ug/kg	
2,4,6-Trichlorophenol	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
2,4,5-Trichlorophenol	1800 U	ug/kg	1800	1800 U	ug/kg	1800	900 U	ug/kg	900	-	ug/kg	
2-Chloronaphthalene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
2-Nitroaniline	1800 U	ug/kg	1800	1800 UJ	ug/kg	1800	900 U	ug/kg	900	-	ug/kg	
Dimethylphthalate	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Acenaphthylene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
2,6-Dinitrotoluene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
3-Nitroaniline	1800 U	ug/kg	1800	1800 UJ	ug/kg	1800	900 U	ug/kg	900	-	ug/kg	
Acenaphthene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
2,4-Dinitrophenol	1800 U	ug/kg	1800	1800 U	ug/kg	1800	900 U	ug/kg	900	-	ug/kg	
4-Nitrophenol	1800 U	ug/kg	1800	1800 UJ	ug/kg	1800	900 U	ug/kg	900	-	ug/kg	
Dibenzofuran	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
2,4-Dinitrotoluene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Diethylphthalate	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
4-Chlorophenyl-phenylether	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Fluorene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
4-Nitroaniline	1800 U	ug/kg	1800	1800 UJ	ug/kg	1800	900 U	ug/kg	900	-	ug/kg	
4,6-Dinitro-2-methylphenol	1800 U	ug/kg	1800	1800 U	ug/kg	1800	900 U	ug/kg	900	-	ug/kg	
N-Nitrosodiphenylamine	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
4-Bromophenyl-phenylether	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Hexachlorobenzene	380 U	ug/kg	380	380 U	ug/kg	380	370 UJ	ug/kg	370	-	ug/kg	
Pentachlorophenol	1800 U	ug/kg	1800	1800 U	ug/kg	1800	900 U	ug/kg	900	-	ug/kg	
Phenanthrene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Anthracene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Carbazole	-	ug/kg		-	ug/kg		370 U	ug/kg	370	-	ug/kg	
Di-n-butylphthalate	380 U	ug/kg	380	380 UJ	ug/kg	380	370 UJ	ug/kg	370	-	ug/kg	
Fluoranthene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Pyrene	380 UJ	ug/kg	380	380 UJ	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Butylbenzylphthalate	380 UJ	ug/kg	380	380 UJ	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
3,3-Dichlorobenzidine	760 U	ug/kg	760	760 U	ug/kg	760	370 UJ	ug/kg	370	-	ug/kg	
Benzo (a) anthracene	380 U	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
Chrysene	380 UJ	ug/kg	380	380 UJ	ug/kg	380	370 U	ug/kg	370	-	ug/kg	
bis(2-Ethylhexyl) phthalate	380 UJ	ug/kg	380	380 U	ug/kg	380	370 U	ug/kg	370	-	ug/kg	

Naval Air Station Whiting Field, Milton, Florida
Site 1 Surface and Subsurface Soil data

Lab Sample Number:
Site
Locator
Collect Date:

22457001
WHITING
01-SL-03
11-AUG-92

22457002
WHITING
01-SL-03A
11-AUG-92

22935005
WHITING
01SS0101
08-OCT-92

22935005RE
WHITING
01SS0101RE
08-OCT-92

	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
Di-n-octylphthalate	380	U	ug/kg	380	380	U	ug/kg	380	370	U	ug/kg	370	-		ug/kg	
Benzo (b) fluoranthene	380	U	ug/kg	380	380	U	ug/kg	380	370	U	ug/kg	370	-		ug/kg	
Benzo (k) fluoranthene	380	U	ug/kg	380	380	U	ug/kg	380	370	U	ug/kg	370	-		ug/kg	
Benzo (a) pyrene	380	U	ug/kg	380	380	U	ug/kg	380	370	U	ug/kg	370	-		ug/kg	
Indeno (1,2,3-cd) pyrene	380	U	ug/kg	380	380	U	ug/kg	380	370	U	ug/kg	370	-		ug/kg	
Dibenzo (a,h) anthracene	380	U	ug/kg	380	380	U	ug/kg	380	370	U	ug/kg	370	-		ug/kg	
Benzo (g,h,i) perylene	380	U	ug/kg	380	380	U	ug/kg	380	370	U	ug/kg	370	-		ug/kg	
CLP PESTICIDES/PCBS 90-SOW			ug/kg													
alpha-BHC	9.2	U	ug/kg	9.2	9.2	U	ug/kg	9.2	-		ug/kg		1.8	U	ug/kg	1.8
beta-BHC	9.2	U	ug/kg	9.2	9.2	U	ug/kg	9.2	-		ug/kg		1.8	U	ug/kg	1.8
delta-BHC	9.2	U	ug/kg	9.2	9.2	U	ug/kg	9.2	-		ug/kg		1.8	U	ug/kg	1.8
gamma-BHC (Lindane)	9.2	U	ug/kg	9.2	9.2	U	ug/kg	9.2	-		ug/kg		1.8	U	ug/kg	1.8
Heptachlor	9.2	U	ug/kg	9.2	9.2	U	ug/kg	9.2	-		ug/kg		1.8	U	ug/kg	1.8
Aldrin	9.2	U	ug/kg	9.2	9.2	U	ug/kg	9.2	-		ug/kg		1.8	U	ug/kg	1.8
Heptachlor epoxide	9.2	U	ug/kg	9.2	9.2	U	ug/kg	9.2	-		ug/kg		1.8	U	ug/kg	1.8
Endosulfan I	9.2	U	ug/kg	9.2	9.2	U	ug/kg	9.2	-		ug/kg		1.8	U	ug/kg	1.8
Dieldrin	18	U	ug/kg	18	18	U	ug/kg	18	-		ug/kg		3.6	U	ug/kg	3.6
4,4-DDE	18	U	ug/kg	18	18	U	ug/kg	18	-		ug/kg		3.6	U	ug/kg	3.6
Endrin	18	U	ug/kg	18	18	U	ug/kg	18	-		ug/kg		3.6	U	ug/kg	3.6
Endosulfan II	18	U	ug/kg	18	18	U	ug/kg	18	-		ug/kg		3.6	U	ug/kg	3.6
4,4-DDD	18	U	ug/kg	18	18	U	ug/kg	18	-		ug/kg		3.6	U	ug/kg	3.6
Endosulfan sulfate	18	U	ug/kg	18	18	U	ug/kg	18	-		ug/kg		3.6	U	ug/kg	3.6
4,4-DDT	18	U	ug/kg	18	18	U	ug/kg	18	-		ug/kg		3.6	U	ug/kg	3.6
Methoxychlor	92	U	ug/kg	92	92	U	ug/kg	92	-		ug/kg		18	U	ug/kg	18
Endrin ketone	18	U	ug/kg	18	18	U	ug/kg	18	-		ug/kg		3.6	U	ug/kg	3.6
Endrin aldehyde	-		ug/kg	-	-		ug/kg	-	-		ug/kg		3.6	U	ug/kg	3.6
alpha-Chlordane	92	U	ug/kg	92	92	U	ug/kg	92	-		ug/kg		1.8	U	ug/kg	1.8
gamma-Chlordane	92	U	ug/kg	92	92	U	ug/kg	92	-		ug/kg		1.8	U	ug/kg	1.8
Toxaphene	180	U	ug/kg	180	180	U	ug/kg	180	-		ug/kg		180	U	ug/kg	180
Aroclor-1016	92	U	ug/kg	92	92	U	ug/kg	92	-		ug/kg		36	U	ug/kg	36
Aroclor-1221	92	U	ug/kg	92	92	U	ug/kg	92	-		ug/kg		73	U	ug/kg	73
Aroclor-1232	92	U	ug/kg	92	92	U	ug/kg	92	-		ug/kg		36	U	ug/kg	36
Aroclor-1242	92	U	ug/kg	92	92	U	ug/kg	92	-		ug/kg		36	U	ug/kg	36
Aroclor-1248	92	U	ug/kg	92	92	U	ug/kg	92	-		ug/kg		36	U	ug/kg	36
Aroclor-1254	180	U	ug/kg	180	180	U	ug/kg	180	-		ug/kg		36	U	ug/kg	36
Aroclor-1260	180	U	ug/kg	180	180	U	ug/kg	180	-		ug/kg		36	U	ug/kg	36
CLP METALS AND CYANIDE			mg/kg													
Aluminum	14800		mg/kg	40	13500		mg/kg	40	4780		mg/kg	40	-		mg/kg	
Antimony	2.8	UJ	mg/kg	12	2.8	UJ	mg/kg	12	2.3	U	mg/kg	12	-		mg/kg	
Arsenic	3.2	J	mg/kg	2	3.2	J	mg/kg	2	1.1	J	mg/kg	2	-		mg/kg	
Barium	15.7	J	mg/kg	40	14.3	J	mg/kg	40	6.3	J	mg/kg	40	-		mg/kg	
Beryllium	.14	J	mg/kg	1	.15	J	mg/kg	1	.08	J	mg/kg	1	-		mg/kg	
Cadmium	.63	U	mg/kg	1	.62	U	mg/kg	1	.65	U	mg/kg	1	-		mg/kg	
Calcium	112	UJ	mg/kg	1000	96.6	UJ	mg/kg	1000	56.7	J	mg/kg	1000	-		mg/kg	
Chromium	48	J	mg/kg	2	11.9	J	mg/kg	2	6		mg/kg	2	-		mg/kg	
Cobalt	.87	J	mg/kg	10	.92	J	mg/kg	10	.72	U	mg/kg	10	-		mg/kg	
Copper	7.3	UJ	mg/kg	5	5.2	UJ	mg/kg	5	2.5	J	mg/kg	5	-		mg/kg	
Iron	13700		mg/kg	20	9940		mg/kg	20	5100		mg/kg	20	-		mg/kg	
Lead	7	UJ	mg/kg	1	6.7	UJ	mg/kg	1	2.6		mg/kg	1	-		mg/kg	
Magnesium	219	J	mg/kg	1000	153	J	mg/kg	1000	76	J	mg/kg	1000	-		mg/kg	

Naval Air Station Whiting Field, Milton, Florida
 Site 1 Surface and Subsurface Soil data

Lab Sample Number:	22457001	22457002	22935005	22935005RE
Site	WHITING	WHITING	WHITING	WHITING
Locator	01-SL-03	01-SL-03A	01SS0101	01SS0101RE
Collect Date:	11-AUG-92	11-AUG-92	08-OCT-92	08-OCT-92

	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL
Manganese	20.2	mg/kg	3	20.5	mg/kg	3	8.4	mg/kg	3	-	mg/kg	
Mercury	.34	mg/kg	.1	.06 U	mg/kg	.1	.17 J	mg/kg	.1	-	mg/kg	
Nickel	3.6 J	mg/kg	8	3.4 J	mg/kg	8	1.7 J	mg/kg	8	-	mg/kg	
Potassium	157 J	mg/kg	1000	137 U	mg/kg	1000	147 U	mg/kg	1000	-	mg/kg	
Selenium	.48 U	mg/kg	1	.48 U	mg/kg	1	.45 U	mg/kg	1	-	mg/kg	
Silver	.34 U	mg/kg	2	.34 U	mg/kg	2	.43 U	mg/kg	2	-	mg/kg	
Sodium	181 UJ	mg/kg	1000	173 UJ	mg/kg	1000	167 J	mg/kg	1000	-	mg/kg	
Thallium	.47 U	mg/kg	2	.47 U	mg/kg	2	.34 U	mg/kg	2	-	mg/kg	
Vanadium	38.5	mg/kg	10	27.6	mg/kg	10	13	mg/kg	10	-	mg/kg	
Zinc	11.7	mg/kg	4	11.3	mg/kg	4	6.1 J	mg/kg	4	-	mg/kg	
Cyanide	.25 U	mg/kg	1	.25 U	mg/kg	1	.09 U	mg/kg	1	-	mg/kg	

Naval Air Station Whiting Field, Milton, Florida
Site 1 Surface and Subsurface Soil data

Lab Sample Number:	G8864002	G8864003	G8864004	G8864005
Site	WHITING	WHITING	WHITING	WHITING
Locator	01S00101	01S00201	01S00301	01S00401
Collect Date:	05-DEC-95	05-DEC-95	05-DEC-95	05-DEC-95
	VALUE QUAL UNITS DL			

	ug/kg												
CLP VOLATILES 90-SOW													
Chloromethane	11 UJ ug/kg	11	11										
Bromomethane	11 U ug/kg	11	11										
Vinyl chloride	11 U ug/kg	11	11										
Chloroethane	11 U ug/kg	11	11										
Methylene chloride	11 U ug/kg	11	11										
Acetone	11 U ug/kg	11	11										
Carbon disulfide	11 U ug/kg	11	11										
1,1-Dichloroethene	11 U ug/kg	11	11										
1,1-Dichloroethane	11 U ug/kg	11	11										
1,2-Dichloroethene (total)	11 U ug/kg	11	11										
Chloroform	11 U ug/kg	11	11										
1,2-Dichloroethane	11 U ug/kg	11	11										
2-Butanone	11 U ug/kg	11	11										
1,1,1-Trichloroethane	11 U ug/kg	11	11										
Carbon tetrachloride	11 U ug/kg	11	11										
Bromodichloromethane	11 U ug/kg	11	11										
1,2-Dichloropropane	11 U ug/kg	11	11										
cis-1,3-Dichloropropene	11 U ug/kg	11	11										
Trichloroethene	11 U ug/kg	11	11										
Dibromochloromethane	11 U ug/kg	11	11										
1,1,2-Trichloroethane	11 U ug/kg	11	11										
Benzene	11 U ug/kg	11	11										
trans-1,3-Dichloropropene	11 U ug/kg	11	11										
Bromoform	11 U ug/kg	11	11										
4-Methyl-2-pentanone	11 U ug/kg	11	11										
2-Hexanone	11 U ug/kg	11	11										
Tetrachloroethene	11 U ug/kg	11	11										
Toluene	11 U ug/kg	11	11										
1,1,2,2-Tetrachloroethane	11 U ug/kg	11	11										
Chlorobenzene	11 U ug/kg	11	11										
Ethylbenzene	11 U ug/kg	11	11										
Styrene	11 U ug/kg	11	11										
Xylenes (total)	11 U ug/kg	11	11										
CLP SEMIVOLATILES 90-SOW													
Phenol	360 U ug/kg	360	370 U ug/kg	370	380 U ug/kg	380	370 U ug/kg	370	370 U ug/kg	370	370 U ug/kg	370	370
bis(2-Chloroethyl) ether	360 U ug/kg	360	370 U ug/kg	370	380 U ug/kg	380	370 U ug/kg	370	370 U ug/kg	370	370 U ug/kg	370	370
2-Chlorophenol	360 U ug/kg	360	370 U ug/kg	370	380 U ug/kg	380	370 U ug/kg	370	370 U ug/kg	370	370 U ug/kg	370	370
1,3-Dichlorobenzene	360 U ug/kg	360	370 U ug/kg	370	380 U ug/kg	380	370 U ug/kg	370	370 U ug/kg	370	370 U ug/kg	370	370
1,4-Dichlorobenzene	360 U ug/kg	360	370 U ug/kg	370	380 U ug/kg	380	370 U ug/kg	370	370 U ug/kg	370	370 U ug/kg	370	370

Naval Air Station Whiting Field, Milton, Florida
Site 1 Surface and Subsurface Soil data

Lab Sample Number:	G8864002	G8864003	G8864004	G8864005								
Site	WHITING	WHITING	WHITING	WHITING								
Locator	01S00101	01S00201	01S00301	01S00401								
Collect Date:	05-DEC-95	05-DEC-95	05-DEC-95	05-DEC-95								
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL
1,2-Dichlorobenzene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
2-Methylphenol	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
2,2-oxybis(1-Chloropropane)	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
4-Methylphenol	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
N-Nitroso-di-n-propylamine	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Hexachloroethane	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Nitrobenzene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Isophorone	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
2-Nitrophenol	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
2,4-Dimethylphenol	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
bis(2-Chloroethoxy) methane	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
2,4-Dichlorophenol	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
1,2,4-Trichlorobenzene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Naphthalene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
4-Chloroaniline	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Hexachlorobutadiene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
4-Chloro-3-methylphenol	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
2-Methylnaphthalene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Hexachlorocyclopentadiene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
2,4,6-Trichlorophenol	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
2,4,5-Trichlorophenol	900 U	ug/kg	900	940 U	ug/kg	940	950 U	ug/kg	950	920 U	ug/kg	920
2-Chloronaphthalene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
2-Nitroaniline	900 U	ug/kg	900	940 U	ug/kg	940	950 U	ug/kg	950	920 U	ug/kg	920
Dimethylphthalate	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Acenaphthylene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
2,6-Dinitrotoluene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
3-Nitroaniline	900 U	ug/kg	900	940 U	ug/kg	940	950 U	ug/kg	950	920 U	ug/kg	920
Acenaphthene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
2,4-Dinitrophenol	900 U	ug/kg	900	940 U	ug/kg	940	950 U	ug/kg	950	920 U	ug/kg	920
4-Nitrophenol	900 U	ug/kg	900	940 U	ug/kg	940	950 U	ug/kg	950	920 U	ug/kg	920
Dibenzofuran	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
2,4-Dinitrotoluene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Diethylphthalate	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
4-Chlorophenyl-phenylether	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Fluorene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
4-Nitroaniline	900 U	ug/kg	900	940 U	ug/kg	940	950 U	ug/kg	950	920 U	ug/kg	920
4,6-Dinitro-2-methylphenol	900 U	ug/kg	900	940 U	ug/kg	940	950 U	ug/kg	950	920 U	ug/kg	920
N-Nitrosodiphenylamine	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
4-Bromophenyl-phenylether	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Hexachlorobenzene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Pentachlorophenol	900 U	ug/kg	900	940 U	ug/kg	940	950 U	ug/kg	950	920 U	ug/kg	920
Phenanthrene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Anthracene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Carbazole	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Di-n-butylphthalate	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Fluoranthene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Pyrene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Butylbenzylphthalate	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
3,3-Dichlorobenzidine	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Benzo (a) anthracene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Chrysene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
bis(2-Ethylhexyl) phthalate	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370

Naval Air Station Whiting Field, Milton, Florida
Site 1 Surface and Subsurface Soil data

Lab Sample Number:
Site
Locator
Collect Date:

G8864002
WHITING
01S00101
05-DEC-95
VALUE QUAL UNITS DL

G8864003
WHITING
01S00201
05-DEC-95
VALUE QUAL UNITS DL

G8864004
WHITING
01S00301
05-DEC-95
VALUE QUAL UNITS DL

G8864005
WHITING
01S00401
05-DEC-95
VALUE QUAL UNITS DL

	VALUE	QUAL UNITS	DL									
Di-n-octylphthalate	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Benzo (b) fluoranthene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Benzo (k) fluoranthene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Benzo (a) pyrene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Indeno (1,2,3-cd) pyrene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Dibenzo (a,h) anthracene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
Benzo (g,h,i) perylene	360 U	ug/kg	360	370 U	ug/kg	370	380 U	ug/kg	380	370 U	ug/kg	370
CLP PESTICIDES/PCBS 90-SOW		ug/kg										
alpha-BHC	1.8 UJ	ug/kg	1.8	1.9 UJ	ug/kg	1.9	1.9 UJ	ug/kg	1.9	1.9 UJ	ug/kg	1.9
beta-BHC	1.8 U	ug/kg	1.8	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9
delta-BHC	1.8 U	ug/kg	1.8	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9
gamma-BHC (Lindane)	1.8 U	ug/kg	1.8	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9
Heptachlor	1.8 U	ug/kg	1.8	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9
Aldrin	1.8 U	ug/kg	1.8	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9
Heptachlor epoxide	1.8 U	ug/kg	1.8	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9
Endosulfan I	1.8 U	ug/kg	1.8	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9
Dieldrin	3.6 U	ug/kg	3.6	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7
4,4-DDE	3.6 U	ug/kg	3.6	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7
Endrin	3.6 U	ug/kg	3.6	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7
Endosulfan II	3.6 U	ug/kg	3.6	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7
4,4-DDD	3.6 U	ug/kg	3.6	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7
Endosulfan sulfate	3.6 U	ug/kg	3.6	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7
4,4-DDT	3.6 U	ug/kg	3.6	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7
Methoxychlor	18 U	ug/kg	18	19 U	ug/kg	19	19 U	ug/kg	19	19 U	ug/kg	19
Endrin ketone	3.6 U	ug/kg	3.6	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7
Endrin aldehyde	3.6 U	ug/kg	3.6	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7	3.7 U	ug/kg	3.7
alpha-Chlordane	1.8 U	ug/kg	1.8	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9
gamma-Chlordane	1.8 U	ug/kg	1.8	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9	1.9 U	ug/kg	1.9
Toxaphene	180 U	ug/kg	180	190 U	ug/kg	190	190 U	ug/kg	190	190 U	ug/kg	190
Aroclor-1016	36 U	ug/kg	36	37 U	ug/kg	37	37 U	ug/kg	37	37 U	ug/kg	37
Aroclor-1221	73 U	ug/kg	73	75 U	ug/kg	75	75 U	ug/kg	75	75 U	ug/kg	75
Aroclor-1232	36 U	ug/kg	36	37 U	ug/kg	37	37 U	ug/kg	37	37 U	ug/kg	37
Aroclor-1242	36 U	ug/kg	36	37 U	ug/kg	37	37 U	ug/kg	37	37 U	ug/kg	37
Aroclor-1248	36 U	ug/kg	36	37 U	ug/kg	37	37 U	ug/kg	37	37 U	ug/kg	37
Aroclor-1254	36 U	ug/kg	36	37 U	ug/kg	37	37 U	ug/kg	37	37 U	ug/kg	37
Aroclor-1260	36 U	ug/kg	36	37 U	ug/kg	37	37 U	ug/kg	37	37 U	ug/kg	37
CLP METALS AND CYANIDE		mg/kg										
Aluminum	4530	mg/kg	40	14600	mg/kg	40	15200	mg/kg	40	5330	mg/kg	40
Antimony	12 UJ	mg/kg	12									
Arsenic	3.4	mg/kg	2	3.2	mg/kg	2	4.1	mg/kg	2	1.9 J	mg/kg	2
Barium	5.4 J	mg/kg	40	18 J	mg/kg	40	16.9 J	mg/kg	40	8.6 J	mg/kg	40
Beryllium	.05 J	mg/kg	1	.15 J	mg/kg	1	.17 J	mg/kg	1	.06 J	mg/kg	1
Cadmium	1 U	mg/kg	1	1 U	mg/kg	1	1 U	mg/kg	1	1 UJ	mg/kg	1
Calcium	1000 UJ	mg/kg	1000									
Chromium	5.5	mg/kg	2	12.5	mg/kg	2	15.1	mg/kg	2	3.8	mg/kg	2
Cobalt	10 U	mg/kg	10	.72 J	mg/kg	10	10 U	mg/kg	10	10 U	mg/kg	10
Copper	5 UJ	mg/kg	5	5.4 J	mg/kg	5	4.8 J	mg/kg	5	5 UJ	mg/kg	5
Iron	3390	mg/kg	20	9600	mg/kg	20	10200	mg/kg	20	2980	mg/kg	20
Lead	4	mg/kg	.6	5.7	mg/kg	.6	5.7	mg/kg	.6	3.8	mg/kg	.6
Magnesium	61.1 J	mg/kg	1000	293 J	mg/kg	1000	266 J	mg/kg	1000	113 J	mg/kg	1000

Naval Air Station Whiting Field, Milton, Florida
 Site 1 Surface and Subsurface Soil data

Lab Sample Number:
 Site
 Locator
 Collect Date:

G8864002
 WHITING
 01S00101
 05-DEC-95

G8864003
 WHITING
 01S00201
 05-DEC-95

G8864004
 WHITING
 01S00301
 05-DEC-95

G8864005
 WHITING
 01S00401
 05-DEC-95

VALUE QUAL UNITS DL VALUE QUAL UNITS DL VALUE QUAL UNITS DL VALUE QUAL UNITS DL

Manganese	23.7 J	mg/kg	3	19.3 J	mg/kg	3	18.7 J	mg/kg	3	66.8 J	mg/kg	3
Mercury	.1 U	mg/kg	.1	.01 J	mg/kg	.1	.01 J	mg/kg	.1	.02 J	mg/kg	.1
Nickel	8 UJ	mg/kg	8									
Potassium	1000 U	mg/kg	1000	241 J	mg/kg	1000	249 J	mg/kg	1000	1000 U	mg/kg	1000
Selenium	1 UJ	mg/kg	1									
Silver	2 U	mg/kg	2									
Sodium	1000 UJ	mg/kg	1000									
Thallium	2 U	mg/kg	2	2 U	mg/kg	2	2 UJ	mg/kg	2	2 U	mg/kg	2
Vanadium	10.1 J	mg/kg	10	26.6	mg/kg	10	27.3	mg/kg	10	8.1 J	mg/kg	10
Zinc	4 UJ	mg/kg	4	6.9	mg/kg	4	6.4	mg/kg	4	3.9 J	mg/kg	4
Cyanide	.5 U	mg/kg	.5	.5 U	mg/kg	.5	.13 J	mg/kg	.5	1.1	mg/kg	.5

Naval Air Station Whiting Field, Milton, Florida
 Site 1 Surface and Subsurface Soil data

Lab Sample Number: G8864006
 Site WHITING
 Locator 01S00501
 Collect Date: 05-DEC-95

	VALUE	QUAL	UNITS	DL
CLP VOLATILES 90-SOW				
	ug/kg			
Chloromethane	11	UJ	ug/kg	11
Bromomethane	11	U	ug/kg	11
Vinyl chloride	11	U	ug/kg	11
Chloroethane	11	U	ug/kg	11
Methylene chloride	11	U	ug/kg	11
Acetone	11	U	ug/kg	11
Carbon disulfide	11	U	ug/kg	11
1,1-Dichloroethene	11	U	ug/kg	11
1,1-Dichloroethane	11	U	ug/kg	11
1,2-Dichloroethene (total)	11	U	ug/kg	11
Chloroform	11	U	ug/kg	11
1,2-Dichloroethane	11	U	ug/kg	11
2-Butanone	11	U	ug/kg	11
1,1,1-Trichloroethane	11	U	ug/kg	11
Carbon tetrachloride	11	U	ug/kg	11
Bromodichloromethane	11	U	ug/kg	11
1,2-Dichloropropane	11	U	ug/kg	11
cis-1,3-Dichloropropene	11	U	ug/kg	11
Trichloroethene	11	U	ug/kg	11
Dibromochloromethane	11	U	ug/kg	11
1,1,2-Trichloroethane	11	U	ug/kg	11
Benzene	11	U	ug/kg	11
trans-1,3-Dichloropropene	11	U	ug/kg	11
Bromoform	11	U	ug/kg	11
4-Methyl-2-pentanone	11	U	ug/kg	11
2-Hexanone	11	U	ug/kg	11
Tetrachloroethene	11	U	ug/kg	11
Toluene	11	U	ug/kg	11
1,1,2,2-Tetrachloroethane	11	U	ug/kg	11
Chlorobenzene	11	U	ug/kg	11
Ethylbenzene	11	U	ug/kg	11
Styrene	11	U	ug/kg	11
Xylenes (total)	11	U	ug/kg	11
CLP SEMIVOLATILES 90-SOW				
	ug/kg			
Phenol	380	U	ug/kg	380
bis(2-Chloroethyl) ether	380	U	ug/kg	380
2-Chlorophenol	380	U	ug/kg	380
1,3-Dichlorobenzene	380	U	ug/kg	380
1,4-Dichlorobenzene	380	U	ug/kg	380

Naval Air Station Whiting Field, Milton, Florida
 Site 1 Surface and Subsurface Soil data

Lab Sample Number: G8864006
 Site WHITING
 Locator 01S00501
 Collect Date: 05-DEC-95

VALUE QUAL UNITS DL

	VALUE	QUAL	UNITS	DL
1,2-Dichlorobenzene	380	U	ug/kg	380
2-Methylphenol	380	U	ug/kg	380
2,2-oxybis(1-Chloropropane)	380	U	ug/kg	380
4-Methylphenol	380	U	ug/kg	380
N-Nitroso-di-n-propylamine	380	U	ug/kg	380
Hexachloroethane	380	U	ug/kg	380
Nitrobenzene	380	U	ug/kg	380
Isophorone	380	U	ug/kg	380
2-Nitrophenol	380	U	ug/kg	380
2,4-Dimethylphenol	380	U	ug/kg	380
bis(2-Chloroethoxy) methane	380	U	ug/kg	380
2,4-Dichlorophenol	380	U	ug/kg	380
1,2,4-Trichlorobenzene	380	U	ug/kg	380
Naphthalene	380	U	ug/kg	380
4-Chloroaniline	380	U	ug/kg	380
Hexachlorobutadiene	380	U	ug/kg	380
4-Chloro-3-methylphenol	380	U	ug/kg	380
2-Methylnaphthalene	380	U	ug/kg	380
Hexachlorocyclopentadiene	380	U	ug/kg	380
2,4,6-Trichlorophenol	380	U	ug/kg	380
2,4,5-Trichlorophenol	960	U	ug/kg	960
2-Chloronaphthalene	380	U	ug/kg	380
2-Nitroaniline	960	U	ug/kg	960
Dimethylphthalate	380	U	ug/kg	380
Acenaphthylene	380	U	ug/kg	380
2,6-Dinitrotoluene	380	U	ug/kg	380
3-Nitroaniline	960	U	ug/kg	960
Acenaphthene	380	U	ug/kg	380
2,4-Dinitrophenol	960	U	ug/kg	960
4-Nitrophenol	960	U	ug/kg	960
Dibenzofuran	380	U	ug/kg	380
2,4-Dinitrotoluene	380	U	ug/kg	380
Diethylphthalate	380	U	ug/kg	380
4-Chlorophenyl-phenylether	380	U	ug/kg	380
Fluorene	380	U	ug/kg	380
4-Nitroaniline	960	U	ug/kg	960
4,6-Dinitro-2-methylphenol	960	U	ug/kg	960
N-Nitrosodiphenylamine	380	U	ug/kg	380
4-Bromophenyl-phenylether	380	U	ug/kg	380
Hexachlorobenzene	380	U	ug/kg	380
Pentachlorophenol	960	U	ug/kg	960
Phenanthrene	380	U	ug/kg	380
Anthracene	380	U	ug/kg	380
Carbazole	380	U	ug/kg	380
Di-n-butylphthalate	380	U	ug/kg	380
Fluoranthene	380	U	ug/kg	380
Pyrene	380	U	ug/kg	380
Butylbenzylphthalate	380	U	ug/kg	380
3,3-Dichlorobenzidine	380	U	ug/kg	380
Benzo (a) anthracene	380	U	ug/kg	380
Chrysene	380	U	ug/kg	380
bis(2-Ethylhexyl) phthalate	380	U	ug/kg	380

Naval Air Station Whiting Field, Milton, Florida
 Site 1 Surface and Subsurface Soil data

Lab Sample Number: G8864006
 Site WHITING
 Locator 01S00501
 Collect Date: 05-DEC-95

	VALUE	QUAL	UNITS	DL
Di-n-octylphthalate	380 U		ug/kg	380
Benzo (b) fluoranthene	380 U		ug/kg	380
Benzo (k) fluoranthene	380 U		ug/kg	380
Benzo (a) pyrene	380 U		ug/kg	380
Indeno (1,2,3-cd) pyrene	380 U		ug/kg	380
Dibenzo (a,h) anthracene	380 U		ug/kg	380
Benzo (g,h,i) perylene	380 U		ug/kg	380
CLP PESTICIDES/PCBS 90-SOW				
			ug/kg	
alpha-BHC	1.9 UJ		ug/kg	1.9
beta-BHC	1.9 U		ug/kg	1.9
delta-BHC	1.9 U		ug/kg	1.9
gamma-BHC (Lindane)	1.9 U		ug/kg	1.9
Heptachlor	1.9 U		ug/kg	1.9
Aldrin	1.9 U		ug/kg	1.9
Heptachlor epoxide	1.9 U		ug/kg	1.9
Endosulfan I	1.9 U		ug/kg	1.9
Dieldrin	3.7 U		ug/kg	3.7
4,4-DDE	3.7 U		ug/kg	3.7
Endrin	3.7 U		ug/kg	3.7
Endosulfan II	3.7 U		ug/kg	3.7
4,4-DDD	3.7 U		ug/kg	3.7
Endosulfan sulfate	3.7 U		ug/kg	3.7
4,4-DDT	3.7 U		ug/kg	3.7
Methoxychlor	19 U		ug/kg	19
Endrin ketone	3.7 U		ug/kg	3.7
Endrin aldehyde	3.7 U		ug/kg	3.7
alpha-Chlordane	1.9 U		ug/kg	1.9
gamma-Chlordane	1.9 U		ug/kg	1.9
Toxaphene	190 U		ug/kg	190
Aroclor-1016	37 U		ug/kg	37
Aroclor-1221	76 U		ug/kg	76
Aroclor-1232	37 U		ug/kg	37
Aroclor-1242	37 U		ug/kg	37
Aroclor-1248	37 U		ug/kg	37
Aroclor-1254	37 U		ug/kg	37
Aroclor-1260	37 U		ug/kg	37
CLP METALS AND CYANIDE				
			mg/kg	
Aluminum	14500		mg/kg	40
Antimony	12 UJ		mg/kg	12
Arsenic	4.2		mg/kg	2
Barium	12.8 J		mg/kg	40
Beryllium	.14 J		mg/kg	1
Cadmium	1 UJ		mg/kg	1
Calcium	1000 UJ		mg/kg	1000
Chromium	10.8		mg/kg	2
Cobalt	.93 J		mg/kg	10
Copper	4.4 J		mg/kg	5
Iron	9910		mg/kg	20
Lead	44		mg/kg	.6
Magnesium	141 J		mg/kg	1000

Naval Air Station Whiting Field, Milton, Florida
Site 1 Surface and Subsurface Soil data

Lab Sample Number: G8864006
Site WHITING
Locator 01S00501
Collect Date: 05-DEC-95

VALUE QUAL UNITS DL

Manganese	68.1 J	mg/kg	3
Mercury	.02 J	mg/kg	.1
Nickel	8 UJ	mg/kg	8
Potassium	141 J	mg/kg	1000
Selenium	1 U	mg/kg	1
Silver	2 U	mg/kg	2
Sodium	1000 UJ	mg/kg	1000
Thallium	2 UJ	mg/kg	2
Vanadium	25.3	mg/kg	10
Zinc	4.9 J	mg/kg	4
Cyanide	.3 J	mg/kg	.5

APPENDIX D

GROUNDWATER SAMPLE ANALYTICAL DATA

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	90177001	90177002	90178001	90175002							
Site	WHITING	WHITING	WHITING	WHITING							
Locator	WHF1-1	WHF1-1B	WHF1-2	WHF1-3							
Collect Date:	18-OCT-93	18-OCT-93	19-OCT-93	15-OCT-93							
VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL

CLP VOLATILES 90-SOW

ug/l

Chloromethane	10 U	ug/l	10									
Bromomethane	10 U	ug/l	10									
Vinyl chloride	10 U	ug/l	10									
Chloroethane	10 U	ug/l	10									
Methylene chloride	10 U	ug/l	10									
Acetone	10 U	ug/l	10									
Carbon disulfide	10 U	ug/l	10									
1,1-Dichloroethene	10 U	ug/l	10									
1,1-Dichloroethane	10 U	ug/l	10									
1,2-Dichloroethene (total)	10 U	ug/l	10									
Chloroform	10 U	ug/l	10									
1,2-Dichloroethane	10 U	ug/l	10									
2-Butanone	10 U	ug/l	10									
1,1,1-Trichloroethane	10 U	ug/l	10									
Carbon tetrachloride	10 U	ug/l	10									
Bromodichloromethane	10 U	ug/l	10									
1,2-Dichloropropane	10 U	ug/l	10									
cis-1,3-Dichloropropene	10 U	ug/l	10									
Trichloroethene	10 U	ug/l	10									
Dibromochloromethane	10 U	ug/l	10									
1,1,2-Trichloroethane	10 U	ug/l	10									
Benzene	10 U	ug/l	10									
trans-1,3-Dichloropropene	10 U	ug/l	10									
Bromoform	10 U	ug/l	10									
4-Methyl-2-pentanone	10 U	ug/l	10									
2-Hexanone	10 U	ug/l	10									
Tetrachloroethene	10 U	ug/l	10									
Toluene	10 U	ug/l	10									
1,1,2,2-Tetrachloroethane	10 U	ug/l	10									
Chlorobenzene	10 U	ug/l	10									
Ethylbenzene	10 U	ug/l	10									
Styrene	10 U	ug/l	10									
Xylenes (total)	10 U	ug/l	10									

CLP SEMIVOLATILES 90-SOW

ug/l

Phenol	10 U	ug/l	10									
bis(2-Chloroethyl) ether	10 U	ug/l	10									
2-Chlorophenol	10 U	ug/l	10									
1,3-Dichlorobenzene	10 U	ug/l	10									
1,4-Dichlorobenzene	10 U	ug/l	10									
1,2-Dichlorobenzene	10 U	ug/l	10									
2-Methylphenol	10 U	ug/l	10									
2,2-oxybis(1-Chloropropane)	10 U	ug/l	10									
4-Methylphenol	10 U	ug/l	10									
N-Nitroso-di-n-propylamine	10 U	ug/l	10									
Hexachloroethane	10 U	ug/l	10									
Nitrobenzene	10 U	ug/l	10									
Isophorone	10 U	ug/l	10									
2-Nitrophenol	10 U	ug/l	10									
2,4-Dimethylphenol	10 U	ug/l	10									

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:
Site
Locator
Collect Date:

90177001
WHITING
WHF1-1
18-OCT-93

90177002
WHITING
WHF1-1B
18-OCT-93

90178001
WHITING
WHF1-2
19-OCT-93

90175002
WHITING
WHF1-3
15-OCT-93

	VALUE	QUAL	UNITS	DL												
bis(2-Chloroethoxy) methane	10	U	ug/l	10												
2,4-Dichlorophenol	10	U	ug/l	10												
1,2,4-Trichlorobenzene	10	U	ug/l	10												
Naphthalene	10	U	ug/l	10												
4-Chloroaniline	10	U	ug/l	10												
Hexachlorobutadiene	10	U	ug/l	10												
4-Chloro-3-methylphenol	10	U	ug/l	10												
2-Methylnaphthalene	10	U	ug/l	10												
Hexachlorocyclopentadiene	10	U	ug/l	10												
2,4,6-Trichlorophenol	10	U	ug/l	10												
2,4,5-Trichlorophenol	25	U	ug/l	25												
2-Chloronaphthalene	10	U	ug/l	10												
2-Nitroaniline	25	U	ug/l	25												
Dimethylphthalate	10	U	ug/l	10												
Acenaphthylene	10	U	ug/l	10												
2,6-Dinitrotoluene	10	U	ug/l	10												
3-Nitroaniline	25	U	ug/l	25												
Acenaphthene	10	U	ug/l	10												
2,4-Dinitrophenol	25	U	ug/l	25	25	U	ug/l	25	25	U	ug/l	25	25	UJ	ug/l	25
4-Nitrophenol	25	U	ug/l	25	25	U	ug/l	25	25	U	ug/l	25	25	UJ	ug/l	25
Dibenzofuran	10	U	ug/l	10												
2,4-Dinitrotoluene	10	U	ug/l	10												
Diethylphthalate	10	U	ug/l	10												
4-Chlorophenyl-phenylether	10	U	ug/l	10												
Fluorene	10	U	ug/l	10												
4-Nitroaniline	25	U	ug/l	25												
4,6-Dinitro-2-methylphenol	25	U	ug/l	25												
N-Nitrosodiphenylamine	10	U	ug/l	10												
4-Bromophenyl-phenylether	10	U	ug/l	10												
Hexachlorobenzene	10	U	ug/l	10												
Pentachlorophenol	25	U	ug/l	25												
Phenanthrene	10	U	ug/l	10												
Anthracene	10	U	ug/l	10												
Carbazole	10	U	ug/l	10												
Di-n-butylphthalate	12	UJ	ug/l	10	10	U	ug/l	10	10	U	ug/l	10	10	U	ug/l	10
Fluoranthene	10	U	ug/l	10												
Pyrene	10	U	ug/l	10												
Butylbenzylphthalate	10	U	ug/l	10												
3,3-Dichlorobenzidine	10	U	ug/l	10												
Benzo (a) anthracene	10	U	ug/l	10												
Chrysene	10	U	ug/l	10												
bis(2-Ethylhexyl) phthalate	10	U	ug/l	10												
Di-n-octylphthalate	10	U	ug/l	10												
Benzo (b) fluoranthene	10	U	ug/l	10												
Benzo (k) fluoranthene	10	U	ug/l	10												
Benzo (a) pyrene	10	U	ug/l	10												
Indeno (1,2,3-cd) pyrene	10	U	ug/l	10												
Dibenzo (a,h) anthracene	10	U	ug/l	10												
Benzo (g,h,i) perylene	10	U	ug/l	10												
CLP PESTICIDES/PCBS 90-SOW	ug/l															
alpha-BHC	.05	U	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	90177001		90177002		90178001		90175002					
Site	WHITING		WHITING		WHITING		WHITING					
Locator	WHF1-1		WHF1-1B		WHF1-2		WHF1-3					
Collect Date:	18-OCT-93		18-OCT-93		19-OCT-93		15-OCT-93					
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL

beta-BHC	.025	J	ug/l	.05	.019	J	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05
delta-BHC	.05	U	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05
gamma-BHC (Lindane)	.05	U	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05
Heptachlor	.05	U	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05
Aldrin	.05	U	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05
Heptachlor epoxide	.05	U	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05
Endosulfan I	.05	U	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05
Dieldrin	.1	U	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1
4,4-DDE	.1	U	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1
Endrin	.1	U	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1
Endosulfan II	.1	U	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1
4,4-DDD	.1	U	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1
Endosulfan sulfate	.1	U	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1
4,4-DDT	.1	U	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1
Methoxychlor	.5	U	ug/l	.5	.5	UJ	ug/l	.5	.5	UJ	ug/l	.5	.5	UJ	ug/l	.5
Endrin ketone	.1	U	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1
Endrin aldehyde	.1	U	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1	.1	UJ	ug/l	.1
alpha-Chlordane	.05	U	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05
gamma-Chlordane	.05	U	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05	.05	UJ	ug/l	.05
Toxaphene	5	U	ug/l	5	5	UJ	ug/l	5	5	UJ	ug/l	5	5	UJ	ug/l	5
Aroclor-1016	1	U	ug/l	1	1	UJ	ug/l	1	1	UJ	ug/l	1	1	UJ	ug/l	1
Aroclor-1221	2	U	ug/l	2	2	UJ	ug/l	2	2	UJ	ug/l	2	2	UJ	ug/l	2
Aroclor-1232	1	U	ug/l	1	1	UJ	ug/l	1	1	UJ	ug/l	1	1	UJ	ug/l	1
Aroclor-1242	1	U	ug/l	1	1	UJ	ug/l	1	1	UJ	ug/l	1	1	UJ	ug/l	1
Aroclor-1248	1	U	ug/l	1	1	UJ	ug/l	1	1	UJ	ug/l	1	1	UJ	ug/l	1
Aroclor-1254	1	U	ug/l	1	1	UJ	ug/l	1	1	UJ	ug/l	1	1	UJ	ug/l	1
Aroclor-1260	1	U	ug/l	1	1	UJ	ug/l	1	1	UJ	ug/l	1	1	UJ	ug/l	1

CLP METALS AND CYANIDE	ug/l															
Aluminum	132	J	ug/l	200	30700	U	ug/l	200	61700	U	ug/l	200	10800	U	ug/l	200
Antimony	20.7	U	ug/l	60	20.7	U	ug/l	60	104	U	ug/l	60	20.7	U	ug/l	60
Arsenic	1.6	U	ug/l	10	1.6	U	ug/l	10	1.6	U	ug/l	10	1.6	U	ug/l	10
Barium	5.7	J	ug/l	200	72.7	J	ug/l	200	118	J	ug/l	200	28.9	J	ug/l	200
Beryllium	.48	J	ug/l	5	2.2	J	ug/l	5	10	J	ug/l	5	.89	J	ug/l	5
Cadmium	3.2	U	ug/l	5	3.2	U	ug/l	5	16	U	ug/l	5	3.2	U	ug/l	5
Calcium	1070	J	ug/l	5000	3120	J	ug/l	5000	1090	J	ug/l	5000	1300	J	ug/l	5000
Chromium	3.3	U	ug/l	10	111	U	ug/l	10	1150	U	ug/l	10	24.7	U	ug/l	10
Cobalt	4.1	U	ug/l	50	5.5	J	ug/l	50	20.5	U	ug/l	50	4.1	U	ug/l	50
Copper	2.3	J	ug/l	25	68.4	U	ug/l	25	36.8	J	ug/l	25	12.2	J	ug/l	25
Iron	65.9	J	ug/l	100	104000	U	ug/l	100	318000	U	ug/l	100	15800	U	ug/l	100
Lead	1.7	J	ug/l	3	20.4	U	ug/l	3	36.2	U	ug/l	3	4.7	U	ug/l	3
Magnesium	314	J	ug/l	5000	2280	J	ug/l	5000	1810	J	ug/l	5000	1260	J	ug/l	5000
Manganese	14.8	J	ug/l	15	243	U	ug/l	15	374	U	ug/l	15	57.4	U	ug/l	15
Mercury	.15	U	ug/l	.2	.23	U	ug/l	.2	.36	U	ug/l	.2	.15	U	ug/l	.2
Nickel	9	UJ	ug/l	40	13.8	J	ug/l	40	210	U	ug/l	40	9	UJ	ug/l	40
Potassium	614	J	ug/l	5000	2420	J	ug/l	5000	3090	J	ug/l	5000	1220	J	ug/l	5000
Selenium	2	U	ug/l	5	2	U	ug/l	5	2	U	ug/l	5	2	U	ug/l	5
Silver	2.7	U	ug/l	10	5.8	J	ug/l	10	15.4	U	ug/l	10	2.7	U	ug/l	10
Sodium	1980	J	ug/l	5000	2510	J	ug/l	5000	2670	J	ug/l	5000	2340	J	ug/l	5000
Thallium	.88	U	ug/l	10	.88	U	ug/l	10	.88	U	ug/l	10	.88	U	ug/l	10
Vanadium	2.5	U	ug/l	50	268	U	ug/l	50	1360	U	ug/l	50	77.5	U	ug/l	50
Zinc	1.4	U	ug/l	25	50	U	ug/l	20	109	U	ug/l	20	22.5	U	ug/l	20

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	90177001			90177002			90178001			90175002		
Site	WHITING			WHITING			WHITING			WHITING		
Locator	WHF1-1			WHF1-1B			WHF1-2			WHF1-3		
Collect Date:	18-OCT-93			18-OCT-93			19-OCT-93			15-OCT-93		
	VALUE	QUAL UNITS	DL									

Cyanide	1.7 U	ug/l	10	1.7 U	ug/l	10	2.5 J	ug/l	10	1.7 U	ug/l	10
Groundwater Quality												
Alkalinity as CaCO3	-			-			-			-		
Ammonia-N	-			-			-			-		
Chloride	-			-			-			-		
Hardness as CaCO3	-			-			-			-		
Nitrate-Nitrite	-			-			-			-		
Phosphorous-P, Total	-			-			-			-		
Sulfate	-			-			-			-		
Sulfide	-			-			-			-		
Total Dissolved Solids	-			-			-			-		
Total Kjeldahl Nitrogen	-			-			-			-		
Total organic carbon	-			-			-			-		

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB874005	RB873007	RB874006	RB873008							
Site	WHITING	WHITING	WHITING	WHITING							
Locator	01G00101	01G00101	01G00102	01G00102							
Collect Date:	19-JUL-96	19-JUL-96	19-JUL-96	19-JUL-96							
VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL

CLP VOLATILES 90-SOW

ug/l

Chloromethane	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Bromomethane	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Vinyl chloride	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Chloroethane	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Methylene chloride	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Acetone	-	ug/l	10 UJ	ug/l	10	-	ug/l	10 UJ	ug/l	10
Carbon disulfide	-	ug/l	1 J	ug/l	10	-	ug/l	10 U	ug/l	10
1,1-Dichloroethene	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
1,1-Dichloroethane	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
1,2-Dichloroethene (total)	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Chloroform	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
1,2-Dichloroethane	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
2-Butanone	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
1,1,1-Trichloroethane	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Carbon tetrachloride	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Bromodichloromethane	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
1,2-Dichloropropane	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
cis-1,3-Dichloropropene	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Trichloroethene	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Dibromochloromethane	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
1,1,2-Trichloroethane	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Benzene	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
trans-1,3-Dichloropropene	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Bromoform	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
4-Methyl-2-pentanone	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
2-Hexanone	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Tetrachloroethene	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Toluene	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
1,1,2,2-Tetrachloroethane	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Chlorobenzene	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Ethylbenzene	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Styrene	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
Xylenes (total)	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10

CLP SEMIVOLATILES 90-SOW

ug/l

Phenol	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
bis(2-Chloroethyl) ether	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
2-Chlorophenol	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
1,3-Dichlorobenzene	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10
1,4-Dichlorobenzene	-	ug/l	10 U	ug/l	10	-	ug/l	10 U	ug/l	10

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:
Site
Locator
Collect Date:

RB874005
WHITING
01G00101
19-JUL-96

RB873007
WHITING
01G00101
19-JUL-96

RB874006
WHITING
01G00102
19-JUL-96

RB873008
WHITING
01G00102
19-JUL-96

	VALUE	QUAL UNITS	DL									
1,2-Dichlorobenzene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2-Methylphenol	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,2-oxybis(1-Chloropropane)	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
4-Methylphenol	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
N-Nitroso-di-n-propylamine	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Hexachloroethane	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Nitrobenzene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Isophorone	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2-Nitrophenol	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,4-Dimethylphenol	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
bis(2-Chloroethoxy) methane	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,4-Dichlorophenol	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
1,2,4-Trichlorobenzene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Naphthalene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
4-Chloroaniline	-	ug/l		10 UJ	ug/l	10	-	ug/l		10 UJ	ug/l	10
Hexachlorobutadiene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
4-Chloro-3-methylphenol	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2-Methylnaphthalene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Hexachlorocyclopentadiene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,4,6-Trichlorophenol	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,4,5-Trichlorophenol	-	ug/l		25 U	ug/l	25	-	ug/l		25 U	ug/l	25
2-Chloronaphthalene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2-Nitroaniline	-	ug/l		25 U	ug/l	25	-	ug/l		25 U	ug/l	25
Dimethylphthalate	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Acenaphthylene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,6-Dinitrotoluene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
3-Nitroaniline	-	ug/l		25 U	ug/l	25	-	ug/l		25 U	ug/l	25
Acenaphthene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,4-Dinitrophenol	-	ug/l		25 UJ	ug/l	25	-	ug/l		25 UJ	ug/l	25
4-Nitrophenol	-	ug/l		25 U	ug/l	25	-	ug/l		25 U	ug/l	25
Dibenzofuran	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
2,4-Dinitrotoluene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Diethylphthalate	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
4-Chlorophenyl-phenylether	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Fluorene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
4-Nitroaniline	-	ug/l		25 U	ug/l	25	-	ug/l		25 U	ug/l	25
4,6-Dinitro-2-methylphenol	-	ug/l		25 UJ	ug/l	25	-	ug/l		25 UJ	ug/l	25
N-Nitrosodiphenylamine	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
4-Bromophenyl-phenylether	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Hexachlorobenzene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Pentachlorophenol	-	ug/l		25 U	ug/l	25	-	ug/l		25 U	ug/l	25
Phenanthrene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Anthracene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Carbazole	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Di-n-butylphthalate	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Fluoranthene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Pyrene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Butylbenzylphthalate	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
3,3-Dichlorobenzidine	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Benzo (a) anthracene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
Chrysene	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10
bis(2-Ethylhexyl) phthalate	-	ug/l		10 U	ug/l	10	-	ug/l		10 U	ug/l	10

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB874005	RB873007	RB874006	RB873008
Site	WHITING	WHITING	WHITING	WHITING
Locator	01G00101	01G00101	01G00102	01G00102
Collect Date:	19-JUL-96	19-JUL-96	19-JUL-96	19-JUL-96

	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	
Di-n-octylphthalate	-		ug/l		10 U		ug/l		10	-			10 U		ug/l		10
Benzo (b) fluoranthene	-		ug/l		10 U		ug/l		10	-			10 U		ug/l		10
Benzo (k) fluoranthene	-		ug/l		10 U		ug/l		10	-			10 U		ug/l		10
Benzo (a) pyrene	-		ug/l		10 U		ug/l		10	-			10 U		ug/l		10
Indeno (1,2,3-cd) pyrene	-		ug/l		10 U		ug/l		10	-			10 U		ug/l		10
Dibenzo (a,h) anthracene	-		ug/l		10 U		ug/l		10	-			10 U		ug/l		10
Benzo (g,h,i) perylene	-		ug/l		10 U		ug/l		10	-			10 U		ug/l		10
CLP PESTICIDES/PCBS 90-SOW	ug/l																
alpha-BHC	-		ug/l		.05 U		ug/l		.05	-			.05 U		ug/l		.05
beta-BHC	-		ug/l		.05 U		ug/l		.05	-			.05 U		ug/l		.05
delta-BHC	-		ug/l		.05 U		ug/l		.05	-			.05 U		ug/l		.05
gamma-BHC (Lindane)	-		ug/l		.05 U		ug/l		.05	-			.05 U		ug/l		.05
Heptachlor	-		ug/l		.05 U		ug/l		.05	-			.05 U		ug/l		.05
Aldrin	-		ug/l		.05 U		ug/l		.05	-			.05 U		ug/l		.05
Heptachlor epoxide	-		ug/l		.05 U		ug/l		.05	-			.05 U		ug/l		.05
Endosulfan I	-		ug/l		.05 U		ug/l		.05	-			.05 U		ug/l		.05
Dieldrin	-		ug/l		.1 U		ug/l		.1	-			.1 U		ug/l		.1
4,4-DDE	-		ug/l		.1 U		ug/l		.1	-			.1 U		ug/l		.1
Endrin	-		ug/l		.1 U		ug/l		.1	-			.1 U		ug/l		.1
Endosulfan II	-		ug/l		.1 U		ug/l		.1	-			.1 U		ug/l		.1
4,4-DDD	-		ug/l		.1 U		ug/l		.1	-			.1 U		ug/l		.1
Endosulfan sulfate	-		ug/l		.1 U		ug/l		.1	-			.1 U		ug/l		.1
4,4-DDT	-		ug/l		.1 U		ug/l		.1	-			.1 U		ug/l		.1
Methoxychlor	-		ug/l		.5 U		ug/l		.5	-			.5 U		ug/l		.5
Endrin ketone	-		ug/l		.1 U		ug/l		.1	-			.1 U		ug/l		.1
Endrin aldehyde	-		ug/l		.1 U		ug/l		.1	-			.1 U		ug/l		.1
alpha-Chlordane	-		ug/l		.05 U		ug/l		.05	-			.05 U		ug/l		.05
gamma-Chlordane	-		ug/l		.05 U		ug/l		.05	-			.05 U		ug/l		.05
Toxaphene	-		ug/l		5 U		ug/l		5	-			5 U		ug/l		5
Aroclor-1016	-		ug/l		1 U		ug/l		1	-			1 U		ug/l		1
Aroclor-1221	-		ug/l		2 U		ug/l		2	-			2 U		ug/l		2
Aroclor-1232	-		ug/l		1 U		ug/l		1	-			1 U		ug/l		1
Aroclor-1242	-		ug/l		1 U		ug/l		1	-			1 U		ug/l		1
Aroclor-1248	-		ug/l		1 U		ug/l		1	-			1 U		ug/l		1
Aroclor-1254	-		ug/l		1 U		ug/l		1	-			1 U		ug/l		1
Aroclor-1260	-		ug/l		1 U		ug/l		1	-			1 U		ug/l		1
CLP METALS AND CYANIDE	ug/l																
Aluminum	-		ug/l		55.6 U		ug/l			-			19.1 U		ug/l		
Antimony	-		ug/l		8.6 U		ug/l			-			8.6 U		ug/l		
Arsenic	-		ug/l		.5 U		ug/l			-			.5 U		ug/l		
Barium	-		ug/l		15.6 J		ug/l			-			15.6 J		ug/l		
Beryllium	-		ug/l		.3 U		ug/l			-			.53 J		ug/l		
Cadmium	-		ug/l		1.2 U		ug/l			-			1.2 U		ug/l		
Calcium	-		ug/l		796 J		ug/l			-			5850		ug/l		
Chromium	-		ug/l		2 U		ug/l			-			2 U		ug/l		
Cobalt	-		ug/l		2.3 U		ug/l			-			2.3 U		ug/l		
Copper	-		ug/l		1.1 U		ug/l			-			1.1 U		ug/l		
Iron	-		ug/l		80.1 U		ug/l			-			12.2 U		ug/l		
Lead	-		ug/l		.5 U		ug/l			-			1.3 U		ug/l		
Magnesium	-		ug/l		719 J		ug/l			-			337 J		ug/l		

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB874005		RB873007		RB874006		RB873008		
Site	WHITING		WHITING		WHITING		WHITING		
Locator	01G00101		01G00101		01G00102		01G00102		
Collect Date:	19-JUL-96		19-JUL-96		19-JUL-96		19-JUL-96		
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL

Manganese	-	ug/l		6.7 J	ug/l		-	ug/l		6.7 J	ug/l
Mercury	-	ug/l		.1 U	ug/l		-	ug/l		.1 U	ug/l
Nickel	-	ug/l		7.3 U	ug/l		-	ug/l		7.3 U	ug/l
Potassium	-	ug/l		714 J	ug/l		-	ug/l		938 J	ug/l
Selenium	-	ug/l		.6 U	ug/l		-	ug/l		.6 U	ug/l
Silver	-	ug/l		2.5 U	ug/l		-	ug/l		2.5 U	ug/l
Sodium	-	ug/l		1550 J	ug/l		-	ug/l		2100 J	ug/l
Thallium	-	ug/l		.6 U	ug/l		-	ug/l		.6 U	ug/l
Vanadium	-	ug/l		1.2 U	ug/l		-	ug/l		1.2 U	ug/l
Zinc	-	ug/l		2.8 U	ug/l		-	ug/l		10.2 U	ug/l
Cyanide	-	ug/l		1.5 U	ug/l		-	ug/l		1.9 J	ug/l

Groundwater Quality

Alkalinity as CaCO3	10 U	mg/l	10	-			22	mg/l	10	-
Ammonia-N	.3 U	mg/l	.3	-			.3 U	mg/l	.3	-
Chloride	10 U	mg/l	10	-			10 U	mg/l	10	-
Hardness as CaCO3	10 U	mg/l	10	-			22	mg/l	10	-
Nitrate-Nitrite	.41	mg/l	.1	-			.38	mg/l	.1	-
Phosphorous-P, Total	.1 U	mg/l	.1	-			.1 U	mg/l	.1	-
Sulfate	2	mg/l	.1	-			.23	mg/l	.1	-
Sulfide	2 U	mg/l	2	-			2 U	mg/l	2	-
Total Dissolved Solids	29	mg/l	10	-			44	mg/l	10	-
Total Kjeldahl Nitrogen	.3 U	mg/l	.3	-			.3 U	mg/l	.3	-
Total organic carbon	1 U	mg/l	1	-			1 U	mg/l	1	-

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB874007	RB873009	RB873008	RB886002							
Site	WHITING	WHITING	WHITING	WHITING							
Locator	01G00102D	01G00102D	01G00102D	01G00201							
Collect Date:	19-JUL-96	19-JUL-96	19-JUL-96	22-JUL-96							
VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL

CLP VOLATILES 90-SOW

ug/l

Chloromethane	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Bromomethane	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Vinyl chloride	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Chloroethane	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Methylene chloride	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Acetone	-	ug/l	-	ug/l	10 UJ	ug/l	10	-	ug/l
Carbon disulfide	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
1,1-Dichloroethene	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
1,1-Dichloroethane	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
1,2-Dichloroethene (total)	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Chloroform	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
1,2-Dichloroethane	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
2-Butanone	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
1,1,1-Trichloroethane	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Carbon tetrachloride	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Bromodichloromethane	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
1,2-Dichloropropane	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
cis-1,3-Dichloropropene	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Trichloroethene	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Dibromochloromethane	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
1,1,2-Trichloroethane	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Benzene	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
trans-1,3-Dichloropropene	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Bromoform	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
4-Methyl-2-pentanone	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
2-Hexanone	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Tetrachloroethene	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Toluene	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
1,1,2,2-Tetrachloroethane	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Chlorobenzene	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Ethylbenzene	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Styrene	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l
Xylenes (total)	-	ug/l	-	ug/l	10 U	ug/l	10	-	ug/l

CLP SEMIVOLATILES 90-SOW

ug/l

Phenol	-	ug/l	10 U	ug/l	10	-	ug/l	-	ug/l
bis(2-Chloroethyl) ether	-	ug/l	10 U	ug/l	10	-	ug/l	-	ug/l
2-Chlorophenol	-	ug/l	10 U	ug/l	10	-	ug/l	-	ug/l
1,3-Dichlorobenzene	-	ug/l	10 U	ug/l	10	-	ug/l	-	ug/l
1,4-Dichlorobenzene	-	ug/l	10 U	ug/l	10	-	ug/l	-	ug/l

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB874007		RB873009		RB873008		RB886002		
Site	WHITING		WHITING		WHITING		WHITING		
Locator	01G00102D		01G00102D		01G00102D		01G00201		
Collect Date:	19-JUL-96		19-JUL-96		19-JUL-96		22-JUL-96		
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL
1,2-Dichlorobenzene	-	ug/l		10 U	ug/l	10	-	ug/l	
2-Methylphenol	-	ug/l		10 U	ug/l	10	-	ug/l	
2,2-oxybis(1-Chloropropane)	-	ug/l		10 U	ug/l	10	-	ug/l	
4-Methylphenol	-	ug/l		10 U	ug/l	10	-	ug/l	
N-Nitroso-di-n-propylamine	-	ug/l		10 U	ug/l	10	-	ug/l	
Hexachloroethane	-	ug/l		10 U	ug/l	10	-	ug/l	
Nitrobenzene	-	ug/l		10 U	ug/l	10	-	ug/l	
Isophorone	-	ug/l		10 U	ug/l	10	-	ug/l	
2-Nitrophenol	-	ug/l		10 U	ug/l	10	-	ug/l	
2,4-Dimethylphenol	-	ug/l		10 U	ug/l	10	-	ug/l	
bis(2-Chloroethoxy) methane	-	ug/l		10 U	ug/l	10	-	ug/l	
2,4-Dichlorophenol	-	ug/l		10 U	ug/l	10	-	ug/l	
1,2,4-Trichlorobenzene	-	ug/l		10 U	ug/l	10	-	ug/l	
Naphthalene	-	ug/l		10 U	ug/l	10	-	ug/l	
4-Chloroaniline	-	ug/l		10 UJ	ug/l	10	-	ug/l	
Hexachlorobutadiene	-	ug/l		10 U	ug/l	10	-	ug/l	
4-Chloro-3-methylphenol	-	ug/l		10 U	ug/l	10	-	ug/l	
2-Methylnaphthalene	-	ug/l		10 U	ug/l	10	-	ug/l	
Hexachlorocyclopentadiene	-	ug/l		10 U	ug/l	10	-	ug/l	
2,4,6-Trichlorophenol	-	ug/l		10 U	ug/l	10	-	ug/l	
2,4,5-Trichlorophenol	-	ug/l		25 U	ug/l	25	-	ug/l	
2-Chloronaphthalene	-	ug/l		10 U	ug/l	10	-	ug/l	
2-Nitroaniline	-	ug/l		25 U	ug/l	25	-	ug/l	
Dimethylphthalate	-	ug/l		10 U	ug/l	10	-	ug/l	
Acenaphthylene	-	ug/l		10 U	ug/l	10	-	ug/l	
2,6-Dinitrotoluene	-	ug/l		10 U	ug/l	10	-	ug/l	
3-Nitroaniline	-	ug/l		25 U	ug/l	25	-	ug/l	
Acenaphthene	-	ug/l		10 U	ug/l	10	-	ug/l	
2,4-Dinitrophenol	-	ug/l		25 UJ	ug/l	25	-	ug/l	
4-Nitrophenol	-	ug/l		25 U	ug/l	25	-	ug/l	
Dibenzofuran	-	ug/l		10 U	ug/l	10	-	ug/l	
2,4-Dinitrotoluene	-	ug/l		10 U	ug/l	10	-	ug/l	
Diethylphthalate	-	ug/l		10 U	ug/l	10	-	ug/l	
4-Chlorophenyl-phenylether	-	ug/l		10 U	ug/l	10	-	ug/l	
Fluorene	-	ug/l		10 U	ug/l	10	-	ug/l	
4-Nitroaniline	-	ug/l		25 U	ug/l	25	-	ug/l	
4,6-Dinitro-2-methylphenol	-	ug/l		25 UJ	ug/l	25	-	ug/l	
N-Nitrosodiphenylamine	-	ug/l		10 U	ug/l	10	-	ug/l	
4-Bromophenyl-phenylether	-	ug/l		10 U	ug/l	10	-	ug/l	
Hexachlorobenzene	-	ug/l		10 U	ug/l	10	-	ug/l	
Pentachlorophenol	-	ug/l		25 U	ug/l	25	-	ug/l	
Phenanthrene	-	ug/l		10 U	ug/l	10	-	ug/l	
Anthracene	-	ug/l		10 U	ug/l	10	-	ug/l	
Carbazole	-	ug/l		10 U	ug/l	10	-	ug/l	
Di-n-butylphthalate	-	ug/l		10 U	ug/l	10	-	ug/l	
Fluoranthene	-	ug/l		10 U	ug/l	10	-	ug/l	
Pyrene	-	ug/l		10 U	ug/l	10	-	ug/l	
Butylbenzylphthalate	-	ug/l		10 U	ug/l	10	-	ug/l	
3,3-Dichlorobenzidine	-	ug/l		10 U	ug/l	10	-	ug/l	
Benzo (a) anthracene	-	ug/l		10 U	ug/l	10	-	ug/l	
Chrysene	-	ug/l		10 U	ug/l	10	-	ug/l	
bis(2-Ethylhexyl) phthalate	-	ug/l		10 U	ug/l	10	-	ug/l	

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB874007			RB873009			RB873008			RB886002		
Site	WHITING			WHITING			WHITING			WHITING		
Locator	01G00102D			01G00102D			01G00102D			01G00201		
Collect Date:	19-JUL-96			19-JUL-96			19-JUL-96			22-JUL-96		
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL
Di-n-octylphthalate	-	ug/l		10 U	ug/l		10	-	ug/l	-	ug/l	
Benzo (b) fluoranthene	-	ug/l		10 U	ug/l		10	-	ug/l	-	ug/l	
Benzo (k) fluoranthene	-	ug/l		10 U	ug/l		10	-	ug/l	-	ug/l	
Benzo (a) pyrene	-	ug/l		10 U	ug/l		10	-	ug/l	-	ug/l	
Indeno (1,2,3-cd) pyrene	-	ug/l		10 U	ug/l		10	-	ug/l	-	ug/l	
Dibenzo (a,h) anthracene	-	ug/l		10 U	ug/l		10	-	ug/l	-	ug/l	
Benzo (g,h,i) perylene	-	ug/l		10 U	ug/l		10	-	ug/l	-	ug/l	
CLP PESTICIDES/PCBS 90-SOW	ug/l											
alpha-BHC	-	ug/l		.05 UJ	ug/l		.05	-	ug/l	-	ug/l	
beta-BHC	-	ug/l		.05 UJ	ug/l		.05	-	ug/l	-	ug/l	
delta-BHC	-	ug/l		.05 UJ	ug/l		.05	-	ug/l	-	ug/l	
gamma-BHC (Lindane)	-	ug/l		.05 UJ	ug/l		.05	-	ug/l	-	ug/l	
Heptachlor	-	ug/l		.05 UJ	ug/l		.05	-	ug/l	-	ug/l	
Aldrin	-	ug/l		.05 UJ	ug/l		.05	-	ug/l	-	ug/l	
Heptachlor epoxide	-	ug/l		.05 UJ	ug/l		.05	-	ug/l	-	ug/l	
Endosulfan I	-	ug/l		.05 UJ	ug/l		.05	-	ug/l	-	ug/l	
Dieldrin	-	ug/l		.1 UJ	ug/l		.1	-	ug/l	-	ug/l	
4,4-DDE	-	ug/l		.1 UJ	ug/l		.1	-	ug/l	-	ug/l	
Endrin	-	ug/l		.1 UJ	ug/l		.1	-	ug/l	-	ug/l	
Endosulfan II	-	ug/l		.1 UJ	ug/l		.1	-	ug/l	-	ug/l	
4,4-DDD	-	ug/l		.1 UJ	ug/l		.1	-	ug/l	-	ug/l	
Endosulfan sulfate	-	ug/l		.1 UJ	ug/l		.1	-	ug/l	-	ug/l	
4,4-DDT	-	ug/l		.1 UJ	ug/l		.1	-	ug/l	-	ug/l	
Methoxychlor	-	ug/l		.5 UJ	ug/l		.5	-	ug/l	-	ug/l	
Endrin ketone	-	ug/l		.1 UJ	ug/l		.1	-	ug/l	-	ug/l	
Endrin aldehyde	-	ug/l		.1 UJ	ug/l		.1	-	ug/l	-	ug/l	
alpha-Chlordane	-	ug/l		.05 UJ	ug/l		.05	-	ug/l	-	ug/l	
gamma-Chlordane	-	ug/l		.05 UJ	ug/l		.05	-	ug/l	-	ug/l	
Toxaphene	-	ug/l		5 UJ	ug/l		5	-	ug/l	-	ug/l	
Aroclor-1016	-	ug/l		1 UJ	ug/l		1	-	ug/l	-	ug/l	
Aroclor-1221	-	ug/l		2 UJ	ug/l		2	-	ug/l	-	ug/l	
Aroclor-1232	-	ug/l		1 UJ	ug/l		1	-	ug/l	-	ug/l	
Aroclor-1242	-	ug/l		1 UJ	ug/l		1	-	ug/l	-	ug/l	
Aroclor-1248	-	ug/l		1 UJ	ug/l		1	-	ug/l	-	ug/l	
Aroclor-1254	-	ug/l		1 UJ	ug/l		1	-	ug/l	-	ug/l	
Aroclor-1260	-	ug/l		1 UJ	ug/l		1	-	ug/l	-	ug/l	
CLP METALS AND CYANIDE	ug/l											
Aluminum	-	ug/l		10.3 U	ug/l		-	ug/l	-	ug/l		
Antimony	-	ug/l		8.6 U	ug/l		-	ug/l	-	ug/l		
Arsenic	-	ug/l		.5 U	ug/l		-	ug/l	-	ug/l		
Barium	-	ug/l		15.6 J	ug/l		-	ug/l	-	ug/l		
Beryllium	-	ug/l		.3 U	ug/l		-	ug/l	-	ug/l		
Cadmium	-	ug/l		1.2 U	ug/l		-	ug/l	-	ug/l		
Calcium	-	ug/l		6250	ug/l		-	ug/l	-	ug/l		
Chromium	-	ug/l		2 U	ug/l		-	ug/l	-	ug/l		
Cobalt	-	ug/l		2.3 U	ug/l		-	ug/l	-	ug/l		
Copper	-	ug/l		1.4 J	ug/l		-	ug/l	-	ug/l		
Iron	-	ug/l		8.8 U	ug/l		-	ug/l	-	ug/l		
Lead	-	ug/l		1.5 U	ug/l		-	ug/l	-	ug/l		
Magnesium	-	ug/l		331 J	ug/l		-	ug/l	-	ug/l		

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB874007		RB873009		RB873008		RB886002		
Site	WHITING		WHITING		WHITING		WHITING		
Locator	01G00102D		01G00102D		01G00102D		01G00201		
Collect Date:	19-JUL-96		19-JUL-96		19-JUL-96		22-JUL-96		
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL

Manganese	-	ug/l		9 J	ug/l		-	ug/l		-	ug/l
Mercury	-	ug/l		.1 U	ug/l		-	ug/l		-	ug/l
Nickel	-	ug/l		7.3 U	ug/l		-	ug/l		-	ug/l
Potassium	-	ug/l		842 J	ug/l		-	ug/l		-	ug/l
Selenium	-	ug/l		.6 U	ug/l		-	ug/l		-	ug/l
Silver	-	ug/l		2.5 U	ug/l		-	ug/l		-	ug/l
Sodium	-	ug/l		2070 J	ug/l		-	ug/l		-	ug/l
Thallium	-	ug/l		.6 U	ug/l		-	ug/l		-	ug/l
Vanadium	-	ug/l		1.6 J	ug/l		-	ug/l		-	ug/l
Zinc	-	ug/l		11.4 U	ug/l		-	ug/l		-	ug/l
Cyanide	-	ug/l		1.5 U	ug/l		-	ug/l		-	ug/l

Groundwater Quality

Alkalinity as CaCO3	20	mg/l	10	-	-	-	10 U	mg/l	10
Ammonia-N	.3 U	mg/l	.3	-	-	-	.3 U	mg/l	.3
Chloride	10 U	mg/l	10	-	-	-	10 U	mg/l	10
Hardness as CaCO3	21	mg/l	10	-	-	-	24	mg/l	10
Nitrate-Nitrite	.42	mg/l	.1	-	-	-	.57	mg/l	.1
Phosphorous-P, Total	.1 U	mg/l	.1	-	-	-	.33	mg/l	.1
Sulfate	.22	mg/l	.1	-	-	-	.62	mg/l	.1
Sulfide	2 U	mg/l	2	-	-	-	2 U	mg/l	2
Total Dissolved Solids	29	mg/l	10	-	-	-	22	mg/l	10
Total Kjeldahl Nitrogen	.3 U	mg/l	.3	-	-	-	.5	mg/l	.3
Total organic carbon	1 U	mg/l	1	-	-	-	1 U	mg/l	1

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB887003	RB887004	RB886003	RB887006								
Site	WHITING	WHITING	WHITING	WHITING								
Locator	01G00201	01G00201F	01G00301	01G00301								
Collect Date:	22-JUL-96	22-JUL-96	23-JUL-96	23-JUL-96								
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL

CLP VOLATILES 90-SOW

ug/l

Chloromethane	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Bromomethane	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Vinyl chloride	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Chloroethane	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Methylene chloride	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Acetone	38 UJ	ug/l	38	-	ug/l	-	ug/l	14 UJ	ug/l	14
Carbon disulfide	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
1,1-Dichloroethene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
1,1-Dichloroethane	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
1,2-Dichloroethene (total)	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Chloroform	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
1,2-Dichloroethane	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2-Butanone	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
1,1,1-Trichloroethane	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Carbon tetrachloride	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Bromodichloromethane	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
1,2-Dichloropropane	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
cis-1,3-Dichloropropene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Trichloroethene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Dibromochloromethane	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
1,1,2-Trichloroethane	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Benzene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
trans-1,3-Dichloropropene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Bromoform	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
4-Methyl-2-pentanone	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2-Hexanone	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Tetrachloroethene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Toluene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
1,1,2,2-Tetrachloroethane	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Chlorobenzene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Ethylbenzene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Styrene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Xylenes (total)	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10

CLP SEMIVOLATILES 90-SOW

ug/l

Phenol	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
bis(2-Chloroethyl) ether	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2-Chlorophenol	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
1,3-Dichlorobenzene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
1,4-Dichlorobenzene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:
Site
Locator
Collect Date:

RB887003
WHITING
01G00201
22-JUL-96

RB887004
WHITING
01G00201F
22-JUL-96

RB886003
WHITING
01G00301
23-JUL-96

RB887006
WHITING
01G00301
23-JUL-96

VALUE QUAL UNITS DL VALUE QUAL UNITS DL VALUE QUAL UNITS DL VALUE QUAL UNITS DL

1,2-Dichlorobenzene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2-Methylphenol	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2,2-oxybis(1-Chloropropane)	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
4-Methylphenol	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
N-Nitroso-di-n-propylamine	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Hexachloroethane	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Nitrobenzene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Isophorone	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2-Nitrophenol	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2,4-Dimethylphenol	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
bis(2-Chloroethoxy) methane	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2,4-Dichlorophenol	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
1,2,4-Trichlorobenzene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Naphthalene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
4-Chloroaniline	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Hexachlorobutadiene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
4-Chloro-3-methylphenol	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2-Methylnaphthalene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Hexachlorocyclopentadiene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2,4,6-Trichlorophenol	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2,4,5-Trichlorophenol	25 U	ug/l	25	-	ug/l	-	ug/l	25 U	ug/l	25
2-Chloronaphthalene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2-Nitroaniline	25 U	ug/l	25	-	ug/l	-	ug/l	25 U	ug/l	25
Dimethylphthalate	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Acenaphthylene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2,6-Dinitrotoluene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
3-Nitroaniline	25 U	ug/l	25	-	ug/l	-	ug/l	25 U	ug/l	25
Acenaphthene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2,4-Dinitrophenol	25 U	ug/l	25	-	ug/l	-	ug/l	25 U	ug/l	25
4-Nitrophenol	25 U	ug/l	25	-	ug/l	-	ug/l	25 U	ug/l	25
Dibenzofuran	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
2,4-Dinitrotoluene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Diethylphthalate	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
4-Chlorophenyl-phenylether	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Fluorene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
4-Nitroaniline	25 UJ	ug/l	25	-	ug/l	-	ug/l	25 UJ	ug/l	25
4,6-Dinitro-2-methylphenol	25 U	ug/l	25	-	ug/l	-	ug/l	25 U	ug/l	25
N-Nitrosodiphenylamine	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
4-Bromophenyl-phenylether	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Hexachlorobenzene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Pentachlorophenol	25 U	ug/l	25	-	ug/l	-	ug/l	25 U	ug/l	25
Phenanthrene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Anthracene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Carbazole	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Di-n-butylphthalate	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Fluoranthene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Pyrene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Butylbenzylphthalate	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
3,3-Dichlorobenzidine	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Benzo (a) anthracene	10 U	ug/l	10	-	ug/l	-	ug/l	10 U	ug/l	10
Chrysene	10 UJ	ug/l	10	-	ug/l	-	ug/l	10 UJ	ug/l	10
bis(2-Ethylhexyl) phthalate	10 U	ug/l	10	-	ug/l	-	ug/l	2 J	ug/l	10

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB887003	RB887004	RB886003	RB887006
Site	WHITING	WHITING	WHITING	WHITING
Locator	01G00201	01G00201F	01G00301	01G00301
Collect Date:	22-JUL-96	22-JUL-96	23-JUL-96	23-JUL-96

	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL
Di-n-octylphthalate	10 U	ug/l	10	-	ug/l	-	-	ug/l	-	10 U	ug/l	10
Benzo (b) fluoranthene	10 U	ug/l	10	-	ug/l	-	-	ug/l	-	10 U	ug/l	10
Benzo (k) fluoranthene	10 U	ug/l	10	-	ug/l	-	-	ug/l	-	10 U	ug/l	10
Benzo (a) pyrene	10 U	ug/l	10	-	ug/l	-	-	ug/l	-	10 U	ug/l	10
Indeno (1,2,3-cd) pyrene	10 U	ug/l	10	-	ug/l	-	-	ug/l	-	10 U	ug/l	10
Dibenzo (a,h) anthracene	10 U	ug/l	10	-	ug/l	-	-	ug/l	-	10 U	ug/l	10
Benzo (g,h,i) perylene	10 U	ug/l	10	-	ug/l	-	-	ug/l	-	10 U	ug/l	10
CLP PESTICIDES/PCBS 90-SOW ug/l												
alpha-BHC	.05 UJ	ug/l	.05	-	ug/l	-	-	ug/l	-	.05 UJ	ug/l	.05
beta-BHC	.05 UJ	ug/l	.05	-	ug/l	-	-	ug/l	-	.05 UJ	ug/l	.05
delta-BHC	.05 UJ	ug/l	.05	-	ug/l	-	-	ug/l	-	.05 UJ	ug/l	.05
gamma-BHC (Lindane)	.05 UJ	ug/l	.05	-	ug/l	-	-	ug/l	-	.05 UJ	ug/l	.05
Heptachlor	.05 UJ	ug/l	.05	-	ug/l	-	-	ug/l	-	.05 UJ	ug/l	.05
Aldrin	.05 UJ	ug/l	.05	-	ug/l	-	-	ug/l	-	.05 UJ	ug/l	.05
Heptachlor epoxide	.05 UJ	ug/l	.05	-	ug/l	-	-	ug/l	-	.05 UJ	ug/l	.05
Endosulfan I	.05 UJ	ug/l	.05	-	ug/l	-	-	ug/l	-	.05 UJ	ug/l	.05
Dieldrin	.1 UJ	ug/l	.1	-	ug/l	-	-	ug/l	-	.1 UJ	ug/l	.1
4,4-DDE	.1 UJ	ug/l	.1	-	ug/l	-	-	ug/l	-	.1 UJ	ug/l	.1
Endrin	.1 UJ	ug/l	.1	-	ug/l	-	-	ug/l	-	.1 UJ	ug/l	.1
Endosulfan II	.1 UJ	ug/l	.1	-	ug/l	-	-	ug/l	-	.1 UJ	ug/l	.1
4,4-DDD	.1 UJ	ug/l	.1	-	ug/l	-	-	ug/l	-	.1 UJ	ug/l	.1
Endosulfan sulfate	.1 UJ	ug/l	.1	-	ug/l	-	-	ug/l	-	.1 UJ	ug/l	.1
4,4-DDT	.1 UJ	ug/l	.1	-	ug/l	-	-	ug/l	-	.1 UJ	ug/l	.1
Methoxychlor	.5 UJ	ug/l	.5	-	ug/l	-	-	ug/l	-	.5 UJ	ug/l	.5
Endrin ketone	.1 UJ	ug/l	.1	-	ug/l	-	-	ug/l	-	.1 UJ	ug/l	.1
Endrin aldehyde	.1 UJ	ug/l	.1	-	ug/l	-	-	ug/l	-	.1 UJ	ug/l	.1
alpha-Chlordane	.05 UJ	ug/l	.05	-	ug/l	-	-	ug/l	-	.05 UJ	ug/l	.05
gamma-Chlordane	.05 UJ	ug/l	.05	-	ug/l	-	-	ug/l	-	.05 UJ	ug/l	.05
Toxaphene	5 UJ	ug/l	5	-	ug/l	-	-	ug/l	-	5 UJ	ug/l	5
Aroclor-1016	1 UJ	ug/l	1	-	ug/l	-	-	ug/l	-	1 UJ	ug/l	1
Aroclor-1221	2 UJ	ug/l	2	-	ug/l	-	-	ug/l	-	2 UJ	ug/l	2
Aroclor-1232	1 UJ	ug/l	1	-	ug/l	-	-	ug/l	-	1 UJ	ug/l	1
Aroclor-1242	1 UJ	ug/l	1	-	ug/l	-	-	ug/l	-	1 UJ	ug/l	1
Aroclor-1248	1 UJ	ug/l	1	-	ug/l	-	-	ug/l	-	1 UJ	ug/l	1
Aroclor-1254	1 UJ	ug/l	1	-	ug/l	-	-	ug/l	-	1 UJ	ug/l	1
Aroclor-1260	1 UJ	ug/l	1	-	ug/l	-	-	ug/l	-	1 UJ	ug/l	1
CLP METALS AND CYANIDE ug/l												
Aluminum	842	ug/l		33 U	ug/l		-	ug/l		202	ug/l	
Antimony	8.6 U	ug/l		8.6 U	ug/l		-	ug/l		8.6 U	ug/l	
Arsenic	.5 U	ug/l		.5 U	ug/l		-	ug/l		.5 U	ug/l	
Barium	71.4 J	ug/l		26 J	ug/l		-	ug/l		21.3 J	ug/l	
Beryllium	.51 J	ug/l		.3 U	ug/l		-	ug/l		.3 U	ug/l	
Cadmium	1.2 U	ug/l		1.2 U	ug/l		-	ug/l		1.2 U	ug/l	
Calcium	2730 J	ug/l		2070 J	ug/l		-	ug/l		960 J	ug/l	
Chromium	7.2 J	ug/l		2 U	ug/l		-	ug/l		5.8 J	ug/l	
Cobalt	2.3 U	ug/l		2.3 U	ug/l		-	ug/l		2.3 U	ug/l	
Copper	2.4 J	ug/l		1.1 U	ug/l		-	ug/l		1.6 J	ug/l	
Iron	2630	ug/l		5.4 U	ug/l		-	ug/l		256	ug/l	
Lead	5.2 U	ug/l		.8 U	ug/l		-	ug/l		.7 U	ug/l	
Magnesium	807 J	ug/l		712 J	ug/l		-	ug/l		717 J	ug/l	

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB887003		RB887004		RB886003		RB887006	
Site	WHITING		WHITING		WHITING		WHITING	
Locator	01G00201		01G00201F		01G00301		01G00301	
Collect Date:	22-JUL-96		22-JUL-96		23-JUL-96		23-JUL-96	
	VALUE	DL	VALUE	DL	VALUE	DL	VALUE	DL

	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL
Manganese	10.5	J	ug/l	4.8	J	ug/l	-	ug/l		4.4	J	ug/l
Mercury	.1	U	ug/l	.1	U	ug/l	-	ug/l		.1	U	ug/l
Nickel	9.6	J	ug/l	7.3	U	ug/l	-	ug/l		11	J	ug/l
Potassium	634	J	ug/l	458	J	ug/l	-	ug/l		554	J	ug/l
Selenium	.6	U	ug/l	.6	U	ug/l	-	ug/l		.6	U	ug/l
Silver	2.5	U	ug/l	2.5	U	ug/l	-	ug/l		2.5	U	ug/l
Sodium	2330	J	ug/l	2260	J	ug/l	-	ug/l		2070	J	ug/l
Thallium	.6	U	ug/l	.6	U	ug/l	-	ug/l		.6	U	ug/l
Vanadium	9	J	ug/l	1.2	U	ug/l	-	ug/l		1.2	U	ug/l
Zinc	90.8		ug/l	58.2		ug/l	-	ug/l		70.2		ug/l
Cyanide	2	U	ug/l	-		ug/l	-	ug/l		3.3	U	ug/l

Groundwater Quality

Alkalinity as CaCO3	-		-		10	U	mg/l	10		-	
Ammonia-N	-		-		.3	U	mg/l	.3		-	
Chloride	-		-		10	U	mg/l	10		-	
Hardness as CaCO3	-		-		14		mg/l	10		-	
Nitrate-Nitrite	-		-		.48		mg/l	.1		-	
Phosphorous-P, Total	-		-		.15		mg/l	.1		-	
Sulfate	-		-		.56		mg/l	.1		-	
Sulfide	-		-		2	U	mg/l	2		-	
Total Dissolved Solids	-		-		19		mg/l	10		-	
Total Kjeldahl Nitrogen	-		-		.4		mg/l	.3		-	
Total organic carbon	-		-		1	U	mg/l	1		-	

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB886001		RB887002			
Site	WHITING		WHITING			
Locator	01G00401		01G00401			
Collect Date:	22-JUL-96		22-JUL-96			
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL

CLP VOLATILES 90-SOW		ug/l				
Chloromethane	-	ug/l	10 U	ug/l	10	
Bromomethane	-	ug/l	10 U	ug/l	10	
Vinyl chloride	-	ug/l	10 U	ug/l	10	
Chloroethane	-	ug/l	10 U	ug/l	10	
Methylene chloride	-	ug/l	10 U	ug/l	10	
Acetone	-	ug/l	10 UJ	ug/l	10	
Carbon disulfide	-	ug/l	10 U	ug/l	10	
1,1-Dichloroethene	-	ug/l	10 U	ug/l	10	
1,1-Dichloroethane	-	ug/l	10 U	ug/l	10	
1,2-Dichloroethene (total)	-	ug/l	10 U	ug/l	10	
Chloroform	-	ug/l	10 U	ug/l	10	
1,2-Dichloroethane	-	ug/l	10 U	ug/l	10	
2-Butanone	-	ug/l	10 U	ug/l	10	
1,1,1-Trichloroethane	-	ug/l	10 U	ug/l	10	
Carbon tetrachloride	-	ug/l	10 U	ug/l	10	
Bromodichloromethane	-	ug/l	10 U	ug/l	10	
1,2-Dichloropropane	-	ug/l	10 U	ug/l	10	
cis-1,3-Dichloropropene	-	ug/l	10 U	ug/l	10	
Trichloroethene	-	ug/l	10 U	ug/l	10	
Dibromochloromethane	-	ug/l	10 U	ug/l	10	
1,1,2-Trichloroethane	-	ug/l	10 U	ug/l	10	
Benzene	-	ug/l	10 U	ug/l	10	
trans-1,3-Dichloropropene	-	ug/l	10 U	ug/l	10	
Bromoform	-	ug/l	10 U	ug/l	10	
4-Methyl-2-pentanone	-	ug/l	10 U	ug/l	10	
2-Hexanone	-	ug/l	10 U	ug/l	10	
Tetrachloroethene	-	ug/l	10 U	ug/l	10	
Toluene	-	ug/l	10 U	ug/l	10	
1,1,2,2-Tetrachloroethane	-	ug/l	10 U	ug/l	10	
Chlorobenzene	-	ug/l	10 U	ug/l	10	
Ethylbenzene	-	ug/l	10 U	ug/l	10	
Styrene	-	ug/l	10 U	ug/l	10	
Xylenes (total)	-	ug/l	10 U	ug/l	10	
CLP SEMIVOLATILES 90-SOW		ug/l				
Phenol	-	ug/l	10 U	ug/l	10	
bis(2-Chloroethyl) ether	-	ug/l	10 U	ug/l	10	
2-Chlorophenol	-	ug/l	10 U	ug/l	10	
1,3-Dichlorobenzene	-	ug/l	10 U	ug/l	10	
1,4-Dichlorobenzene	-	ug/l	10 U	ug/l	10	

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB886001		RB887002		
Site	WHITING		WHITING		
Locator	01G00401		01G00401		
Collect Date:	22-JUL-96		22-JUL-96		
VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL

1,2-Dichlorobenzene	-	ug/l	10 U	ug/l	10
2-Methylphenol	-	ug/l	10 U	ug/l	10
2,2-oxybis(1-Chloropropane)	-	ug/l	10 U	ug/l	10
4-Methylphenol	-	ug/l	10 U	ug/l	10
N-Nitroso-di-n-propylamine	-	ug/l	10 U	ug/l	10
Hexachloroethane	-	ug/l	10 U	ug/l	10
Nitrobenzene	-	ug/l	10 U	ug/l	10
Isophorone	-	ug/l	10 U	ug/l	10
2-Nitrophenol	-	ug/l	10 U	ug/l	10
2,4-Dimethylphenol	-	ug/l	10 U	ug/l	10
bis(2-Chloroethoxy) methane	-	ug/l	10 U	ug/l	10
2,4-Dichlorophenol	-	ug/l	10 U	ug/l	10
1,2,4-Trichlorobenzene	-	ug/l	10 U	ug/l	10
Naphthalene	-	ug/l	10 U	ug/l	10
4-Chloroaniline	-	ug/l	10 U	ug/l	10
Hexachlorobutadiene	-	ug/l	10 U	ug/l	10
4-Chloro-3-methylphenol	-	ug/l	10 U	ug/l	10
2-Methylnaphthalene	-	ug/l	10 U	ug/l	10
Hexachlorocyclopentadiene	-	ug/l	10 U	ug/l	10
2,4,6-Trichlorophenol	-	ug/l	10 U	ug/l	10
2,4,5-Trichlorophenol	-	ug/l	25 U	ug/l	25
2-Chloronaphthalene	-	ug/l	10 U	ug/l	10
2-Nitroaniline	-	ug/l	25 U	ug/l	25
Dimethylphthalate	-	ug/l	10 U	ug/l	10
Acenaphthylene	-	ug/l	10 U	ug/l	10
2,6-Dinitrotoluene	-	ug/l	10 U	ug/l	10
3-Nitroaniline	-	ug/l	25 U	ug/l	25
Acenaphthene	-	ug/l	10 U	ug/l	10
2,4-Dinitrophenol	-	ug/l	25 U	ug/l	25
4-Nitrophenol	-	ug/l	25 U	ug/l	25
Dibenzofuran	-	ug/l	10 U	ug/l	10
2,4-Dinitrotoluene	-	ug/l	10 U	ug/l	10
Diethylphthalate	-	ug/l	10 U	ug/l	10
4-Chlorophenyl-phenylether	-	ug/l	10 U	ug/l	10
Fluorene	-	ug/l	10 U	ug/l	10
4-Nitroaniline	-	ug/l	25 UJ	ug/l	25
4,6-Dinitro-2-methylphenol	-	ug/l	25 U	ug/l	25
N-Nitrosodiphenylamine	-	ug/l	10 U	ug/l	10
4-Bromophenyl-phenylether	-	ug/l	10 U	ug/l	10
Hexachlorobenzene	-	ug/l	10 U	ug/l	10
Pentachlorophenol	-	ug/l	25 U	ug/l	25
Phenanthrene	-	ug/l	10 U	ug/l	10
Anthracene	-	ug/l	10 U	ug/l	10
Carbazole	-	ug/l	10 U	ug/l	10
Di-n-butylphthalate	-	ug/l	10 U	ug/l	10
Fluoranthene	-	ug/l	10 U	ug/l	10
Pyrene	-	ug/l	10 U	ug/l	10
Butylbenzylphthalate	-	ug/l	10 U	ug/l	10
3,3-Dichlorobenzidine	-	ug/l	10 U	ug/l	10
Benzo (a) anthracene	-	ug/l	10 U	ug/l	10
Chrysene	-	ug/l	10 UJ	ug/l	10
bis(2-Ethylhexyl) phtalate	-	ug/l	10 U	ug/l	10

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB886001	RB887002
Site	WHITING	WHITING
Locator	01G00401	01G00401
Collect Date:	22-JUL-96	22-JUL-96

	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL
Di-n-octylphthalate	-	ug/l		10 U	ug/l	10
Benzo (b) fluoranthene	-	ug/l		10 U	ug/l	10
Benzo (k) fluoranthene	-	ug/l		10 U	ug/l	10
Benzo (a) pyrene	-	ug/l		10 U	ug/l	10
Indeno (1,2,3-cd) pyrene	-	ug/l		10 U	ug/l	10
Dibenzo (a,h) anthracene	-	ug/l		10 U	ug/l	10
Benzo (g,h,i) perylene	-	ug/l		10 U	ug/l	10
CLP PESTICIDES/PCBS 90-SOW ug/l						
alpha-BHC	-	ug/l		.05 U	ug/l	.05
beta-BHC	-	ug/l		.05 U	ug/l	.05
delta-BHC	-	ug/l		.05 U	ug/l	.05
gamma-BHC (Lindane)	-	ug/l		.05 U	ug/l	.05
Heptachlor	-	ug/l		.05 U	ug/l	.05
Aldrin	-	ug/l		.05 U	ug/l	.05
Heptachlor epoxide	-	ug/l		.05 U	ug/l	.05
Endosulfan I	-	ug/l		.05 U	ug/l	.05
Dieldrin	-	ug/l		.1 U	ug/l	.1
4,4-DDE	-	ug/l		.1 U	ug/l	.1
Endrin	-	ug/l		.1 U	ug/l	.1
Endosulfan II	-	ug/l		.1 U	ug/l	.1
4,4-DDD	-	ug/l		.1 U	ug/l	.1
Endosulfan sulfate	-	ug/l		.1 U	ug/l	.1
4,4-DDT	-	ug/l		.1 U	ug/l	.1
Methoxychlor	-	ug/l		.5 U	ug/l	.5
Endrin ketone	-	ug/l		.1 U	ug/l	.1
Endrin aldehyde	-	ug/l		.1 U	ug/l	.1
alpha-Chlordane	-	ug/l		.05 U	ug/l	.05
gamma-Chlordane	-	ug/l		.05 U	ug/l	.05
Toxaphene	-	ug/l		5 U	ug/l	5
Aroclor-1016	-	ug/l		1 U	ug/l	1
Aroclor-1221	-	ug/l		2 U	ug/l	2
Aroclor-1232	-	ug/l		1 U	ug/l	1
Aroclor-1242	-	ug/l		1 U	ug/l	1
Aroclor-1248	-	ug/l		1 U	ug/l	1
Aroclor-1254	-	ug/l		1 U	ug/l	1
Aroclor-1260	-	ug/l		1 U	ug/l	1
CLP METALS AND CYANIDE ug/l						
Aluminum	-	ug/l		62.4 U	ug/l	
Antimony	-	ug/l		8.6 U	ug/l	
Arsenic	-	ug/l		.5 U	ug/l	
Barium	-	ug/l		19.7 J	ug/l	
Beryllium	-	ug/l		.53 J	ug/l	
Cadmium	-	ug/l		1.2 U	ug/l	
Calcium	-	ug/l		712 J	ug/l	
Chromium	-	ug/l		2 U	ug/l	
Cobalt	-	ug/l		2.3 U	ug/l	
Copper	-	ug/l		1.1 U	ug/l	
Iron	-	ug/l		246	ug/l	
Lead	-	ug/l		1.1 U	ug/l	
Magnesium	-	ug/l		644 J	ug/l	

Naval Air Station Whiting Field, Milton, Florida
Site 1 Groundwater Data

Lab Sample Number:	RB886001		RB887002			
Site	WHITING		WHITING			
Locator	01G00401		01G00401			
Collect Date:	22-JUL-96		22-JUL-96			
	VALUE	QUAL UNITS	DL	VALUE	QUAL UNITS	DL

Manganese	-	ug/l		3.4 J	ug/l	
Mercury	-	ug/l		.1 U	ug/l	
Nickel	-	ug/l		7.4 J	ug/l	
Potassium	-	ug/l		316 U	ug/l	
Selenium	-	ug/l		.6 U	ug/l	
Silver	-	ug/l		2.5 U	ug/l	
Sodium	-	ug/l		1980 J	ug/l	
Thallium	-	ug/l		.6 U	ug/l	
Vanadium	-	ug/l		1.3 J	ug/l	
Zinc	-	ug/l		1.8 U	ug/l	
Cyanide	-	ug/l		1.5 U	ug/l	

Groundwater Quality

Alkalinity as CaCO3	10 U	mg/l	10	-
Ammonia-N	.3 U	mg/l	.3	-
Chloride	10 U	mg/l	10	-
Hardness as CaCO3	10 U	mg/l	10	-
Nitrate-Nitrite	.51	mg/l	.25	-
Phosphorous-P, Total	.1 U	mg/l	.1	-
Sulfate	.39	mg/l	.1	-
Sulfide	2 U	mg/l	2	-
Total Dissolved Solids	20	mg/l	10	-
Total Kjeldahl Nitrogen	.3 U	mg/l	.3	-
Total organic carbon	1 U	mg/l	1	-

APPENDIX E
HUMAN HEALTH RISK DATA

HUMAN HEALTH TOXICITY PROFILES

Aluminum. Aluminum occurs naturally in the soil and makes up approximately 8 percent of the earth's crust. Higher soil concentrations are associated with industries that burn coal and aluminum mining and smelting. Human exposures to aluminum may occur through ingestion of foods grown in soil that contains aluminum and use of antacids, antiperspirants, and other drug store items. Aluminum in antiperspirants can cause skin rashes in some people. Factory workers who inhale large amounts of aluminum dust may develop lung problems. Aluminum has caused lower birth weights in some animals. Studies have shown that aluminum accumulates in the brains of people with Alzheimer's disease; however, any causal link between aluminum exposure and this disease is yet to be demonstrated. Both human epidemiological studies and animal experiments strongly suggest that aluminum is not a carcinogen.

References:

Agency for Toxic Substances and Disease Registry (ATSDR). 1989. *Toxicological Profile for Aluminum*. U.S. Public Health Service (October).

Arsenic. Arsenic has historically been used in pesticide formulations. The current uses of arsenic are in wood preservation and in tanneries, as well as the glass and wine making industries. Toxicity depends on its chemical form. Arsenic is an irritant of the skin, mucous membranes, and gastrointestinal tract. Symptoms of acute toxicity include vomiting, diarrhea, convulsions, and a severe drop in blood pressure. Subchronic effects include hyperpigmentation, sensory-motor polyneuropathy, persistent headache, and lethargy. Chronic oral exposure has caused skin lesions, peripheral vascular disease, and peripheral neuropathy. The USEPA has classified arsenic in Group A, human carcinogen, based on increased incidence of lung cancer in occupational exposure studies. Also, there is evidence of an increase in skin cancer in populations consuming drinking water containing inorganic arsenic.

References:

ATSDR. 1992. *Toxicological Profile for Arsenic*. U.S. Public Health Service, (February).

Iron. Iron is a metal required for a variety of physiological functions such as heme biosynthesis, oxidative phosphorylation, and mixed-function oxidase-mediated metabolic reactions. Only divalent forms of iron are absorbed. As absorption occurs, divalent iron is biochemically converted to trivalent iron, the biologically active form. Under normal conditions, absorbed dietary iron is complexed to hemoglobin and transported to the liver for storage until needed for physiological reactions. The balance of iron is regulated only by the amount of dietary intake and the degree of intestinal absorption. Intestinal absorption tends to be low (2 to 15 percent) except during periods of increased iron need when absorption efficiency increases dramatically.

Acute iron toxicity has been well characterized following the accidental ingestion of iron-containing preparations by children. Shortly after ingestion, the corrosive effects of iron cause vomiting and diarrhea, often bloody. Later signs include shock, metabolic acidosis, seizures, liver and/or kidney failure, coma, and death. Chronic iron overload manifests as disturbances in liver function, diabetes mellitus, and endocrine and cardiovascular effects. Inhalation of iron containing dust or fumes in occupational settings may result in deposition of iron particles in the lungs leading to interstitial fibrosis.

References:

Aisen, P., G. Cohen, and J.O. Kang. 1990. "Iron Toxicosis." *Int. Rev. Exp. Pathol.* 31:1-46.

Goyer, R.A. 1991. "Toxic Effects of Metals." In *Casarett and Doull's Toxicology: The Basic Science of Poisons*. 3rd edition. Eds. C.D. Klaassen, M.O. Amdur, and J. Doull. New York: Macmillan Publishing Co.

Table E-1
Screening Concentrations for Surface Soil
for Selection of Chemicals of Potential Concern for Site 1

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Chemical	Risk-Based Screening Concentration ¹	Florida Cleanup Goal ²	Florida Cleanup Goal Based on Leaching	Selected Screening Concentration ³
<u>Volatile Organic Compounds (µg/kg)</u>				
Xylenes (total)	16,000,000	13,000,000	100	13,000,000
<u>Pesticides (µg/kg)</u>				
Dieldrin	40	70	20	40
<u>Inorganic Analytes (mg/kg)</u>				
Aluminum	7,800	75,000	NSC	7,800
Arsenic	⁴ 0.43	0.8	NSC	0.43
Barium	550	5,200	NSC	550
Beryllium	0.15	0.2	NSC	0.15
Cadmium	3.9	37	NSC	3.9
Calcium	⁵ 1,000,000	NSC	NSC	1,000,000
Chromium	⁶ 39	⁶ 290	NSC	39
Cobalt	470	4,700	NSC	470
Copper	310	NSC	NSC	310
Cyanide	⁷ 160	1,600	NSC	160
Iron	2,300	NSC	NSC	2,300
Lead	⁸ 400	500	NSC	400
Magnesium	⁵ 460,468	NSC	NSC	460,468
Manganese	180	370	NSC	180
Mercury	2.3	23	NSC	2.3
Nickel	160	1,500	NSC	160

See notes at end of table.

Table E-1 (Continued)
Screening Concentrations for Surface Soil
for Selection of Chemicals of Potential Concern for Site 1

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Chemical	Risk-Based Screening Concentration ¹	Florida Cleanup Goal ²	Florida Cleanup Goal Based on Leaching	Selected Screening Concentration ³
<u>Inorganic Analytes (mg/kg) (Continued)</u>				
Potassium	⁵ 1,000,000	NSC	NSC	1,000,000
Sodium	⁵ 1,000,000	NSC	NSC	1,000,000
Vanadium	55	490	NSC	55
Zinc	2,300	23,000	NSC	2,300

¹ For all chemicals except the essential nutrients, the U.S. Environmental Protection Agency Region III Risk-Based Concentration (RBC) Table for residential soil (May 30, 1996) has been used, unless otherwise noted. Screening values are based on a cancer risk of 10⁻⁶ or a hazard quotient of 1.0. Noncarcinogenic RBCs have been adjusted to reflect a target hazard quotient of 0.1.

² Florida Department of Environmental Protection memorandum dated September 29, 1995, and January 19, 1996 update. Cleanup goals are based on a target cancer risk of 10⁻⁶ or a target hazard quotient of 1.

³ The selected screening concentration for the human health risk assessment is the lowest value of the RBC and the Florida Cleanup Goal. The Florida Soil Cleanup Goal based on leaching was applied only when an inorganic analyte was selected as a human health chemical of potential concern in groundwater.

⁴ RBC value is based on arsenic's as a carcinogen.

⁵ Essential nutrient screening value (see General Information Report).

⁶ RBC and Florida Cleanup Goal values are based on Chromium IV.

⁷ RBC value is based on hydrogen cyanide.

⁸ RBC is not available for lead; value is from Revised Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites (OSWER Directive 9355.4-12).

Notes: $\mu\text{g}/\text{kg}$ = micrograms per kilogram.
 mg/kg = milligrams per kilogram.
 NSC = no screening criteria available.

Table E-2
Screening Concentrations for Groundwater
for Selection of Chemicals of Potential Concern for Site 1

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Chemical	Risk-Based Screening Concentration ¹	Federal MCL ²	Florida Groundwater Guidance Concentration ³	Selected Screening Concentration ⁴
<u>Volatile Organic Compounds (µg/l)</u>				
Carbon disulfide	100	NA	[700]	100
<u>Semivolatile Organic Compounds (µg/l)</u>				
bis(2-Ethylhexyl)phthalate	4.8	6	6	4.8
beta-BHC	0.037	NA	[0.1]	0.037
<u>Inorganic Analytes (µg/l)</u>				
Aluminum	3,700	(50)	(200)	50
Barium	260	2,000	2,000	260
Beryllium	0.016	4	4	0.016
Calcium	⁵ 1,055,398	NA	NA	1,055,398
Chromium	⁶ 18	100	100 ⁶	18
Cobalt	220	NA	NA	220
Copper	150	⁷ 1,300	(1,000)	150
Cyanide	⁸ 73	200	200	73
Iron	1,100	(300)	(300)	300
Lead	NA	⁹ 15	15	15
Magnesium	118,807 ⁶	NA	NA	118,807
Manganese	84	(50)	(50)	50
Mercury	1.1	2	2	1.1
Nickel	73	100	100	73
Potassium	⁵ 297,016	NA	NA	297,016
Silver	18	(100)	(100)	18
See notes at end of table.				

Table E-2 (Continued)
Screening Concentrations for Groundwater
for Selection of Chemicals of Potential Concern for Site 1

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Chemical	Risk-Based Screening Concentration ¹	Federal MCL ²	Florida Groundwater Guidance Concentration ³	Selected Screening Concentration ⁴
Inorganic Analytes ($\mu\text{g}/\text{l}$) (Continued)				
Sodium	⁵ 396,022	NA	160,000	160,000
Vanadium	26	NA	[49]	26
Zinc	1,100	(5,000)	(5,000)	1,100

¹ For all chemicals except the essential nutrients, the U.S. Environmental Protection Agency (USEPA) Region III Risk-Based Concentration (RBC) Table for tap water (May 1996) has been used. Screening values are based on a cancer risk of 10^{-6} and a hazard quotient of 1. Per USEPA Region IV Guidance (USEPA, 1995), the noncarcinogenic RBCs have been adjusted to reflect a target hazard quotient of 0.1.

² Federal MCLs are taken from USEPA Drinking Water Regulations and Health Advisories from February 1996. Primary MCLs have no marks, Secondary MCLs are indicated by parentheses (), and Federal maximum contaminant level goals (MCLGs) are indicated by brackets []. The lowest of these nonzero values is presented.

³ Florida Department of Environmental Protection Groundwater Guidance Concentrations from June 1994. Primary Standards have no marks, Secondary Standards are indicated by parentheses (), and other criteria (i.e., carcinogen, organoleptic, or a systemic toxicant) are indicated by brackets [].

⁴ The selected screening concentration for the human health risk assessment is the lowest value of the RBC, Federal MCL value, and Florida Guidance Concentration values.

⁵ Essential nutrient screening value (see General Information Report).

⁶ RBC value is based on Chromium VI.

⁷ Treatment technology action level for copper in drinking water distribution system (USEPA Drinking Water Standards and Health Advisories, May, 1996).

⁸ RBC value is based hydrogen cyanide.

⁹ Treatment technology action level for lead in drinking water (USEPA Drinking Water Standards and Health Advisories, May 1996).

Notes: MCL = maximum contaminant level.

$\mu\text{g}/\text{l}$ = micrograms per liter.

NA = not available.

BHC = benzene hexachloride.

Table E-3
Screening Concentrations for Subsurface Soil
for Selection of Chemicals of Potential Concern for Site 1

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Chemical	Risk-Based Screening Concentration ¹	Florida Cleanup Goal ²	Florida Cleanup Goal Based on Leaching ²	Selected Screening Concentration ³
<u>Volatile Organic Compounds</u> (µg/kg)				
Acetone	20,000,000	1,800,000	1,400	1,800,000
<u>Inorganic Analytes</u> (mg/kg)				
Aluminum	100,000	1,000,000	NSC	100,000
Arsenic	⁴ 3.8	⁴ 3.7	NSC	3.7
Barium	14,000	84,000	NSC	14,000
Beryllium	1.3	1.0	NSC	1.0
Calcium	⁵ 1,000,000	NSC	NSC	1,000,000
Chromium	⁶ 1,000	⁶ 430	NSC	430
Copper	8,200	NSC	NSC	8,200
Iron	61,000	NSC	NSC	61,000
Lead	⁷ 400	1,000	NSC	400
Magnesium	⁵ 460,468	NSC	NSC	460,468
Manganese	4,700	5,500	NSC	4,700
Mercury	61	480	NSC	61
Nickel	4,100	26,000	NSC	4,100
Sodium	⁵ 1,000,000	NSC	NSC	1,000,000
Vanadium	1,400	4,800	NSC	1,400
Zinc	61,000	560,000	NSC	61,000

¹ For all chemicals except the essential nutrients, the U.S. Environmental Protection Agency Region III Risk-Based Concentration (RBC) Table for industrial soil (May 30, 1996) has been used, unless otherwise noted. Screening values are based on a cancer risk of 10⁻⁶ or a hazard quotient of 1.0. Noncarcinogenic RBCs have been adjusted to reflect a target hazard quotient of 0.1.

² Florida Department of Environmental Protection memorandum dated September 29, 1995, and January 19, 1996 update. Cleanup goals are based on a target cancer risk of 10⁻⁶ or a target hazard quotient of 1.

³ The selected screening concentration for the human health risk assessment is the lowest value of the RBC and the Florida Cleanup Goal. The Florida Soil Cleanup Goal based on leaching is applied only when an inorganic analyte was selected as a human health chemical of potential concern in groundwater.

⁴ RBC value is based on arsenic's properties as a carcinogen.

⁵ Essential nutrient screening value (see General Information Report).

⁶ RBC and Florida Cleanup Goal values are based on Chromium VI.

⁷ RBC is not available for lead; value is from Revised Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites (OSWER Directive 9355.4-12).

Notes: µg/kg = micrograms per kilogram.
 mg/kg = milligrams per kilogram.
 NSC = no screening criteria available.

**Table E-4
Oral Dose-Response Data
for Carcinogenic Effects**

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Chemical	Weight of Evidence (route-specific)	Oral Slope Factor (mg/kg-day) ⁻¹	Source	Test Species	Exposure Route	Tumor Type	Study Source
<u>Inorganic Analytes</u>							
Aluminum	D	NE					
Arsenic	A	1.5e + 00	IRIS	Human	Oral-drinking water	Skin	IRIS
Iron	D	NE					

Notes: IRIS on-line database search, current as of April 1997.
Health Effects Assessment Summary Tables (HEAST), current as of November 1995.

mg/kg-day = milligrams per kilogram-day.
D = not classifiable as to human carcinogenicity.
NE = not evaluated.
A = human carcinogen.
IRIS = Integrated Risk Information System.

**Table E-5
Dermal Dose-Response Data for Carcinogenic Effects**

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Compound	Weight of Evidence (route-specific)	Oral Slope Factor (mg/kg-day) ⁻¹	Oral Absorption Efficiency	Reference	Dermal Slope Factor (mg/kg-day) ⁻¹
<u>Inorganic Analytes</u>					
Aluminum	D	NE			NE
Arsenic	A	1.5e+00	98%	Vahter, 1983	1.5e+00
Iron	D	NE			NE

Notes: For documentation concerning oral slope factors, refer to Table E-4.
Integrated Risk Information System (IRIS) on-line database search, current as of April 1997.
Health Effects Assessment Summary Tables (HEAST), current as of November 1995.

Vahter, M. 1983. "Metabolism of Arsenic." In *Biological and Environmental Effect of Arsenic*. Ed. B.A. Fowler, 171-198. New York: Elsevier.

mg/kg-day = milligrams per kilogram-day.
D = not classifiable as to human carcinogenicity.
NE = not evaluated.
A = human carcinogen.
% = percent.

**Table E-6
Inhalation Dose-Response Data
for Carcinogenic Effects**

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Chemical	Weight of Evidence (route-specific)	Inhalation Slope Factor (mg/kg-day) ⁻¹	Source	Inhalation Unit Risk ($\mu\text{g}/\text{m}^3$) ⁻¹	Source	Test Species	Exposure Route	Tumor Type	Study Source
<u>Inorganic Analytes</u>									
Aluminum		NE		NE					
Arsenic	A	15	IRIS	4.3e-03	IRIS	Human	Inhalation	Lung	IRIS
Iron	D	NE		NE					
<p>Notes: IRIS on-line database search, current as of April 1997. Health Effects Assessment Summary Tables (HEAST), current as of November 1995.</p> <p>mg/kg-day = milligrams per kilogram-day. $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter. NE = not evaluated. A = human carcinogen. D = not classifiable as to human carcinogenicity. IRIS = Integrated Risk Information System.</p>									

**Table E-7
Oral Dose-Response Data
for Noncarcinogenic Effects**

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Chemical	Chronic		Subchronic		Study Type	Confidence Level	Critical Effect	Test Animal	Uncertainty Factor	Study Source
	Oral RfD (mg/kg-day)	Source	Oral RfD (mg/kg-day)	Source						
Inorganic Analytes										
Aluminum	1.0e+00	(1)	ND							
Arsenic	3.0e-04	IRIS	3.0e-04	HEAST	Oral-drinking water	Medium	Hyperpigmentation, keratosis	Human	3 D	IRIS
Iron	3.0e-01	(1)	ND							
<p>Notes: IRIS on-line database search, current as of April 1997. HEAST, current as of November 1995.</p> <p>RfD = reference dose. mg/kg-day = milligrams per kilogram-day. ND = no data. IRIS = Integrated Risk Information System. HEAST = Health Effects Assessment Summary Tables. D = not classifiable as to human carcinogenicity.</p>										

Table E-8
Dermal Dose-Response Data for Noncarcinogenic Effects

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Chemical	Chronic Oral RfD (mg/kg-day)	Subchronic Oral RfD (mg/kg-day)	Oral Absorption Efficiency	Reference	Dermal Chronic RfD (mg/kg-day)	Dermal Subchronic RfD (mg/kg-day)
Inorganic Analytes						
Aluminum	1.0e+00	ND	20%	*	2.0e-01	ND
Arsenic	3.0e-04	3.0e-04	98%	Vahter, 1983	2.9e-04	2.9e-04
Iron	3.0e-01	ND	2%	Goyer, 1991	6.0e-03	ND

* Inorganics lacking specific information on absorption efficiency are assigned a default value of 20% (U.S. Environmental Protection Agency, 1995).

Notes: Integrated Risk Information System (IRIS) on-line database search, current as of April 1997.
 Health Effects Assessment Summary Tables (HEAST), current as of November 1995.
 Goyer, R.A. 1991. "Toxic Effects of Metals." In *Cassarett and Doull's Toxicology: The Basic Science of Poisons*. 4th edition. Eds. M.O. Amdur, J. Doull, and C.D. Klaassen. New York: Pergamon Press.
 Vahter, M. 1983. "Metabolism of Arsenic." In *Biological and Environmental Effect of Arsenic*. Ed. B.A. Fowler, 171-198. New York: Elsevier.

RfD = reference dose.
 mg/kg-day = milligrams per kilogram-day.
 ND = no data.
 % = percent.

Table E-9
Inhalation Dose-Response Data
for Noncarcinogenic Effects

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station, Whiting Field
 Milton, Florida

Chemical	Chronic		Subchronic		Study Type	Confidence Level	Critical Effect	Test Animal	Uncertainty Factor	Study Source
	RfC ($\mu\text{g}/\text{m}^3$)	Source	RfC ($\mu\text{g}/\text{m}^3$)	Source						
<u>Inorganic Analytes</u>										
Aluminum	ND		ND							
Arsenic	ND		ND							
Iron	ND		ND							
Notes: RfC = reference concentration. $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter. ND = no data.										

TABLE E-10

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
 ADULT RESIDENT
 NAS WHITING FIELD
 MILTON, FLORIDA
 SITE 1

EXPOSURE PARAMETERS

EQUATIONS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	100	mg/day	USEPA, 1995
FRACTION INGESTED	FI	100%	unitless	USEPA, 1995
ADHERENCE FACTOR	AF	1	mg/cm ² -event	USEPA, 1995
ABSORPTION FRACTION	ABS _s	chemical-specific	unitless	USEPA, 1995
SURFACE AREA EXPOSED	SA	5,750	cm ²	USEPA, 1992
DOSE ABSORBED PER EVENT	DA _{event}	chemical-specific	mg/cm ² -event	USEPA, 1992
CONVERSION FACTOR	CF	1.00E-09	kg/ug	Organic conversion
CONVERSION FACTOR	CF	1.00E-06	kg/mg	Inorganic conversion
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE FREQUENCY	EF	350	days/year [1]	Assumption
EXPOSURE DURATION	ED	24	years	USEPA, 1995
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	24	years	USEPA, 1995

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)⁻¹
 HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE_{INGESTION} = $\frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

INTAKE_{DERMAL} = $\frac{DA_{event} \times SA \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

Where:

DA_{event} = CS x AF x ABS_s x CF

Note: For noncarcinogenic effects, AT = ED.

[1] Units for exposure frequency are events/year in the calculation of the dermally absorbed dose.
 USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.
 USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
 USEPA, 1995. Supplemental Guidance to RAGS: Region IV, Human Health Risk Assessment Bulletin No. 3.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF (mg/kg-day) ⁻¹	CANCER RISK INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [2] (mg/kg-day) ⁻¹	CANCER RISK DERMAL	TOTAL CANCER RISK
Arsenic	I	4.2	mg/kg	2.0E-06	1.5	3.0E-06	0.001	1.1E-07	1.5	1.7E-07	3.1E-06
SUMMARY CANCER RISK						3E-06				2E-07	3E-06

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).
 [2] Calculated from oral CSFs.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL RfD (mg/kg-day)	HAZARD QUOTIENT INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL RfD [2] (mg/kg-day)	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	2.1E-02	1	0.02	0.001	1.2E-03	0.2	0.006	0.03
Arsenic	I	4.2	mg/kg	5.8E-06	0.0003	0.02	0.001	3.3E-07	0.00029	0.001	0.02
Iron	I	11800	mg/kg	1.6E-02	0.3	0.05	0.001	9.3E-04	0.006	0.2	0.2
SUMMARY HAZARD INDEX						0.09				0.2	0.3

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November, 1995).
 [2] Calculated from oral RfDs.

TABLE E-11

INHALATION OF PARTICULATES - SURFACE SOIL
 ADULT RESIDENT
 NAS WHITING FIELD
 MILTON, FLORIDA
 SITE 1

EXPOSURE PARAMETERS

EQUATIONS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	1.24E+09	m ³ /kg	default [1]
CONCENTRATION AIR	CA	chemical-specific	mg/m ³	
INHALATION RATE	IR	0.833	m ³ /hour	USEPA, 1995
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE TIME	ET	16	hours/day	Assumption
EXPOSURE FREQUENCY	EF	350	days/year	USEPA, 1995
EXPOSURE DURATION	ED	24	years	USEPA, 1995
CONVERSION FACTOR	CF	0.001	mg/ug	Organics only
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	24	years	USEPA, 1995

CANCER RISK = INTAKE (mg/kg-day) x INHALATION CANCER SLOPE FACTOR (mg/kg-day)⁻¹

HAZARD QUOTIENT = INTAKE (mg/kg-day) / INHALATION REFERENCE DOSE (mg/kg-day)

INTAKE = $\frac{CA \times IR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

Where:

CA = C x CF x (1/PEF)

Note:

For noncarcinogenic effects: AT = ED

[1] Florida Soil Clean-Up Goal Variable. FDEP, 1995.

USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.

USEPA, 1995. Supplemental Guidance to RAGS : Region IV, Human Health Risk Assessment Bulletin No. 3.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day) ⁻¹	CANCER RISK
Arsenic	I	4.2	mg/kg	3.39E-09	2.1E-10	15	3.2E-09
SUMMARY CANCER RISK							3E-09

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION RfD (mg/kg-day)	HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	1.23E-05	2.2E-06	ND	
Arsenic	I	4.2	mg/kg	3.39E-09	6.2E-10	ND	
Iron	I	11800	mg/kg	9.52E-06	1.7E-06	ND	
SUMMARY HAZARD INDEX							ND

ND = No data

TABLE E-12

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
 CHILD RESIDENT
 NAS WHITING FIELD
 MILTON, FLORIDA
 SITE 1

EXPOSURE PARAMETERS

EQUATIONS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	200	mg/day	USEPA, 1995
FRACTION INGESTED	FI	100%	unitless	USEPA, 1995
ADHERENCE FACTOR	AF	1	mg/cm ² -event	USEPA, 1995
AGE-SPECIFIC SURFACE AREA	SA	age-specific	cm ²	USEPA, 1989
ABSORPTION FRACTION	ABS	chemical-specific	unitless	USEPA, 1995
CONVERSION FACTOR	CF	1.00E-06	kg/mg	Inorganic conversion
CONVERSION FACTOR	CF	1.00E-09	kg/ug	Organic conversion
BODY WEIGHT	BW	15	kg	USEPA, 1991
AGE-SPECIFIC BODY WEIGHT	BW	age-specific	kg	USEPA, 1989
EXPOSURE FREQUENCY	EF	350	days/year [1]	USEPA, 1995
EXPOSURE DURATION	ED	6	years	USEPA, 1995
AGE-SPECIFIC EXPOSURE DURATION	ED	age-specific	years	Assumption
AGE-WEIGHTED SURFACE AREA [2]	SA _{wt-ed}	766	cm ² -year/kg	USEPA, 1992
DOSE ABSORBED PER EVENT	DA _{event}	chemical-specific	mg/cm ² -event	USEPA, 1992
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	6	years	USEPA, 1995

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)⁻¹
 HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE_{INGESTION} = $\frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

INTAKE_{DERMAL} = (DA_{event} x EF / AT x 365 days/year) x SA_{wt-ed}

Where:
 SA_{wt-ed} = SUM (SA x ED / BW)
 DA_{event} = CS x AF x ABS x CF

Note: For noncarcinogenic effects, AT = ED.

[1] Units for exposure frequency are in events/year in the calculation of the dermally absorbed dose.
 [2] In estimating the dermally absorbed dose for children age 1 through 6, the time-weighted, bodyweight normalized surface area exposed is calculated from surface area, exposure duration, and body weight for each of 6 age periods, age 1 through 6, per USEPA, 1992. USEPA, 1989. Exposure Factors Handbook: EPA/600/8-89/043; May 1989.
 USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.
 USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
 USEPA, 1995. Supplemental Guidance to RAGS: Region IV, Human Health Risk Assessment Bulletin No. 3.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF (mg/kg-day) ⁻¹	CANCER RISK INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [2] (mg/kg-day) ⁻¹	CANCER RISK DERMAL	TOTAL CANCER RISK
Arsenic	I	4.2	mg/kg	4.6E-06	1.5	6.9E-06	0.001	4.4E-08	1.5	6.6E-08	7.0E-06
SUMMARY CANCER RISK						7E-06				7E-08	7E-06

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).
 [2] Calculated from oral CSFs.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL RD (mg/kg-day)	HAZARD QUOTIENT INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL RD [2] (mg/kg-day)	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	1.9E-01	1	0.2	0.001	1.9E-03	0.2	0.01	0.2
Arsenic	I	4.2	mg/kg	5.4E-05	0.0003	0.2	0.001	5.1E-07	0.00029	0.002	0.2
Iron	I	11800	mg/kg	1.5E-01	0.3	0.5	0.001	1.4E-03	0.006	0.2	0.7
SUMMARY HAZARD INDEX						0.9				0.3	1

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).
 [2] Calculated from oral RfDs.

TABLE E-13

INHALATION OF PARTICULATES - SURFACE SOIL
 CHILD RESIDENT
 NAS WHITING FIELD
 MILTON, FLORIDA
 SITE 1

EXPOSURE PARAMETERS

EQUATIONS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	1.24E+09	m ³ /kg	default [1]
CONCENTRATION IN AIR	CA	chemical-specific	mg/m ³	
INHALATION RATE	IR	0.625	m ³ /hour	USEPA, 1995
BODY WEIGHT	BW	15	kg	USEPA, 1991
EXPOSURE TIME	ET	24	hours/day	Assumption
EXPOSURE FREQUENCY	EF	350	days/year	USEPA, 1991
EXPOSURE DURATION	ED	6	years	USEPA, 1991
CONVERSION FACTOR	CF	0.001	mg/ug	Organics only
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	6	years	USEPA, 1991

CANCER RISK = INTAKE (mg/kg-day) x INHALATION CANCER SLOPE FACTOR (mg/kg-day)⁻¹

HAZARD QUOTIENT = INTAKE (mg/kg-day) / INHALATION REFERENCE DOSE (mg/kg-day)

INTAKE = $\frac{CA \times IR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

Where:

CA = C x CF x (1/PEF)

Note:

For noncarcinogenic effects: AT = ED

[1] Florida Soil Clean-Up Goal Variable. FDEP, 1995.
 USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.
 USEPA, 1995. Supplemental Guidance to RAGS: Region 4 Bulletins, Bulletin No. 3, November 1995.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day) ⁻¹	CANCER RISK
Arsenic	I	4.2	mg/kg	3.39E-09	2.8E-10	15	4.2E-09
SUMMARY CANCER RISK							4E-09

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION RfD (mg/kg-day)	HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	1.23E-05	1.2E-05	ND	
Arsenic	I	4.2	mg/kg	3.39E-09	3.2E-09	ND	
Iron	I	11900	mg/kg	9.52E-06	9.1E-06	ND	
SUMMARY HAZARD INDEX							ND

ND = No data

TABLE E-14

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
 ADULT TRESPASSER
 NAS WHITING FIELD
 MILTON, FLORIDA
 SITE 1

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE	
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific		
INGESTION RATE	IR	100	mg/day	USEPA, 1991	
FRACTION INGESTED	FI	100%	unitless	USEPA, 1995	
ADHERENCE FACTOR	AF	1	mg/cm ² -event	USEPA, 1995	
ABSORPTION FRACTION	ABS _s	chemical specific	unitless	USEPA, 1995	
SURFACE AREA EXPOSED	SA	5,750	cm ²	USEPA, 1992	
DOSE ABSORBED PER EVENT	D _{Aevent}	chemical specific	mg/cm ² -event	USEPA, 1992	
CONVERSION FACTOR	CF	1.00E-06	kg/mg	inorganics	
	CF	1.00E-09	kg/ug	organics	
BODY WEIGHT	BW	70	kg	USEPA, 1991	
EXPOSURE FREQUENCY	EF	45	days/year [1]	Assumption	
EXPOSURE DURATION	ED	20	years	Assumption	
AVERAGING TIME	CANCER	AT	70	years	USEPA, 1991
	NONCANCER	AT	20	years	Assumption

[1] Units for exposure frequency are events/year in the calculation of the dermally absorbed dose.
 USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.
 USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; 1/92.
 USEPA, 1995. Supplemental Guidance to RAGS: Region IV, Human Health Risk Assessment Bulletin No. 3.

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)⁻¹

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE_{INGESTION} = $\frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

INTAKE_{DERMAL} = $\frac{D_{Aevent} \times SA \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

Where:

D_{Aevent} = CS x AF x ABS_s x CF

Note: For noncarcinogenic effects: AT = ED

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF (mg/kg-day) ⁻¹	CANCER RISK INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [2] (mg/kg-day) ⁻¹	CANCER RISK DERMAL	TOTAL CANCER RISK
Arsenic	I	4.2	mg/kg	2.1E-07	1.5	3.2E-07	0.001	1.2E-08	1.5	1.8E-08	3.4E-07
SUMMARY CANCER RISK						3E-07				2E-08	3E-07

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).

[2] Calculated from oral CSFs.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL RD (mg/kg-day)	HAZARD QUOTIENT INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL RD [2] (mg/kg-day)	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	2.7E-03	1	0.003	0.001	1.5E-04	0.2	0.0008	0.003
Arsenic	I	4.2	mg/kg	7.4E-07	0.0003	0.002	0.001	4.3E-08	0.00029	0.0001	0.003
Iron	I	11800	mg/kg	2.1E-03	0.3	0.01	0.001	1.2E-04	0.006	0.020	0.03
SUMMARY HAZARD INDEX						0.01				0.02	0.03

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).

[2] Calculated from oral RDs.

TABLE E-15

INHALATION OF PARTICULATES - SURFACE SOIL
ADULT TRESPASSER
NAS WHITING FIELD
MILTON, FLORIDA
SITE 1

EXPOSURE PARAMETERS

EQUATIONS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	1.24E+09	m ³ /kg	default [1]
CONCENTRATION AIR	CA	chemical-specific	mg/m ³	
INHALATION RATE	IR	0.833	m ³ /hour	USEPA, 1995
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE TIME	ET	4	hours/day	Assumption
EXPOSURE FREQUENCY	EF	45	days/year	Assumption
EXPOSURE DURATION	ED	20	years	Assumption
CONVERSION FACTOR	CF	0.001	mg/ug	Organics only
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	20	years	USEPA, 1991

CANCER RISK = INTAKE (mg/kg-day) x INHALATION CANCER SLOPE FACTOR (mg/kg-day)⁻¹

HAZARD QUOTIENT = INTAKE (mg/kg-day) / INHALATION REFERENCE DOSE (mg/kg-day)

INTAKE = CA x IR x ET x EF x ED
BW x AT x 365 days/yr

Where:

CA = C x CF x (1/PEF)

Note: For noncarcinogenic effects, AT = ED

[1] Florida Soil Clean-Up Goal Variable. FDEP, 1995.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.
USEPA, 1995. Supplemental Guidance to RAGS : Region IV, Human Health Risk Assessment Bulletin No. 3.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day) ⁻¹	CANCER RISK
Arsenic	I	4.2	mg/kg	3.39E-09	5.7E-12	15	8.5E-11
SUMMARY CANCER RISK							9E-11

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION RID (mg/kg-day)	HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	1.23E-05	7.2E-08	ND	
Arsenic	I	4.2	mg/kg	3.39E-09	2.0E-11	ND	
Iron	I	11800	mg/kg	9.52E-06	5.6E-08	ND	
SUMMARY HAZARD INDEX							0E+00

ND = No data

TABLE E-16

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
 ADOLESCENT TRESPASSER
 NAS WHITING FIELD
 MILTON, FLORIDA
 SITE 1

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	100	mg/day	USEPA, 1991
FRACTION INGESTED	FI	100%	unitless	Assumption
ADHERENCE FACTOR	AF	1	mg/cm ² -event	USEPA, 1995
AGE-SPECIFIC SURFACE AREA	SA _i	age-specific	cm ²	USEPA, 1989
ABSORPTION FRACTION	ABS _i	chemical-specific	unitless	USEPA, 1995
CONVERSION FACTOR	CF	1.00E-06	kg/mg	Inorganics
	CF	1.00E-09	kg/mg	Organics
BODY WEIGHT	BW	45	kg	USEPA, 1995
AGE-SPECIFIC BODY WEIGHT	BW _i	age-specific	kg	USEPA, 1989
EXPOSURE FREQUENCY	EF	45	days/year [1]	Assumption
EXPOSURE DURATION	ED	10	years	USEPA, 1995
AGE-SPECIFIC EXPOSURE DURATION	ED _i	age-specific	years	Assumption
AGE-WEIGHTED SURFACE AREA [2]	SA _{adj}	1013	cm ² -year/kg	Per USEPA, 1992
DOSE ABSORBED PER EVENT	DA _{event}	chemical-specific	mg/cm ² -event	Per USEPA, 1992
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	10	years	USEPA, 1995

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)⁻¹
 HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE_{INGESTION} = $\frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

INTAKE_{DERMAL} = AT x 365 days/year x SA_{adj}

Where:

SA_{adj} = SUM (SA_i x ED_i / BW)

DA_{event} = CS x AF x ABS_i x CF

Note: For noncarcinogenic effects: AT = ED.

[1] Units for exposure frequency are in events/year in the calculation of the dermally absorbed dose.
 [2] In estimating the dermally absorbed dose for children age 7 through 16, the time-weighted, bodyweight normalized surface area exposed is calculated from surface area, exposure duration, and body weight for each of 10 age periods, age 7 through 16, per USEPA, 1992.
 USEPA, 1989. Exposure Factors Handbook; EPA/600/8-89/043; May 1989.
 USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.
 USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
 USEPA, 1995. Supplemental Guidance to RAGS: Region 4 Bulletin, Bulletin No. 3, November 1995.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF (mg/kg-day) ⁻¹	CANCER RISK INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [2] (mg/kg-day) ⁻¹	CANCER RISK DERMAL	TOTAL CANCER RISK
Arsenic	I	4.2	mg/kg	1.6E-07	1.5	2.5E-07	0.001	7.5E-09	1.5	1.1E-08	2.6E-07
SUMMARY CANCER RISK						2E-07				1E-08	3E-07

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).
 [2] Calculated from oral CSFs.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL RfD (mg/kg-day)	HAZARD QUOTIENT INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL RfD [2] (mg/kg-day)	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	4.2E-03	1	0.004	0.001	1.9E-04	0.2	0.0009	0.005
Arsenic	I	4.2	mg/kg	1.2E-06	0.0003	0.004	0.001	5.2E-08	0.00029	0.0002	0.004
Iron	I	11800	mg/kg	3.2E-03	0.3	0.01	0.001	1.5E-04	0.006	0.02	0.04
SUMMARY HAZARD INDEX						0.02				0.03	0.04

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).
 [2] Calculated from oral RfDs.

TABLE E-17

INHALATION OF PARTICULATES - SURFACE SOIL
 ADOLESCENT TRESPASSER
 NAS WHITING FIELD
 MILTON, FLORIDA
 SITE 1

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE	
SOIL CONCENTRATION	C	chemical-specific	chemical-specific		$\text{CANCER RISK} = \text{INTAKE (mg/kg-day)} \times \text{INHALATION CANCER SLOPE FACTOR (mg/kg-day)}^{-1}$ $\text{HAZARD QUOTIENT} = \text{INTAKE (mg/kg-day)} / \text{INHALATION REFERENCE DOSE (mg/kg-day)}$ $\text{INTAKE} = \frac{\text{CA} \times \text{IR} \times \text{ET} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT} \times 365 \text{ days/yr}}$ <p>Where:</p> $\text{CA} = \text{C} \times \text{CF} \times (1/\text{PEF})$ <p>Note: For noncarcinogenic effects: AT = ED</p>
PART. EMISSION FACTOR	PEF	1.24E+09	m ³ /kg	default [1]	
CONCENTRATION AIR	CA	chemical-specific	mg/m ³		
INHALATION RATE	IR	0.625	m ³ /hour	USEPA, 1995	
BODY WEIGHT	BW	45	kg	USEPA, 1995	
EXPOSURE TIME	ET	4	hours/day	Assumption	
EXPOSURE FREQUENCY	EF	45	days/year	Assumption	
EXPOSURE DURATION	ED	10	years	USEPA, 1995	
CONVERSION FACTOR	CF	0.001	mg/ug	Organics only	
AVERAGING TIME					
CANCER	AT	70	years	USEPA, 1991	
NONCANCER	AT	10	years	USEPA, 1995	
<p>[1] Florida Soil Clean-Up Goal Variable. FDEP, 1995. USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03. USEPA 1995. Supplemental Guidance to RAGS, Region 4 Bulletins, Bulletin No. 3, November 1995.</p>					

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day) ⁻¹	CANCER RISK
Arsenic	I	4.2	mg/kg	3.39E-09	3.3E-12	15	5.0E-11
SUMMARY CANCER RISK							5E-11

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION RfD (mg/kg-day)	HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	1.23E-05	8.4E-08	ND	
Arsenic	I	4.2	mg/kg	3.39E-09	2.3E-11	ND	
Iron	I	11800	mg/kg	9.52E-06	6.5E-08	ND	
SUMMARY HAZARD INDEX							ND

ND = No data

TABLE E-18

**DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
OCCUPATIONAL WORKER
NAS WHITING FIELD
MILTON, FLORIDA
SITE 1**

EXPOSURE PARAMETERS

EQUATIONS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	50	mg/day	USEPA, 1995
FRACTION INGESTED	FI	100%	unitless	Assumption
ADHERENCE FACTOR	AF	1	mg/cm ² -event	USEPA, 1992
ABSORPTION FRACTION	ABS	chemical-specific	unitless	Assumption
SURFACE AREA EXPOSED	SA	2,300	cm ²	USEPA, 1992
DOSE ABSORBED PER EVENT	DA _{event}	chemical-specific	mg/cm ² -event	USEPA, 1995
CONVERSION FACTOR	CF	1.00E-09	kg/ug	Organic conversion
CONVERSION FACTOR	CF	1.00E-06	kg/mg	Inorganic conversion
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE FREQUENCY	EF	250	days/year [1]	USEPA, 1995
EXPOSURE DURATION	ED	25	years	USEPA, 1995
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	25	years	USEPA, 1995

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)⁻¹
HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE_{INGESTION} = CS x IR x FI x CF x EF x ED
BW x AT x 365 days/yr

INTAKE_{DERMAL} = DA_{event} x SA x AF x EF x ED
BW x AT x 365 days/yr

Where:

DA_{event} = CS x AF x ABS x CF

Note: For noncarcinogenic effects, AT = ED

[1] Units for exposure frequency are events/year in the calculation of the dermally absorbed dose.
 USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors", OSWER Directive 9285.6-03.
 USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; 1/92.
 USEPA, 1995. Supplemental Guidance to RAGS: Region IV, Human Health Risk Assessment Bulletin No. 3.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF (mg/kg-day) ⁻¹	CANCER RISK INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [2] (mg/kg-day) ⁻¹	CANCER RISK DERMAL	TOTAL CANCER RISK
Arsenic	I	4.2	mg/kg	7.3E-07	1.5	1.1E-06	0.001	3.4E-08	1.5	5.1E-08	1.2E-06
SUMMARY CANCER RISK						1E-06				5E-08	1E-06

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).
 [2] Calculated from oral CSFs.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL RfD (mg/kg-day)	HAZARD QUOTIENT INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL RfD [2] (mg/kg-day)	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	7.4E-03	1	0.007	0.001	3.4E-04	0.2	0.002	0.009
Arsenic	I	4.2	mg/kg	2.1E-06	0.0003	0.01	0.001	9.5E-08	0.00029	0.0003	0.01
Iron	I	11800	mg/kg	5.8E-03	0.3	0.02	0.001	2.7E-04	0.006	0.04	0.06
SUMMARY HAZARD INDEX						0.03				0.05	0.08

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).
 [2] Calculated from oral RfDs.

TABLE E-19

INHALATION OF PARTICULATES - SURFACE SOIL
 OCCUPATIONAL WORKER
 NAS WHITING FIELD
 MILTON, FLORIDA
 SITE 1

EXPOSURE PARAMETERS

EQUATIONS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	1.24E+09	m ³ /kg	default [1]
CONCENTRATION AIR	CA	chemical-specific	mg/m ³	
INHALATION RATE	IR	0.833	m ³ /hour	USEPA, 1995 [2]
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE TIME	ET	8	hours/day	Assumption
EXPOSURE FREQUENCY	EF	250	days/year	Assumption
EXPOSURE DURATION	ED	25	years	USEPA, 1995
CONVERSION FACTOR	CF	0.001	mg/ug	Organics only
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	25	years	USEPA, 1995

[1] Florida Soil Clean-Up Goal Variable. FDEP, 1995.

[2] Inhalation rate differs from the GIR report. GIR report presented the site maintenance worker rate in the occupational worker spreadsheet. This rate assumes little outdoor activity.

USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance:
 "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.

USEPA, 1995. Supplemental Guidance to RAGS: Region 4 Bulletins, Bulletin No. 3, November 1995.

CANCER RISK = INTAKE (mg/kg-day) x INHALATION CANCER SLOPE FACTOR (mg/kg-day)⁻¹

HAZARD QUOTIENT = INTAKE (mg/kg-day) / INHALATION REFERENCE DOSE (mg/kg-day)

INTAKE = $\frac{CA \times IR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

Where:

CA = C x CF x (1/PEF)

Note: For noncarcinogenic effects, AT = ED.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day) ⁻¹	CANCER RISK
Arsenic	I	4.2	mg/kg	3.39E-09	7.9E-11	15	1.2E-09
SUMMARY CANCER RISK							1E-09

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION RfD (mg/kg-day)	HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	1.23E-05	8.0E-07	ND	
Arsenic	I	4.2	mg/kg	3.39E-09	2.2E-10	ND	
Iron	I	11800	mg/kg	9.52E-06	6.2E-07	ND	
SUMMARY HAZARD INDEX							ND

ND = No data

TABLE E-20

**DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
SITE MAINTENANCE WORKER
NAS WHITING FIELD
MILTON, FLORIDA
SITE 1**

EXPOSURE PARAMETERS

EQUATIONS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	50	mg/day	USEPA, 1995
FRACTION INGESTED	FI	100%	unitless	Assumption
ADHERENCE FACTOR	AF	1	mg/cm ² -event	USEPA, 1995
ABSORPTION FRACTION	ABS	chemical-specific	unitless	Assumption
SURFACE AREA EXPOSED	SA	5,750	cm ²	USEPA, 1992
DOSE ABSORBED PER EVENT	DA _{event}	chemical-specific	mg/cm ² -event	USEPA, 1992
CONVERSION FACTOR	CF	1.00E-09	kg/ug	Organic conversion
CONVERSION FACTOR	CF	1.00E-06	kg/mg	Inorganic conversion
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE FREQUENCY	EF	30	days/year [1]	Assumption
EXPOSURE DURATION	ED	25	years	USEPA, 1995
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	25	years	USEPA, 1995

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)⁻¹

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

**INTAKE_{INGESTION} = CS x IR x FI x CF x EF x ED
BW x AT x 365 days/yr**

**INTAKE_{DERMAL} = DA_{event} x SA x EF x ED
BW x AT x 365 days/yr**

Where:

DA_{event} = CS x AF x ABS x CF

Note: For noncarcinogenic effects, AT = ED

[1] Units for exposure frequency are events/year in the calculation of the dermally absorbed dose.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.
USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; 1/92.
USEPA, 1995. Supplemental Guidance to RAGS: Region IV, Human Health Risk Assessment Bulletin No. 3.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF (mg/kg-day) ⁻¹	CANCER RISK INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [2] (mg/kg-day) ⁻¹	CANCER RISK DERMAL	TOTAL CANCER RISK
Arsenic	I	4.2	mg/kg	8.8E-08	1.5	1.3E-07	0.001	1.0E-08	1.5	1.5E-08	1.5E-07
SUMMARY CANCER RISK						1E-07				2E-08	1E-07

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).
[2] Calculated from oral CSFs.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL RD (mg/kg-day)	HAZARD QUOTIENT INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL RD [2] (mg/kg-day)	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	8.9E-04	1	0.001	0.001	1.0E-04	0.2	0.0005	0.001
Arsenic	I	4.2	mg/kg	2.5E-07	0.0003	0.001	0.001	2.8E-08	0.00029	0.0001	0.0009
Iron	I	11800	mg/kg	6.9E-04	0.3	0.002	0.001	8.0E-05	0.006	0.013	0.016
SUMMARY HAZARD INDEX						0.004				0.01	0.02

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).
[2] Calculated from oral RDs.

TABLE E-21

INHALATION OF PARTICULATES - SURFACE SOIL
 SITE MAINTENANCE WORKER
 NAS WHITING FIELD
 MILTON, FLORIDA
 SITE 1

EXPOSURE PARAMETERS

EQUATIONS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	1.24E+09	m ³ /kg	default [1]
CONCENTRATION AIR	CA	chemical-specific	mg/m ³	
INHALATION RATE	IR	2.5	m ³ /hour	USEPA, 1995 [2]
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE TIME	ET	8	hours/day	Assumption
EXPOSURE FREQUENCY	EF	30	days/year	Assumption
EXPOSURE DURATION	ED	25	years	USEPA, 1995
CONVERSION FACTOR	CF	0.001	mg/ug	Organics only
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	25	years	USEPA, 1995

CANCER RISK = INTAKE (mg/kg-day) x INHALATION CANCER SLOPE FACTOR (mg/kg-day)⁻¹

HAZARD QUOTIENT = INTAKE (mg/kg-day) / INHALATION REFERENCE DOSE (mg/kg-day)

INTAKE = $\frac{CA \times IR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

Where:

CA = C x CF x (1/PEF)

Note: For noncarcinogenic effects, AT = ED

[1] Florida Soil Clean-Up Goal Variable. FDEP, 1995.
 [2] Inhalation rate differs from the GIR report. GIR report presented the occupational worker rate in the site maintenance worker spreadsheet. This site maintenance worker inhalation rate assumes strenuous outdoor activity. USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.
 USEPA, 1995. Supplemental Guidance to RAGS: Region 4 Bulletins, Bulletin No. 3, November 1995.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day) ⁻¹	CANCER RISK
Arsenic	I	4.2	mg/kg	3.39E-09	2.8E-11	15	4.3E-10
SUMMARY CANCER RISK							4E-10

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION RD (mg/kg-day)	HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	1.23E-05	2.9E-07	ND	
Arsenic	I	4.2	mg/kg	3.39E-09	8.0E-11	ND	
Iron	I	11800	mg/kg	9.52E-06	2.2E-07	ND	
SUMMARY HAZARD INDEX							ND

ND = No data

TABLE E-22

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
EXCAVATION WORKER
NAS WHITING FIELD
MILTON, FLORIDA
SITE 1

EXPOSURE PARAMETERS

EQUATIONS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	480	mg/day	USEPA, 1995
FRACTION INGESTED	FI	100%	unitless	Assumption
ADHERENCE FACTOR	AF	1	mg/cm ² -event	USEPA, 1995
ABSORPTION FRACTION	ABS	chemical-specific	unitless	USEPA, 1995
SURFACE AREA EXPOSED	SA	5,750	cm ²	USEPA, 1992
DOSE ABSORBED PER EVENT	DA _{event}	chemical-specific	mg/cm ² -event	USEPA, 1992
CONVERSION FACTOR	CF	1.00E-09	kg/ug	Organic conversion
CONVERSION FACTOR	CF	1.00E-06	kg/mg	Inorganic conversion
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE FREQUENCY	EF	30	days/year [1]	Assumption
EXPOSURE DURATION	ED	1	years	USEPA, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	1	years	USEPA, 1991

$$\text{CANCER RISK} = \text{INTAKE (mg/kg-day)} \times \text{CANCER SLOPE FACTOR (mg/kg-day)}^{-1}$$

$$\text{HAZARD QUOTIENT} = \text{INTAKE (mg/kg-day)} / \text{REFERENCE DOSE (mg/kg-day)}$$

$$\text{INTAKE}_{\text{INGESTION}} = \frac{\text{CS} \times \text{IR} \times \text{FI} \times \text{CF} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT} \times 365 \text{ days/yr}}$$

$$\text{INTAKE}_{\text{DERMAL}} = \frac{\text{DA}_{\text{event}} \times \text{SA} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT} \times 365 \text{ days/yr}}$$

Where:

$$\text{DA}_{\text{event}} = \text{CS} \times \text{AF} \times \text{ABS} \times \text{CF}$$

Note: For noncarcinogenic effects, AT = ED

[1] Units for exposure frequency are events/year in the calculation of the dermally absorbed dose.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.
USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; 1/92.
USEPA, 1995. Supplemental Guidance to RAGS: Region IV, Human Health Risk Assessment Bulletin No. 3.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF (mg/kg-day) ⁻¹	CANCER RISK INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [2] (mg/kg-day) ⁻¹	CANCER RISK DERMAL	TOTAL CANCER RISK
Arsenic	I	4.2	mg/kg	3.4E-08	1.5	5.1E-08	0.001	4.1E-10	1.5	6.1E-10	5.1E-08
SUMMARY CANCER RISK						5E-08				6E-10	5E-08

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).

[2] Calculated from oral CSFs.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL RfD [1] (mg/kg-day)	HAZARD QUOTIENT INGESTION	DERMAL ABS [2]	INTAKE DERMAL (mg/kg-day)	DERMAL RfD [3] (mg/kg-day)	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	8.6E-03	1	0.009	0.001	1.0E-04	0.2	0.0005	0.009
Arsenic	I	4.2	mg/kg	2.4E-06	0.0003	0.008	0.001	2.8E-08	0.00029	0.0001	0.008
Iron	I	11800	mg/kg	6.7E-03	0.3	0.02	0.001	8.0E-05	0.006	0.01	0.04
SUMMARY HAZARD INDEX						0.04				0.01	0.05

[1] Subchronic RfD values were used for the excavation worker due to short exposure scenario.

[2] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (USEPA, 1995).

[3] Calculated from oral RfDs.

TABLE E-23

INHALATION OF PARTICULATES - SURFACE SOIL
EXCAVATION WORKER
NAS WHITING FIELD
MILTON, FLORIDA
SITE 1

EXPOSURE PARAMETERS

EQUATIONS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	1.24E+09	m ³ /kg	default [1]
CONCENTRATION AIR	CA	chemical-specific	mg/m ³	
INHALATION RATE	IR	2.5	m ³ /hour	USEPA, 1995
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE TIME	ET	8	hours/day	Assumption
EXPOSURE FREQUENCY	EF	30	days/year	Assumption
EXPOSURE DURATION	ED	1	years	Assumption
CONVERSION FACTOR	CF	0.001	mg/ug	Organics only
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	1	years	USEPA, 1991

CANCER RISK = INTAKE (mg/kg-day) x INHALATION CANCER SLOPE FACTOR (mg/kg-day)⁻¹

HAZARD QUOTIENT = INTAKE (mg/kg-day) / INHALATION REFERENCE DOSE (mg/kg-day)

INTAKE = $\frac{CA \times IR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

Where:

CA = C x CF x (1/PEF)

Note: For noncarcinogens, AT = ED.

[1] Florida Soil Clean-Up Goal Variable. FDEP, 1995.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance:
Standard Default Exposure Factors, OSWER Directive 9285.6-03.
USEPA, 1995. Supplemental Guidance to RAGS: Region IV, Human Health Risk Assessment Bulletin No. 3.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day) ⁻¹	CANCER RISK
Arsenic	I	4.2	mg/kg	3.39E-09	1.1E-12	15	1.7E-11
SUMMARY CANCER RISK							2E-11

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m ³)	INTAKE (mg/kg-day)	INHALATION RfD (mg/kg-day)	HAZARD QUOTIENT
Aluminum	I	15200	mg/kg	1.23E-05	2.9E-07	ND	
Arsenic	I	4.2	mg/kg	3.39E-09	8.0E-11	ND	
Iron	I	11800	mg/kg	9.52E-06	2.2E-07	ND	
SUMMARY HAZARD INDEX							ND

ND = No data

TABLE E-24

**INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES)
ADULT RESIDENT
NAS WHITING FIELD
MILTON, FLORIDA
SITE 1**

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION WATER	CW	chemical-specific	ug/liter	
INGESTION RATE	IR	2	liters/day	USEPA, 1995
BODY WEIGHT	BW	70	kg	USEPA, 1991
CONVERSION FACTOR	CF	0.001	mg/ug	
EXPOSURE FREQUENCY	EF	350	days/year	USEPA, 1995
EXPOSURE DURATION	ED	24	years	USEPA, 1995
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	24	years	USEPA, 1991

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)⁻¹
HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = $\frac{CW \times IR \times EF \times ED \times CF}{BW \times AT \times 365 \text{ days/year}}$

Note: For noncarcinogenic effects, AT = ED.

USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance:
 "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.
 USEPA, 1995. Region IV Supplemental Guidance to RAGS, Bulletin No. 3, November.

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day) ⁻¹	CANCER RISK INGESTION
No carcinogenic CPCs					
TOTAL CANCER RISK					0E+00
ND = No Data.					

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION
Aluminum	209	UG/LITER	5.7E-03	1	0.01
Iron	626	UG/LITER	1.7E-02	0.3	0.06
TOTAL HAZARD INDEX					0.07
ND = no data available.					

TABLE E-25

INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES)
 CHILD RESIDENT
 NAS WHITING FIELD
 MILTON, FLORIDA
 SITE 1

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION WATER	CW	chemical-specific	ug/liter	
INGESTION RATE	IR	1	liters/day	USEPA, 1995
BODY WEIGHT	BW	15	kg	USEPA, 1991
CONVERSION FACTOR	CF	0.001	mg/ug	
EXPOSURE FREQUENCY	EF	350	days/year	USEPA, 1995
EXPOSURE DURATION	ED	6	years	USEPA, 1995
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	6	years	USEPA, 1991

USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance:
 Standard Default Exposure Factors; OSWER Directive 9285.6-03.
 USEPA, 1995. Region IV Supplemental Guidance to RAGS, Bulletin No. 3, November.

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)⁻¹
 HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = $\frac{CW \times IR \times EF \times ED \times CF}{BW \times AT \times 365 \text{ days/year}}$

Note: For noncarcinogenic effects, AT = ED.

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day) ⁻¹	CANCER RISK INGESTION
No carcinogenic CPCs					
TOTAL CANCER RISK					0E+00

ND = No Data.

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION
Aluminum	209	UG/LITER	1.3E-02	1	0.01
Iron	626	UG/LITER	4.0E-02	0.3	0.1
TOTAL HAZARD INDEX					0.1

ND = no data available.

TABLE E-26

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL - CENTRAL TENDENCY EXPOSURE
 ADULT RESIDENT
 NAS WHITING FIELD
 MILTON, FLORIDA
 SITE 1

EXPOSURE PARAMETERS

EQUATIONS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	50	mg/day	USEPA, 1989
FRACTION INGESTED	FI	100%	unitless	USEPA, 1995
ADHERENCE FACTOR	AF	1	mg/cm ² -event	USEPA, 1995
ABSORPTION FRACTION	ABS _d	chemical-specific	unitless	USEPA, 1995
SURFACE AREA EXPOSED	SA	5,000	cm ²	GIR - Table C-5-5; USEPA, 1989
DOSE ABSORBED PER EVENT	DA _{event}	chemical-specific	mg/cm ² -event	USEPA, 1992
CONVERSION FACTOR	CF	1.00E-09	kg/ug	Organic conversion
CONVERSION FACTOR	CF	1.00E-06	kg/mg	Inorganic conversion
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE FREQUENCY	EF	300	days/year	Assumption [1]
EXPOSURE DURATION	ED	7	years	USEPA, 1989
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	7	years	USEPA, 1989

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)⁻¹
 HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE_{INGESTION} = $\frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

INTAKE_{DERMAL} = $\frac{DA_{event} \times SA \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

Where:

DA_{event} = CS x AF x ABS_d x CF

Note: For noncarcinogenic effects, AT = ED.

[1] Air Force meteorological data summary for Eglin AFB (close proximity to Milton) states that there is 0.01 inches of rain for 110 days per year. Exposure frequency assumes half of the rainy days require indoor restriction.
 USEPA, 1989. Exposure Factors Handbook; EPA/600/8-89/043; May 1989.
 USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.
 USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
 USEPA, 1995. Supplemental Guidance to RAGS : Region IV, Human Health Risk Assessment Bulletin No. 3.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF (mg/kg-day) ⁻¹	CANCER RISK INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [2] (mg/kg-day) ⁻¹	CANCER RISK DERMAL	TOTAL CANCER RISK
Arsenic [3]	I	2.9	mg/kg	1.7E-07	1.5	2.6E-07	0.001	1.7E-08	1.5	2.6E-08	2.8E-07
SUMMARY CANCER RISK						3E-07				3E-08	3E-07

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).
 [2] Calculated from oral CSFs.
 [3] Soil concentration equals the mean of all samples.

TABLE E-27

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL - CENTRAL TENDENCY EXPOSURE
 CHILD RESIDENT
 NAS WHITING FIELD
 MILTON, FLORIDA
 SITE 1

EXPOSURE PARAMETERS

EQUATIONS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	100	mg/day	USEPA, 1989
FRACTION INGESTED	FI	100%	unitless	USEPA, 1995
ADHERENCE FACTOR	AF	1	mg/cm ² -event	USEPA, 1995
AGE-SPECIFIC SURFACE AREA	SA	age-specific	cm ²	USEPA, 1989
ABSORPTION FRACTION	ABS	chemical-specific	unitless	USEPA, 1995
CONVERSION FACTOR	CF	1.00E-06	kg/mg	Inorganic conversion
CONVERSION FACTOR	CF	1.00E-09	kg/ug	Organic conversion
BODY WEIGHT	BW	15	kg	USEPA, 1991
AGE-SPECIFIC BODY WEIGHT	BW	age-specific	kg	USEPA, 1989
EXPOSURE FREQUENCY	EF	350	days/year	Assumption [1]
EXPOSURE DURATION	ED	2	years	USEPA, 1989
AGE-SPECIFIC EXPOSURE DURATION	ED	age-specific	years	Assumption
AGE-WEIGHTED SURFACE AREA [2]	SA _{wt/eq}	663	cm ² -year/kg	GIR - Table C-5-5; USEPA, 1989
DOSE ABSORBED PER EVENT	DA _{event}	chemical-specific	mg/cm ² -event	USEPA, 1992
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	2	years	USEPA, 1989

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)⁻¹

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE_{INGESTION} = $\frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

INTAKE_{DERMAL} = (DA_{event} x EF / AT x 365 days/year) x SA_{wt/eq}

Where:

SA_{wt/eq} = SUM (SA x ED / BW)

DA_{event} = CS x AF x ABS x CF

Note: For noncarcinogenic effects, AT = ED.

- [1] Air Force meteorological data summary for Eglin AFB (close proximity to Milton) states that there is 0.01 inches of rain for 110 days per year. Exposure frequency assumes half of the rainy days require indoor restriction.
 [2] In estimating the dermally absorbed dose for children age 1 through 6, the time-weighted, bodyweight normalized surface area exposed is calculated from surface area, exposure duration, and body weight for each of 6 age periods, age 1 through 6, per USEPA, 1992. USEPA, 1989. Exposure Factors Handbook; EPA/600/8-89/043; May 1989.
 USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.
 USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
 USEPA, 1995. Supplemental Guidance to RAGS : Region IV, Human Health Risk Assessment Bulletin No. 3.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF (mg/kg-day) ⁻¹	CANCER RISK INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [2] (mg/kg-day) ⁻¹	CANCER RISK DERMAL	TOTAL CANCER RISK
Arsenic [3]	I	2.9	mg/kg	5.3E-07	1.5	7.9E-07	0.001	2.6E-08	1.5	4.0E-08	8.3E-07
SUMMARY CANCER RISK						8E-07				4E-08	8E-07

- [1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (November 1995).
 [2] Calculated from oral CSFs.
 [3] Soil concentration equals the mean of all samples.

APPENDIX F
ECOLOGICAL RISK DATA

Table F-1
Summary of Bioaccumulation and Bioconcentration Data

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Analyte	Log K_{ow} [b]	Bioaccumulation Factor [a]			
		Invertebrate [c]	Plant [d]	Mammal [e]	Bird
<u>Volatile Organic Compounds</u>					
Xylenes (total)	3.2	NA	NA	NA	NA
<u>Pesticides and PCBs</u>					
Dieldrin	4.6	5.5E+00 [f]	1.7E-02	1.5E+00 [g]	4.4E-01 [h]
<u>Inorganic Analytes</u>					
Arsenic	NA	NA	3.0E-01 [i]	1.0E-01 [j]	NA
Cadmium	NA	2.4	3.3E+01 [k]	2.1E+00 [j]	3.8E-01 [l]
Chromium	NA	1.6E-01 [m]	1.5E-03 [n]	2.8E-01 [j]	NA
Cyanide	NA	0.0E+00 [o]	1.0E+00 [p]	0.0E+00 [o]	NA
Lead	NA	7.8E-02 [q]	NA [k]	1.5E-02 [j]	NA
Mercury	NA	6.80E-02 [r]	1.8E-01 [n]	1.0E-02 [s]	2.3 [s]
Vanadium	NA	NA	1.1E-03 [n]	0.12 [j]	NA
<p>[a] Units for bioaccumulation factors (BAFs) are milligrams per kilogram (mg/kg) fresh weight tissue over mg/kg dry weight soil for invertebrates and plants, and mg/kg fresh weight tissue over mg/kg fresh weight food for small mammals and small birds. No BAFs were calculated for volatile organic compounds (VOCs) because available evidence suggests that these analytes do not bioaccumulate.</p> <p>[b] From Superfund Chemical Data Matrix (U.S. Environmental Protection Agency [USEPA], 1993a) unless otherwise noted.</p> <p>[c] Average of earthworm BAFs (Beyer, 1990) converted from dry weight to wet weight assuming earthworm is 80% water, unless otherwise noted.</p> <p>[d] Plant BAF calculated using the following equation presented by Travis and Arms (1988) unless otherwise noted: $\log(\text{Plant Uptake Factor}) = 1.588 - 0.578 (\log K_{ow})$. Converted from dry weight to wet weight plant concentration assuming 80% water content.</p> <p>[e] Calculated using the following equation in Travis and Arms (1988) for semivolatile organic analytes with $\log K_{ow} > 5$: $\log \text{BTF (biotransfer factor)} = \log K_{ow} - 7.6$; result multiplied by average ingestion rates for nonlactating and lactating test animals (12 kilograms per day [kg/day]) to convert from BTFs to BAFs, and divided by a factor of 0.2 to convert from dry feed to fresh feed. When no literature values were available, BAFs were calculated for pesticides regardless of the $\log K_{ow}$, due to the tendency of these lipophilic compounds to bioaccumulate. With the exception of pesticides, BAFs for analytes with $\log K_{ow} < 5$ are assumed to be 0.15 because they are unlikely to bioaccumulate in animal tissue (Maughan, 1993).</p>					
Notes continued on next page.					

Table F-1 (Continued)
Summary of Bioaccumulation and Bioconcentration Data

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

- [f] Geometric mean of reported BAFs for earthworms (Gish, 1970) converted from dry weight to wet weight assuming 80% water composition of earthworms.
- [g] BAF calculated from data presented by Potter *et al.* (1974). Based on an average dieldrin concentration in cow muscle and fat of 0.17 mg/kg (dry weight) and a dieldrin concentration of 0.11 mg/kg in the diet (dry weight).
- [h] Jeffries and Davis (1968).
- [i] Average of BAF values reported from Wang *et al.* (1984), Sheppard *et al.* (1985), and Merry *et al.* (1986).
- [j] Value derived from BTFs, presented in Baes *et al.* (1984) for uptake into cattle. BTF converted to BAF by multiplying by food ingestion rate of 50 kg/day wet weight.
- [k] Mammal value for copper and plant value for cadmium from Levine *et al.*, 1989. Lead does not accumulate in plant tissue; therefore, a BAF of zero was assigned.
- [l] Based on accumulation of cadmium in kidneys of European quail in Pimentel *et al.* (1984).
- [m] BAF for earthworms from Diercxsens *et al.* (1985).
- [n] Value from Baes *et al.* (1984) for leafy portions of plants multiplied by 0.2 to represent 80% water composition of plants.
- [o] Cyanide has not been shown to bioaccumulate in any organisms.
- [p] Cyanide is naturally occurring in some plants; the extent to which it is taken up from soil is unknown and; therefore, a BAF of 1 is conservatively assumed.
- [q] Geometric mean of BAF values (fresh weight/dry weights [fresh/wt./dry wts.]) for worms and woodlice (USEPA, 1985b). Fresh weight tissue concentrations calculated assuming 80% body water content.
- [r] Uptake value (fresh wt./dry wt.) for earthworms from USEPA, 1985 "Environmental Profiles and Hazard Indices for Constituents of Municipal Sludge: Mercury.". Fresh wt. tissue concentration calculated assuming 80% body water content[s] USEPA,
- [s] USEPA. 1985. "Ambient Water Quality Criteria for Mercury." Office of Water Regulations and Standards. Washington, D.C.

Notes: PCBs = polychlorinated biphenyls.
Log K_{ow} = log of the octanol/water partition coefficient
NA = not available.
% = percent.

Table F-2
Ingestion Toxicity Information for Wildlife

Remedial Investigation Report
 Site 1, Northwest Disposal Area
 Naval Air Station Whiting Field
 Milton, Florida

Analyte	Test Species	Test Type	Duration	Effect	Lethal TRV mg/kg-BW-day		Sublethal TRV mg/kg-BW-day		References
					Oral LD ₅₀	TRV ¹	LOAEL	TRV ²	
Volatile Organic Compounds									
Xylenes (total)	Rat	Oral LD ₅₀		Mortality	4,300	¹ 860			NIOSH, 1985
	Rat	Oral (chronic)	103 weeks	Hyperactivity, decreased BW, mortality			500	² 250	IRIS, 1991
	Japanese quail	Oral (acute)	5 days	Mortality	20,000	² 2,014			Hill, E.F., <i>et al.</i> , 1986
Pesticides and PCBs									
Dieldrin	Mouse	Oral LD ₅₀	NR	Mortality	38				Allen, J.R., <i>et al.</i> , 1979
	Mouse	Oral (chronic)	80 weeks	Body tremors			0.33		NCI, 1978
	Mouse	Oral (chronic)	2 year	Liver enlargement with histopathology			0.1		IRIS, 1991
	Mouse	Oral (chronic)	2 year	Hepatic cancer			1.3		ATSDR, 1992a
	Rat	Oral (chronic)	2 year	Histologic changes			2		ATSDR, 1992a
	Rat	Oral (chronic)	2 year	Liver lesions			0.05	0.005	IRIS, 1991
	Dog	Oral (chronic)	2 year	Increased liver weight; liver/body weight			0.05	² 0.005	IRIS, 1991
	Dog	Oral (chronic)	25 months	Hepatocyte degeneration			0.5	² 0.1	ATSDR, 1992a
	Monkey	Oral (chronic)	120 days	Tremors and convulsions			0.1		Smith, R.M., <i>et al.</i> , 1976
	Mouse	Oral (subchronic)	4 weeks	Decreased pup survival			0.65	² 0.13	Virgo, B.B., <i>et al.</i> , 1975
	Rat	Oral LD ₅₀	NR	Mortality	46				Allen, J.R., <i>et al.</i> , 1979
	Guinea pig	Oral LD ₅₀	NR	Mortality	25	¹ 5			Allen, J.R., <i>et al.</i> , 1979
	Rabbit	Oral LD ₅₀	NR	Mortality	45				Allen, J.R., <i>et al.</i> , 1979

See notes at end of table.

Table F-2 (Continued)
Ingestion Toxicity Information for Wildlife

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Analyte	Test Species	Test Type	Duration	Effect	Lethal TRV mg/kg-BW-day		Sublethal TRV mg/kg-BW-day		References
					Oral LD ₅₀	TRV ¹	LOAEL	TRV ²	
Pesticides and PCBs (Continued)									
	House sparrow	Oral LD ₅₀	NR	Mortality	48				USFWS, 1984
	Chicken	Oral LD ₅₀	NR	Mortality	20				Allen, J.R., <i>et al.</i> , 1979
	Rock dove	Oral LD ₅₀	NR	Mortality	27				Virgo, B.B., <i>et al.</i> , 1975
	Gray partridge	Oral LD ₅₀	NR	Mortality	9				Virgo, B.B., <i>et al.</i> , 1975
	Chukar	Oral LD ₅₀	NR	Mortality	25				Virgo, B.B., <i>et al.</i> , 1975
	Japanese quail	Oral LD ₅₀	5 days	Mortality	16				Hill, E.F. <i>et al.</i> , 1975
	Japanese quail	Oral LD ₅₀	NR	Mortality	70				Virgo, B.B., <i>et al.</i> , 1975
	California quail	Oral LD ₅₀	NR	Mortality	9				Virgo, B.B., <i>et al.</i> , 1975
	Bobwhite	Oral LD ₅₀	5 days	Mortality	3.3	0.6			Hill, E.F. <i>et al.</i> , 1975
	Pheasant	Oral LD ₅₀	NR	Mortality	79				Virgo, B.B., <i>et al.</i> , 1975
	Mallard	Oral LD ₅₀	5 days	Mortality	112				Hill, E.F. <i>et al.</i> , 1975
	Mallard	Oral LD ₅₀	5 days	Mortality	111				Hill, E.F. <i>et al.</i> , 1975
	Mallard	Oral LD ₅₀	NR	Mortality	381				Virgo, B.B., <i>et al.</i> , 1975
	Whistling duck	Oral LD ₅₀	NR	Mortality	100				Virgo, B.B., <i>et al.</i> , 1975
	Canada goose	Oral LD ₅₀	NR	Mortality	141				Virgo, B.B., <i>et al.</i> , 1975
	Goat	Oral LD ₅₀	NR	Mortality	100				Allen, J.R., <i>et al.</i> , 1979
	Sheep	Oral LD ₅₀	NR	Mortality	50				Allen, J.R., <i>et al.</i> , 1979
	Cattle	Oral LD ₅₀	NR	Mortality	60				Allen, J.R., <i>et al.</i> , 1979
	Mule deer	Oral LD ₅₀	NR	Mortality	75				Allen, J.R., <i>et al.</i> , 1979
	Cat	Oral LD ₅₀	NR	Mortality	300				Allen, J.R., <i>et al.</i> , 1979

See notes at end of table.

Table F-2 (Continued)
Ingestion Toxicity Information for Wildlife

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Analyte	Test Species	Test Type	Duration	Effect	Lethal TRV mg/kg-BW-day		Sublethal TRV mg/kg-BW-day		References
					Oral LD ₅₀	TRV ¹	LOAEL	TRV ²	
Inorganic Analytes									
Cadmium	Rat	Oral	NR	Reproductive effects			155		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			220		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			21.5	² 4.3	RTECS, 1993
	Rat	Oral	NR	Reproductive effects			23		RTECS, 1993
	Rat	Oral LD ₅₀		Mortality	250				Eisler, R., 1985
	Rat	Oral LD ₅₀	NR	Mortality	225				RTECS, 1993
	Mouse	Oral LD ₅₀	NR	Mortality	890				RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			448		RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			1,700		RTECS, 1993
	Guinea pig	Oral LD ₅₀	NR	Mortality	150	¹ 30			Eisler, R., 1985
Mallard	Oral (subchronic)	90 days	Egg production suppressed			10	² 2	Eisler, R., 1985	
Chromium	Japanese quail	Oral LD ₅₀	5 days	Mortality	126	¹ 25.2			Hill, E.F., <i>et al.</i> , 1986
	Rat	Oral (subchronic)	90 days	NOAEL histopathologic and reproductive effects				1,400	Ivankovic, S., <i>et al.</i> , 1975
	Black duck	Oral (subchronic)	5 months	NOAEL for reproductive effects				200	Outridge, P.M., <i>et al.</i> , 1977
	Rat	Oral LD ₅₀		Mortality	200	¹ 40			ATSDR, 1992b

See notes at end of table.

Table F-2 (Continued)
Ingestion Toxicity Information for Wildlife

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Analyte	Test Species	Test Type	Duration	Effect	Lethal TRV mg/kg-BW-day		Sublethal TRV mg/kg-BW-day		References
					Oral LD ₅₀	TRV ¹	LOAEL	TRV ²	
Inorganic Analytes									
Cyanide	Mouse	Oral (chronic)	30 days	Decreased litter sizes with teratogenic effects			100	² 20	Lecyk, M., 1980
	Rat	Oral (subchronic)	11.5 months	Increased thyroid weight, myelin degeneration			30		IRIS, 1993
	Mouse	Single oral dose	NR	Mortality	8.5	¹ 1.7			Arthur D. Little, Inc., 1981
	Young chickens	Oral	20 days	Decreased growth and food intake			11	² 2.2	Elzubeir, E.A., <i>et al.</i> , 1988
	Pig	Oral	110 days	Thyroid hypofunction during pregnancy			11		Tewe, O.O., <i>et al.</i> , 1981
	Hamsters	Oral	12 days	Decreased fetal weight and delayed ossification			12	11.9	Frakes, R.A., <i>et al.</i> , 1986
	Mallard	Single oral dose	NR	Mortality in 6% of population	1.1	⁴ 0.22			Eisler, R., 1991
Lead	Rat	Oral	NR	Reproductive effects			790		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			1,140		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			520		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			1,100		RTECS, 1993
	Calf	Oral LD ₅₀	NR	Mortality	220				Eisler, R., 1988b
	Rat	Oral (subchronic)	12-14 days	Decreased fetal body weight			2.5		McClain, R.M., <i>et al.</i> , 1972
	Mouse	Oral	NR	Reproductive effects			1,120		RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			6,300		RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			300		RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			4,800		RTECS, 1993
See notes at end of table.									

Table F-2 (Continued)
Ingestion Toxicity Information for Wildlife

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Analyte	Test Species	Test Type	Duration	Effect	Lethal TRV mg/kg-BW-day		Sublethal TRV mg/kg-BW-day		References
					Oral LD ₅₀	TRV ¹	LOAEL	TRV ²	
Inorganic Analytes									
	Domestic animal	Oral	NR	NOAEL for reproductive effects			662		RTECS, 1993
	Kestrel	Diet	NR	Decreased egg laying fertility; decreased egg shell thickness				³ 4.6	Eisler, R., 1988b
	Kestrel nestlings	Oral	10 days	Reduced growth and brain weight; abnormal development			125		Eisler, R., 1988b
	Japanese quail	Oral LD ₅₀	5 days	Mortality	24,752				Hill, E.F., <i>et al.</i> , 1986
	Rat	Oral (chronic)	2 generations	NOAEL for developmental effects				7	Kimmel, C.A., <i>et al.</i> , 1980
	Guinea pig	Oral LD ₅₀		Mortality	300	¹ 60			Sax, N.I., 1984
	Rock dove	Oral (chronic)	NR	Kidney pathology; learning deficiencies			6.25		Anders, E., <i>et al.</i> , 1979
	Rock dove	Oral LD ₅₀		Mortality	375	¹ 75			Kendall, R.J., <i>et al.</i> , 1985
Mercury	Mouse	Oral (subchronic)	180 days	NOAEL for Mortality			2,300		Gianutsos, G., <i>et al.</i> , 1982
	Mouse	Oral LD ₅₀		Mortality	22				NIOSH, 1985
	Mouse	Oral (subchronic)	Day 6-17 (gest)	Stillbirths and neonatal death				4	Suzuki, T., 1979
Organomercury	Rat	Oral (subchronic)	Day 6-14 (gest)	Retarded fetus growth				4	Suzuki, T., 1979
Organomercury	Rat	Oral (chronic)	NR	Reduced fertility			0.5	² 0.1	Eisler, R., 1987
Organomercury	Rat	Oral LD ₅₀		Mortality	180	¹ 3.6			NIOSH, 1985
Organomercury	Pig	Oral (subchronic)	Pregnancy	High incidence of stillbirths				0.5	Eisler, R., 1987

See notes at end of table.

Table F-2 (Continued)
Ingestion Toxicity Information for Wildlife

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Analyte	Test Species	Test Type	Duration	Effect	Lethal TRV mg/kg-BW-day		Sublethal TRV mg/kg-BW-day		References
					Oral LD ₅₀	TRV ¹	LOAEL	TRV ²	
Inorganic Analytes									
Organomercury	Mule deer	Oral LD ₅₀		Mortality	17.9				Eisler, R., 1987
Organomercury	River otter	Oral LD ₅₀		Mortality	2				Eisler, R., 1987
Organomercury	Mink	Oral LD ₅₀		Mortality	1	¹ 0.2			Eisler, R., 1987
Methylmercury	Dog	Oral (subchronic)	Pregnancy	High incidence of still-births			0.1	² 0.02	Eisler, R., 1987
Ethylmercury	House sparrow	Oral LD ₅₀		Mortality	12.6				Eisler, R., 1987
	Rock dove	Oral LD ₅₀		Mortality	22.8				Eisler, R., 1987
	Chicken	Oral LD ₅₀		Mortality	20				Fimreite, N., 1979
Ethylmercury	Bantam chicken	Oral LD ₅₀		Mortality	190				Fimreite, N., 1979
Ethylmercury	Prairie chicken	Oral LD ₅₀		Mortality	11.5				Eisler, R., 1987
Ethylmercury	Chukar	Oral LD ₅₀		Mortality	26.9				Eisler, R., 1987
Methylmercury	Corturnix	Oral LD ₅₀		Mortality	11	¹ 2.2			Eisler, R., 1987
Methylmercury	Mallard	Oral	NR	Reproduction, behavior			0.064	² 0.0125	USEPA, 1993c
Methylmercury	Black duck	Oral (subchronic)	28 weeks	Reproduction inhibited			3 0.22		Eisler, R., 1987
Methylmercury	Fulvous whistling duck	Oral LD ₅₀		Mortality	37.8				Eisler, R., 1987
Methylmercury	Northern bobwhite	Oral LD ₅₀		Mortality	23.8				Eisler, R., 1987
	Bobwhite quail	Oral LD ₅₀	5 days	Mortality	523				Hill, E.F. <i>et al.</i> , 1975
Ethylmercury	Japanese quail	Oral LD ₅₀		Mortality	14.4				Eisler, R., 1987
Organomercury	Gray partridge	Oral LD ₅₀		Mortality	17.6				Eisler, R., 1987
Methylmercury	Gray pheasant	Oral (subchronic)	30 days	Reduced reproductive ability			0.64		Eisler, R., 1987
Methylmercury	Ring-necked pheasant	Oral LD ₅₀		Mortality	11.5				Eisler, R., 1987

See notes at end of table.

Table F-2 (Continued)
Ingestion Toxicity Information for Wildlife

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Analyte	Test Species	Test Type	Duration	Effect	Lethal TRV mg/kg-BW-day		Sublethal TRV mg/kg-BW-day		References
					Oral LD ₅₀	TRV ¹	LOAEL	TRV ²	
Inorganic Analytes									
Vanadium	Japanese quail	Oral LD ₅₀	5 days	Mortality	96	19.2			Hill, E.F., <i>et al.</i> , 1986
	Mouse	Gavage LD ₅₀	One time	Mortality	31	6.2			ATSDR, 1990
	Rat	Oral (subchronic)	2 months	Hypertension			15		Susic, D., <i>et al.</i> , 1986
	Rat	Oral (subchronic)	35 days	NOAEL development effects				8.4	Domingo, J.L., <i>et al.</i> , 1986
	Chicken	Oral (subchronic)	6 weeks	Decrease in egg laying			11	2.2	Berg, L.R., <i>et al.</i> , 1963

¹ Selected lethal TRVs are boxed. The lethal TRVs corresponds to the NOAEL when available. When a NOAEL is not available, then the TRV value is calculated by applying a five fold application factor to the Oral LD 50.

² Selected sublethal TRVs are boxed. The sublethal TRV corresponds to the NOAEL when available. When an NOAEL is not available, the sublethal TRV value is calculated by applying a five-fold application factor to the sublethal LOAEL.

³ Converted to dose per kilogram body weight by multiplying the reported value by Ingestion rate and dividing by body weight. Body weights for birds obtained from Dunning, 1984.

Notes: Ingestion rates were calculated using the following regression equation (for all birds) from USEPA, 1993c: Food Ingestion (kg/day) = 0.00582* Body Weight 0.651 (kg).

Ingestion rates for the chicken from NRC, 1984.

TRV = toxicity reference value.

mg/kg = milligrams per kilogram.

BW = Body weight.

LD₅₀ = Dose resulting in 50% mortality in test population.

LOAEL = lowest observed adverse effect level.

box = selected lethal TRVs.

NIOSH = National Institute for Occupational Safety and Health.

IRIS = Integrated Risk Information System.

PCBs = polychlorinated biphenyls.

NR = not reported.

NCI = National Cancer Institute.

ATSDR = Agency for Toxic Substances and Disease Registry.

USFWS = U.S. Fish and Wildlife Service.

% = percent.

RTECS = Registry of Toxic Effects of Chemical Substances.

NOAEL = no observed adverse effect level.

gest. = gestation.

See notes at end of table.

Table F-2 (Continued)
Ingestion Toxicity Information for WildlifeRemedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida**References**

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See notes at end of table.

Table F-2 (Continued)
Ingestion Toxicity Information for Wildlife

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

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**Table F-3
Selected Wildlife Ingestion TRVs [a]**

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Compound	Small Mammal		Small Bird		Predatory Mammal [b]		Predatory Bird [c]	
	Lethal	Sublethal	Lethal	Sublethal	Lethal	Sublethal	Lethal	Sublethal
<u>Volatile Organic Compounds</u>								
Xylenes (total)	860	250	2,014	NA	860	250	2,014	NA
<u>Pesticides and PCBs</u>								
Dieldrin	5	0.13	0.6	NA	5	0.005	0.6	NA
<u>Inorganic Analytes</u>								
Cadmium	30	4.3	NA	2	30	4.3	NA	2
Chromium	40	1,400	25.2	200	40	1,400	25.2	200
Cyanide	1.7	20	0.22	2.2	1.7	20	0.22	2.2
Lead	60	7	75	4.61	60	7	75	4.61
Mercury	3.6	0.1	2.2	0.0128	0.2	0.02	2.2	0.0128
Vanadium	6.2	8.4	19.2	2.2	6.2	8.4	19.2	2.2

[a] Lethal TRVs correspond to the boxed lethal TRV (one-fifth of the oral LD₅₀ or the LOAEL) presented in Table F-2. Sublethal TRVs correspond to the boxed NOAEL. When NOAEL value is not available, then one-fifth of the sublethal LOAEL is used as a surrogate.

[b] When no data are available, the small mammal values are used as a surrogate.

[c] When no data are available, the small bird values are used as a surrogate.

Notes: All values are in milligrams per kilogram per body weight per day.

NA = not available.

TRV = toxicity reference value.

LD₅₀ = lethal dose to 50 percent of test population.

LOAEL = lowest observed adverse effect level.

NOAEL = no observed adverse effect level.

NR = not reported.

PCB = polychlorinated biphenyl.

Table F-4
Summary of Toxicity Data for Plant Receptors

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Analyte	Reference	TRV in soil [a] (mg/kg)
<u>Volatile Organic Compounds</u>		
Xylene (total)	Hulzebos <i>et al.</i> , 1993	>1,000
<u>Pesticides and PCBs</u>		
Dieldrin		12.5 [b]
<u>Inorganic Analytes</u>		
Cadmium	Will and Suter, 1994	3
Chromium	Will and Suter, 1994	1
Cyanide		NA
Lead	Will and Suter, 1994	50
Mercury	Will and Suter, 1994	0.3
Vanadium	Will and Suter, 1994	2
<p>[a] TRVs are equal to chemical concentrations in soil that are not expected to result in adverse effects to plants.</p> <p>[b] Value for 4,4'-DDT used as a surrogate.</p>		
<p>Notes: TRV = toxicity reference value. mg/kg = milligrams per kilogram. > = greater than. PCBs = polychlorinated biphenyls. NA = not available. DDT = dichlorodiphenyltrichloroethane.</p>		

Table F-5
Summary of Toxicity Data for Terrestrial Invertebrates

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Analytes	Test Type	Test Duration	Test Species	Effects Concentration (mg/kg)	Effects	TRV (mg/kg)	Reference
<u>Volatile Organic Compounds</u>							
Xylene (total)	Soil Test	14-day	<i>E. foetida</i>	106	LC ₅₀	21	Neuhauser <i>et al.</i> , 1985.
<u>Pesticides and PCBs</u>							
Dieldrin	Soil Test	89-day	<i>E. foetida</i>	10	6 % decrease in number of cocoons hatched	10	Reinecke and Venter, 1985
Dieldrin	Soil Test	89-day	<i>E. foetida</i>	30	26 % decrease in number of cocoons hatched		Reinecke and Venter, 1985
Dieldrin	Soil Test	89-day	<i>E. foetida</i>	100	36 % decrease in number of cocoons hatched		Reinecke and Venter, 1985
Dieldrin	Soil Test	89-day	<i>E. foetida</i>	100	50 % decrease in number of cocoons produced		Reinecke and Venter, 1985
<u>Inorganic Analytes</u>							
Cadmium	Soil Test	14-day	<i>E. foetida</i>	900 [a]	0 % mortality		Bouche <i>et al.</i> , 1987
Cadmium	Soil Test	14-day	<i>E. foetida</i>	2,700	100 % mortality		Bouche <i>et al.</i> , 1987
Cadmium	Soil Test	14-day	<i>E. foetida</i>	1,000 [a]	LC ₅₀		van Gestel and van Dis, 1988
Cadmium	Soil Test	20-week	<i>E. foetida</i>	50	Decrease in cocoon production	50	Malecki <i>et al.</i> , 1982
Cadmium	Soil Test	2-week	<i>E. foetida</i>	1,843	LC ₅₀		Neuhauser <i>et al.</i> , 1985
Chromium (III)	Soil Test	8-week	<i>E. foetida</i>	250	Reproduction 50% inhibited	50 [b]	Molnar <i>et al.</i> , 1989
Cyanide	NA	NA	NA	NA	NA	NA	NA
Lead	Soil Test	20-week	<i>E. foetida</i>	5,000 [c]	Decrease in cocoon production		Malecki <i>et al.</i> , 1982
Lead	Soil Test	2-week	<i>E. foetida</i>	5,941	LC ₅₀	1,190 [b]	Neuhauser <i>et al.</i> , 1985

See notes at end of table.

Table F-5 (Continued)
Summary of Toxicity Data for Terrestrial Invertebrates

Remedial Investigation Report
Site 1, Northwest Disposal Area
Naval Air Station Whiting Field
Milton, Florida

Analytes	Test Type	Test Duration	Test Species	Effects Concentration (mg/kg)	Effects	TRV (mg/kg)	Reference
<u>Inorganic Analytes</u>							
Lead	Soil Test	20-week	<i>E. foetida</i>	5,000 [c]	Decrease in cocoon production		Malecki <i>et al.</i> , 1982
Lead	Soil Test	2-week	<i>E. foetida</i>	5,941	LC ₅₀	1,190 [b]	Neuhauser <i>et al.</i> , 1985
Mercury	Soil Test	14-day	<i>E. foetida</i>	36	0 % mortality	36	Bouche <i>et al.</i> , 1987
Mercury	Soil Test	14-day	<i>E. foetida</i>	216	60 % mortality		Bouche <i>et al.</i> , 1987
Vanadium	NA	NA	NA	NA	NA	NA	NA
<p>[a] LC₅₀ value for soil at pH = 7.0; LC₅₀ = 320 µg/g - 560 µg/g for soil pH = 4.1. [b] Conservative factor of 0.2 applied to effect concentration; resultant value should be protective of 99.9% of the exposed population from acute effects (USEPA, 1986). [c] Acetate salt.</p> <p>Notes: TRV = toxicity reference value. NA = not available. PCBs = polychlorinated biphenyls. mg/kg = milligrams per kilogram. LC₅₀ = Media concentration resulting in 50% mortality in test population. % = percent.</p>							

Table F-6
 Exposure Parameters and Assumptions for Representative Wildlife Species [a]
 Site 1
 Naval Air Station
 Milton, Florida

Representative Wildlife Species		Percent Prey in Diet					Home Range (acres)	ED [b]	Site Foraging Frequency [c]	Food Ingestion Rate (kg/day)	Body Weight (kg)
		Inverts	Plants	Small Mammals	Small Birds	Soil					
<i>Cotton mouse</i>	(Small herb. mammal)	10%	88%	0%	0%	2%	0.147	1	1.00E+00	0.0029	0.021
<i>Eastern meadowlark</i>	(Small omn. bird)	75%	20%	0%	0%	5%	5	1	1.00E+00	0.0119	0.087
<i>Short-tailed shrew</i>	(Small carn. mammal)	78%	12%	0%	0%	10%	0.96	1	1.00E+00	0.0024	0.017
<i>Red fox</i>	(Predatory mammal)	20%	10%	57%	10%	3%	250	1	2.00E-02	0.24	4.69
<i>Great-horned owl</i>	(Predatory bird)	0%	0%	80%	19%	1%	15	1	3.33E-01	0.079	1.5

NOTES:

SITE AREA: 5.0 acres

- [a] Documentation of exposure parameters presented in: Table 7-5
- [b] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)
- [c] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

Table F-7

Estimated Exposure from Ingestion of Food and Soil containing the Maximum Exposure Point Concentration of ECPCs: Lethal Effects
 Site 1
 Naval Air Station
 Milton, Florida

EXPOSURE CONCENTRATION DATA

ANALYTE	MAXIMUM EXPOSURE POINT CONCENTRATION (mg/kg)
Xylenes (total)	0.002
Dieldrin	0.0015
Arsenic	4.2
Cadmium	0.71
Chromium	30
Cyanide	1.1
Lead	44
Mercury	0.195
Vanadium	33.6

ESTIMATED CONCENTRATIONS IN PRIMARY FOOD ITEMS

Concentration in Invert. Invertebrate Tissue [b]		Concentration in Plant Plant Tissue [c]	
Invert. BAF [a]	(mg/kg)	Plant BAF [a]	(mg/kg)
NA	NA	NA	NA
5.5E+00	8.3E-03	1.7E-02	2.6E-05
NA	NA	3.0E-01	1.3E+00
2.4E+00	1.7E+00	3.3E+01	2.3E+01
1.6E-01	4.8E+00	1.5E-03	4.5E-02
0.0E+00	0.0E+00	1.0E+00	1.1E+00
7.8E-02	3.4E+00	NA	NA
6.8E-02	1.3E-02	1.8E-01	3.5E-02
NA	NA	1.1E-03	3.7E-02

BAF VALUES FOR OTHER FOOD ITEMS

Small Mammal BAF [a]	Small Bird BAF [a]
NA	NA
1.5E+00	4.4E-01
1.0E-01	NA
2.1E+00	3.8E-01
2.8E-01	NA
0.0E+00	NA
1.5E-02	NA
1.0E-02	2.3E+00
1.2E-01	NA

ECPC = Ecological Chemical of Potential Concern

[a] Bioaccumulation data presented in: Table F-1

[b] Invertebrate tissue concentration is the invertebrate BAF multiplied by the EPC.

[c] Plant tissue concentration is the plant BAF multiplied by the EPC.

Table F-7

Estimated Exposure from Ingestion of Food and Soil containing the Maximum Exposure Point Concentration of ECPCs: Lethal Effects

Site 1

Naval Air Station

Milton, Florida

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

ANALYTE	<i>Cottin mouse</i>	<i>Eastern meadowlark</i>	<i>Short-tailed shrew</i>	<i>Red fox</i>	<i>Great horned owl</i>
Xylenes (total)	5.5E-06	1.4E-05	2.8E-05	6.1E-08	3.5E-07
Dieldrin	1.2E-04	8.6E-04	9.3E-04	5.1E-06	8.3E-05
Arsenic	1.6E-01	6.3E-02	5.9E-02	3.0E-04	1.9E-03
Cadmium	2.9E+00	8.2E-01	2.0E-01	1.6E-02	3.3E-01
Chromium	1.5E-01	7.0E-01	9.5E-01	2.6E-03	2.1E-02
Cyanide	1.4E-01	3.8E-02	1.6E-02	1.5E-04	1.9E-04
Lead	1.7E-01	6.5E-01	1.0E+00	2.1E-03	8.6E-03
Mercury	5.0E-03	3.7E-03	4.2E-03	1.6E-05	1.4E-04
Vanadium	9.7E-02	2.3E-01	4.7E-01	1.2E-03	9.3E-03

[d] Calculated by summing the concentration derived from each pathway (multiplying pathway concentration, percent in diet, SFF, and ingestion rate, and then dividing by body weight).

SFF = Site foraging frequency

Table F-6

Risk for Representative Wildlife Species from Maximum Exposure Concentrations of ECPCs: Lethal Effects

Site 1

Naval Air Station

Milton, Florida

ANALYTE	<i>Cotton mouse</i>			<i>Eastern meadowlark</i>			<i>Short tailed shrew</i>			
	PDE	TRV	HQ	PDE	TRV	HQ	PDE	TRV	HQ	
Xylenes (total)	5.5E-06	8.6E+02	6.4E-09	1.4E-05	2.0E+03	6.8E-09	2.8E-05	8.6E+02	3.3E-08	
Dieldrin	1.2E-04	5.0E+00	2.4E-05	8.6E-04	6.0E-01	1.4E-03	9.3E-04	5.0E+00	1.9E-04	
Arsenic	1.6E-01	2.9E+01	5.7E-03	6.3E-02	3.6E+00	1.8E-02	5.9E-02	2.9E+01	2.0E-03	
Cadmium	2.9E+00	3.0E+01	9.6E-02	8.2E-01	NA	NA	2.0E-01	3.0E+01	6.6E-03	
Chromium	1.5E-01	4.0E+01	3.9E-03	7.0E-01	2.5E+01	2.8E-02	9.5E-01	4.0E+01	2.4E-02	
Cyanide	1.4E-01	1.7E+00	8.0E-02	3.8E-02	2.2E-01	1.7E-01	1.6E-02	1.7E+00	9.1E-03	
Lead	1.7E-01	6.0E+01	2.8E-03	6.5E-01	7.5E+01	8.7E-03	1.0E+00	6.0E+01	1.7E-02	
Mercury	5.0E-03	3.6E+00	1.4E-03	3.7E-03	2.2E+00	1.7E-03	4.2E-03	2.0E-01	2.1E-02	
Vanadium	9.7E-02	6.2E+00	1.6E-02	2.3E-01	1.9E+01	1.2E-02	4.7E-01	6.2E+00	7.7E-02	
SUMMARY HAZARD INDEX			2E-01				2E-01			

PDE = Potential Dietary Exposure (mg/kg-BW/day)

TRV = Toxicity Reference Value (mg/kg-BW/day) = 1/5 of the lowest reported LD₅₀ for closest related species.

Table F-8

Risk for Representative Wildlife Species from Maximum Exposure Concentrations of ECPCs: Lethal Effects

Site 1

Naval Air Station

Milton, Florida

ANALYTE	<i>Red fox</i>			<i>Great-horned owl</i>		
	PDE	TRV	HQ	PDE	TRV	HQ
Xylenes (total)	6.1E-08	8.6E+02	7.1E-11	3.5E-07	2.0E+03	1.7E-10
Dieldrin	5.1E-06	5.0E+00	1.0E-06	8.3E-05	6.0E-01	1.4E-04
Arsenic	3.0E-04	2.9E+01	1.1E-05	1.9E-03	3.6E+00	5.2E-04
Cadmium	1.6E-02	3.0E+01	5.5E-04	3.3E-01	NA	NA
Chromium	2.6E-03	4.0E+01	6.4E-05	2.1E-02	2.5E+01	8.2E-04
Cyanide	1.5E-04	1.7E+00	8.6E-05	1.9E-04	2.2E+00	8.8E-05
Lead	2.1E-03	6.0E+01	3.5E-05	8.6E-03	7.5E+01	1.1E-04
Mercury	1.6E-05	2.0E-01	7.8E-05	1.4E-04	2.2E+00	6.4E-05
Vanadium	1.2E-03	6.2E+00	1.9E-04	9.3E-03	1.9E+01	4.9E-04
SUMMARY HAZARD INDEX			1E-03			2E-03

PDE = Potential Dietary Exposure (mg/kg-BW/day)

TRV = Toxicity Reference Value (mg/kg-BW/day) = 1/5 of the lowest reported LD₅₀ for closest related species.

HQ = Hazard Quotient (calculated by dividing PDE by TRV)

Table F-9

Estimated Exposure from Ingestion of Food and Soil containing the Maximum Exposure Point Concentration of ECPCs: Sublethal Effects
 Site 1
 Naval Air Station
 Milton, Florida

EXPOSURE CONCENTRATION DATA

ANALYTE	MAXIMUM EXPOSURE POINT CONCENTRATION (mg/kg)
Xylenes (total)	0.002
Dieldrin	0.0015
Arsenic	4.2
Cadmium	0.71
Chromium	30
Cyanide	1.1
Lead	44
Mercury	0.195
Vanadium	33.6

ESTIMATED CONCENTRATIONS IN PRIMARY FOOD ITEMS

Concentration in Invert		Concentration in Plant	
Invert BAF [a]	Invertebrate Tissue [b] (mg/kg)	Plant BAF [a]	Plant Tissue [c] (mg/kg)
NA	NA	NA	NA
5.5E+00	8.3E-03	1.7E-02	2.6E-05
NA	NA	3.0E-01	1.3E+00
2.4E+00	1.7E+00	3.3E+01	2.3E+01
1.6E-01	4.8E+00	1.5E-03	4.5E-02
0.0E+00	0.0E+00	1.0E+00	1.1E+00
7.8E-02	3.4E+00	NA	NA
6.8E-02	1.3E-02	1.8E-01	3.5E-02
NA	NA	1.1E-03	3.7E-02

BAF VALUES FOR OTHER FOOD ITEMS

Small Mammal BAF [a]	Small Bird BAF [a]
NA	NA
1.5E+00	4.4E-01
1.0E-01	NA
2.1E+00	3.8E-01
2.8E-01	NA
0.0E+00	NA
1.5E-02	NA
1.0E-02	2.3E+00
1.2E-01	NA

ECPC = Ecological Chemical of Potential Concern

[a] Bioaccumulation data presented in: Table F-1

[b] Invertebrate tissue concentration is the invertebrate BAF multiplied by the EPC.

[c] Plant tissue concentration is the plant BAF multiplied by the EPC.

Table F-9

Estimated Exposure from Ingestion of Food and Soil containing the Maximum Exposure Point Concentration of ECPCs: Sublethal Effects

Site 1

Naval Air Station

Milton, Florida

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

ANALYTE	<i>Cottontail mouse</i>	<i>Eastern meadowlark</i>	<i>Short-tailed shrew</i>	<i>Red fox</i>	<i>Great horned owl</i>
Xylenes (total)	5.5E-06	1.4E-05	2.8E-05	6.1E-08	3.5E-07
Dieldrin	1.2E-04	8.6E-04	9.3E-04	5.1E-06	8.3E-05
Arsenic	1.6E-01	6.3E-02	5.9E-02	3.0E-04	1.9E-03
Cadmium	2.9E+00	8.2E-01	2.0E-01	1.6E-02	3.3E-01
Chromium	1.5E-01	7.0E-01	9.5E-01	2.6E-03	2.1E-02
Cyanide	1.4E-01	3.8E-02	1.6E-02	1.5E-04	1.9E-04
Lead	1.7E-01	6.5E-01	1.0E+00	2.1E-03	8.6E-03
Mercury	5.0E-03	3.7E-03	4.2E-03	1.6E-05	1.4E-04
Vanadium	9.7E-02	2.3E-01	4.7E-01	1.2E-03	9.3E-03

[d] Calculated by summing the concentration derived from each pathway (multiplying pathway concentration, percent in diet, SFF, and ingestion rate, and then dividing by body weight).

SFF = Site foraging frequency

Table F -

Risk for Representative Wildlife Species from Maximum Exposure Concentrations of ECPCs: Sublethal Effects

Site 1

Naval Air Station

Milton, Florida

ANALYTE	<i>Cotton mouse</i>			<i>Eastern meadowlark</i>			<i>Short-tailed shrew</i>			
	PDE	TRV	HQ	PDE	TRV	HQ	PDE	TRV	HQ	
Xylenes (total)	5.5E-06	2.5E+02	2.2E-08	1.4E-05	NA	NA	2.8E-05	2.5E+02	1.1E-07	
Dieldrin	1.2E-04	1.3E-01	9.3E-04	8.6E-04	NA	NA	9.3E-04	1.3E-01	7.2E-03	
Arsenic	1.6E-01	1.2E-01	1.4E+00	6.3E-02	1.0E+00	6.3E-02	5.9E-02	1.2E-01	4.9E-01	
Cadmium	2.9E+00	4.3E+00	6.7E-01	8.2E-01	2.0E+00	4.1E-01	2.0E-01	4.3E+00	4.6E-02	
Chromium	1.5E-01	1.4E+03	1.1E-04	7.0E-01	2.0E+02	3.5E-03	9.5E-01	1.4E+03	6.8E-04	
Cyanide	1.4E-01	2.0E+01	6.8E-03	3.8E-02	2.2E+00	1.7E-02	1.6E-02	2.0E+01	7.8E-04	
Lead	1.7E-01	6.0E+01	2.8E-03	6.5E-01	4.6E+00	1.4E-01	1.0E+00	6.0E+01	1.7E-02	
Mercury	5.0E-03	1.0E-01	5.0E-02	3.7E-03	NA	NA	4.2E-03	1.0E-01	4.2E-02	
Vanadium	9.7E-02	8.4E+00	1.2E-02	2.3E-01	2.2E+00	1.0E-01	4.7E-01	8.4E+00	5.6E-02	
SUMMARY HAZARD INDEX			2E+00				7E-01			

PDE = Potential Dietary Exposure (mg/kg-BW/day)

TRV = Toxicity Reference Value (mg/kg-BW/day) = NOAEL or 1/10 of the lowest reported LOAEL for closest related species.

Table F -10

Risk for Representative Wildlife Species from Maximum Exposure Concentrations of ECPCs: Sublethal Effects

Site 1

Naval Air Station

Milton, Florida

ANALYTE	<i>Red fox</i>			<i>Great-horned owl</i>		
	PDE	TRV	HQ	PDE	TRV	HQ
Xylenes (total)	6.1E-08	2.5E+02	2.5E-10	3.5E-07	NA	NA
Dieldrin	5.1E-06	1.0E-01	5.1E-05	8.3E-05	NA	NA
Arsenic	3.0E-04	1.2E-01	2.5E-03	1.9E-03	1.0E+00	1.9E-03
Cadmium	1.6E-02	4.3E+00	3.8E-03	3.3E-01	2.0E+00	1.7E-01
Chromium	2.6E-03	1.4E+03	1.8E-06	2.1E-02	2.0E+02	1.0E-04
Cyanide	1.5E-04	2.0E+01	7.3E-06	1.9E-04	2.2E+00	8.8E-05
Lead	2.1E-03	6.0E+01	3.5E-05	8.6E-03	4.6E+00	1.9E-03
Mercury	1.6E-05	2.0E-02	7.8E-04	1.4E-04	NA	NA
Vanadium	1.2E-03	8.4E+00	1.4E-04	9.3E-03	2.2E+00	4.2E-03
SUMMARY HAZARD INDEX			7E-03			2E-01

PDE = Potential Dietary Exposure (mg/kg-BW/day)

TRV = Toxicity Reference Value (mg/kg-BW/day) = NOAEL or 1/10 of the lowest reported LOAEL for closest related species.

HQ = Hazard Quotient (calculated by dividing PDE by TRV)

APPENDIX G

**EVALUATION OF BACKGROUND ARSENIC CONCENTRATIONS FOR COVERED
LANDFILL SITES NAS WHITING FIELD, MILTON, FLORIDA**

Appendix G

Evaluation of Background Arsenic Concentrations for Covered Landfill Sites

Naval Air Station (NAS) Whiting Field, Milton, Florida

At NAS Whiting Field nine soil types, as identified by the U. S. Department of Agriculture, Soil Conservation Service (USSCS), are present. The Remedial Investigation (RI) sites at NAS Whiting Field are associated with seven of the nine soil types. The background surface soil data set for each RI site was initially determined to be comprised of background surface soil samples from the same USSCS soil types as occur on the individual sites. However, available information and review of historical aerial photographs indicated that in the construction of landfills at the facility, a borrow pit was dug to an approximate depth of 10 to 15 feet below land surface (bls) and the excavated soil was piled to the side. Following landfill operations, the borrow materials comprised of undifferentiated surface and subsurface soils, were used for the landfill cover. Any additional soils required to complete the landfill cover are believed to have been obtained from other borrow pits located at the facility.

If a mix of surface and subsurface soils were used in the cover for landfills, it would be appropriate to use the combined data set of surface and subsurface soil samples as the background screening value. However in order to be protective of human health and the environment, it is proposed that the background surface and subsurface data set be combined to a single value as be used as the "Industrial Use Soil Cleanup Goal". This modified "Industrial Use Soil Cleanup Goal" is specifically limited to the covered landfill sites including: Site 1, 2, 9, 10, 11, 13, 14, 15, and 16 and to the inorganic analyte arsenic.

Tables 3-8 through 3-18 in the General Information Report present the detected concentrations and summarize the analytical data for the individual background soil samples collected at NAS Whiting Field. A summary of the arsenic background data set and the modified "Industrial Use Soil Cleanup Goal" for arsenic is presented Table I-1. As indicated on the table the modified "Industrial Use Soil Cleanup Goal" for arsenic to be used at covered landfill sites is 4.62 mg/kg.

Table G - 1
Summary of Arsenic Detected in
Surface and Subsurface Background Soil Samples

Remedial Investigation
Naval Air Station
Whiting Field, Florida

Analyte	Frequency of Detection Surface Soil Samples ¹	Mean of Detected Concentrations Surface Soil Samples ²	Frequency of Detection Subsurface Soil Samples ¹	Mean of Detected Concentrations Subsurface Soil Samples ²	Frequency of Detection Surface and Subsurface Soil Samples ¹	Mean of Detected Concentrations Surface and Subsurface Soil Samples ²	Surface and Subsurface Soil Background Screening Concentration (modified Industrial Use Cleanup Goal)
Inorganic Analytes (mg/kg)							
Arsenic	15/15	1.54	14/14	3.14	29/29	2.31	4.62

¹ Frequency of detection is the number of samples in which the analyte was detected divided by the total number of samples analyzed.

² The mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

Notes: mg/kg = milligram per kilogram.

Table G - 2
Comparison of Detected Arsenic Concentrations in Surface and Subsurface Soil Samples
to Florida Soil Cleanup Goals

Remedial Investigation
 Naval Air Station
 Whiting Field, Florida

Analyte	Minimum Detected Concentration	Maximum Detected Concentration	Mean of Detected Concentrations	Soil Cleanup Goals for Florida (Residential) ¹	Soil Cleanup Goals for Florida (Industrial) ¹	modified Industrial Use Cleanup Goal ²
<u>Inorganic Analyte (mg/kg)</u>						
Arsenic	0.52	6.3	2.31	0.8	3.7	4.62

¹ Source: FDEP Memorandum from John Ruddell, Director Division of Waste Management, to District Directors and Waste Program Administrators. Subject: Applicability of Soil Cleanup Goals for Florida, January 19, 1996.

² The modified Industrial Use Cleanup Goal for arsenic is twice the mean of detected concentrations in the surface and subsurface soil samples.

Notes: mg/kg = milligram per kilogram.

APPENDIX H

**COMMENTS AND RESPONSES ON THE DRAFT REMEDIAL INVESTIGATION
REPORT, SITE 1, NORTHWEST DISPOSAL AREA, NAS WHITING FIELD**

**USEPA Review Comments for
Remedial Investigation Report for Site 1, Northwest Disposal Area
October 1997**

Comment 1. Executive Summary, Page IV, Sixth Bullet. This bullet states the "Human Health Risk Assessment determined that soil and groundwater at Site 1 are not likely to pose an unacceptable carcinogenic risk or noncancer hazard to a current or hypothetical future resident at the site." The RI also determined that an occupational worker was unlikely to experience any unacceptable risks or hazards from contact with the soil and groundwater at this site. The text of this bullet should be modified to include the occupational worker.

Response: The bullet will be reworded to conclude that Site 1 is not likely to pose an unacceptable risk to all current and future hypothetical receptors. The revised bullet will read, "Human Health Risk Assessment determined that soil and groundwater at Site 1 are not likely to pose an unacceptable carcinogenic risk or noncancer hazard to a current or hypothetical future receptors at the site based on USEPA guidelines and target risk levels."

Comment 2. Section 3.3, Page 3-3, Second Paragraph. This paragraph begins by referencing soil samples collected during Phase I. However, since the date of the sampling was August 1992, the reference should be changed to Phase IIA.

Response: Agreed. Changes to the text will be made.

Comment 3. Section 6.5, Page 6-17, First Paragraph. This paragraph references paragraphs 5.2.5.1 and 5.2.5.2 which do not exist in this report. The correct references are most likely paragraphs 6.5.1 and 6.5.2, respectively. This discrepancy should be addressed.

Response: The references will be corrected to read 6.5.1 and 6.5.2 as indicated.

Comment 4. Section 6.6, Page 6-28, Last Bullet of the Section. This bullet contains a note that reads "see Subsection 6.2.5," however no such subsection exists within this RI. This note should be modified to reference the appropriate section of the RI.

Response: The reference will be corrected to read "Section 5.5.2".

Comment 5. Section 7.3, Page 7-8, First Paragraph. This paragraph states that findings from the background investigation conducted at NAS Whiting Field are presented in Section 5.4 of the RI. However, Section 5.4 on page 5-8 of the RI contains results of the subsurface soil investigation, not the background investigation. This discrepancy should be addressed.

Response: The reference will be corrected to read "Section 3.3 of this report."

Comment 6. Section 9.1, Page 9-2, First Bullet. This bullet states the "HHRA determined that exposure to chemicals detected in soil and groundwater samples at Site 1 are not likely to pose an unacceptable carcinogenic risk or noncancer hazard to a current or hypothetical future resident at the site." The RI also determined that an occupational worker was unlikely to experience any unacceptable risks or hazards from contact with the soil and groundwater at this site. The text of this bullet should be modified to include the occupational worker.

Response: The bullet will be revised to include all current and future hypothetical future receptors. The revised text will read "HHRA determined that exposure to chemicals detected in soil and groundwater samples at Site 1 are not likely to pose an unacceptable carcinogenic risk or noncancer hazard to a current or hypothetical future receptors at the site based on USEPA guidelines and target risk values."

**EPA Review Comments for the
Human Health & Ecological Risk Assessment Sections of the
Remedial Investigation Report, Site 1, Northwest Disposal Area**

General Comment 1. Only one subsurface sample was collected at the site. The sample was collected from a test excavation at a location where a magnetic anomaly was reportedly detected. Although this site may have represented an assumed biased location, it is not evident from the material presented that the subsurface soils have been adequately characterized. Additional samples were not collected during subsequent subsurface investigation, such as the installation of groundwater monitoring wells. A rationale for not collecting additional subsurface soil samples and a statement defending the adequacy of the one sample collected should be provided in the text.

Response: The subsurface soil sample was collected in part to determine if "hotspots" were present in the landfill. Based on the facility records, absence of additional geophysical anomalies, and the subsurface soil sample analytical results; the site was determined not to be a "hotspot" type landfill. USEPA guidance (USEPA 1991, Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites, February, 1991) does not recommend subsurface soil investigations at non "hotspot" landfills. Therefore additional subsurface soil samples were not warranted given the presumptive remedy of capping as the remedial measure. The document text will be expanded to explain this rationale.

General Comment 2: Several important methods are inserted directly from the General Information Report without having been modified to make them specific to Site 1. As a result, when alternate methods are presented, it is not always clear what procedures are used for the Site 1 ERA. Also, part of the discussion of uncertainties is not modified to be specific to Site 1. The text should be modified so that it is specific to Site 1.

Response: The text will be modified so that the methodology is specific to Site 1.

General Comment 3: Inhalation and dermal exposure pathways are considered to be insignificant exposure routes and are not discussed in detail. However, inhalation and dermal absorption may be important exposure routes when assessing the total risk from certain chemicals to ground-dwelling species. Additional discussion about the risks from these routes is needed.

Response: The following text will be added to Section 7.2.2 (Identification of Exposure Pathways). In addition, a qualitative discussion of the inhalation and dermal exposure pathways will be added to the Uncertainties Analysis.

"All potential routes of exposure are considered in the ERA and are presented in the contaminant pathway model. The model differentiates between those exposure routes that are quantitatively evaluated and those that are qualitatively discussed. This limitation is necessary

to focus the risk evaluation on those pathways for which contaminant exposures are the highest and most likely to occur. Those pathways that cannot be qualitatively evaluated due to a lack of toxicological information are qualitatively discussed and addressed as uncertainties.

Dermal adsorption is considered to be a negligible exposure pathway because the presence of fur and feathers is likely to prevent contamination from coming in direct contact with the skin (personal communication with Ted Simon, USEPA Region 4, September 1997). In addition, soil trapped in the fur or feathers is likely to be ingested during grooming or preening activities, which are evaluated as part of the indirect ingestion exposure pathway.

Exposure via inhalation of fugitive dust is also not likely to be a significant exposure pathway because the vegetation at Site 1 would limit the release of fugitive dust. Exposures associated with VOCs are not evaluated because only one VOC (xylene) was detected in the surface soil at Site 1. Xylene was detected in only two out of eight samples at a maximum concentration of 2 ug/kg. In addition, no evidence of burrowing animals and/or burrows was observed at Site 1 during the 1995 site characterization."

General Comment 4: The risks to herbivorous birds are not addressed in the ERA. A representative species should be included as a receptor.

Response: An herbivorous bird, the mourning dove, will be added to the list of representative wildlife species.

General Comment 5: In calculating risk, it was assumed that chromium, lead, and mercury at Site 1 are present in their least toxic form. No chemical speciation analyses were conducted. The risk assessment should be conducted assuming that the chemicals exist in their most toxic form, and the possible overestimate of risk resulting from this assumption should be discussed.

Response: The risk assessment will be modified assuming that chromium, lead, and mercury exist in their most toxic form at Site 1, and the possible overestimate of risk resulting from this assumption will be discussed as part of the Uncertainty Analysis.

It should be noted, however, that although chemical speciation of these ECPCs was not conducted, the available evidence suggests that site conditions are unlikely to result in the conversion of these metals to their most toxic forms. Conversion of trivalent to hexavalent chromium is not likely at Site 1 because the more toxic, hexavalent form of chromium usually occurs in aqueous environments, particularly for sediments with strong redox potentials. Similarly, it is unlikely that mercury exists in most toxic form, methylmercury, because methylation of inorganic mercury also occurs in aquatic environments via biological processes. Review of disposal practices at Site 1 also supports the assumption that these metals are not present in their most toxic form. There is no history of disposal of tetraethyl lead at the site. Given that paints were one of the waste types disposed of at Site 1, it is likely that both lead and mercury were disposed of in the less toxic, inorganic form.

General Comment 6: The risk to predatory mammals from dieldrin was calculated using the wrong toxicity reference value (TRV). The actual risk from dieldrin is 20x greater than that reported in the ERA.

Response: The TRV for dieldrin will be revised as requested in Specific Comment #20. However, use of this conservative TRV for dieldrin will also be discussed as a potential uncertainty. The TRV for dieldrin is based on continuous exposure to dogs for 2 years, and the noted effects are not likely to be observed in an individual, such as the red fox, which only utilizes the Site 1 area for a percentage of its total foraging frequency.

SPECIFIC COMMENTS

Specific Comment 1. Section 6-1, Page 6-2: The text indicates that only groundwater analytical data from RI Phase IIB was used for the human health risk assessment. This is inconsistent with information presented in Section 5.5.2, Page 5-15, which suggests that additional contaminants that were detected during Phase IIA were also evaluated. This potential discrepancy should be clarified.

Response: The text in section 6-1 is correct - only groundwater analytical data from the RI Phase IIB was used for the human health risk assessment. The text in section 5.5.2 will be revised to be consistent with the approach used in the HHRA.

Specific Comment 2. Section 6-2, Page 6-2: The text states that frequency of detection is a potential criterion for excluding detected contaminants from consideration as a contaminant of potential concern. Given the relatively few samples collected, this criterion should be eliminated from the text.

Response: Text will be added to this bullet to clarify that this criteria is only considered when there are greater than 20 samples in the specific media. The revised text will read

“Less than 5 Percent Frequency of Detection. If an analyte has a frequency of detection (number of samples in which the analyte is detected divided by the number of samples analyzed for that analyte) less than 5 percent (USEPA, 1995a) and is not selected as an HHCP in another medium, it is not selected as an HHCP. The frequency of detection screening criteria is only considered when there is greater than 20 samples in a specific media; therefore, no HHCPs were eliminated from this HHRA based on this screening criteria.”

Specific Comment 3 Section 7.2.1, Page 7-3, Paragraph 4: The text states that “Potential contaminant exposures for reptiles and amphibians exist at NAS Whiting Field, but these exposures were not evaluated in the ERA due to a lack of available data relating contaminant exposures to adverse responses for amphibians and reptiles.” If quantitative exposure data are not available, a general discussion of the anticipated risks to reptiles and amphibians should be included in Section 7.6, Risk Characterization (which includes a discussion of uncertainties) of the ERA.

Response: A general discussion of the anticipated risks to reptiles and amphibians will be added as part of the Uncertainty Analysis in Section 7.7.

Specific Comment 4 Section 7.2.1, Page 7-3, Paragraph 7: The text states that “The ERA only evaluated exposure pathways where contaminant exposures were the highest and most likely to occur and where adequate data pertaining to the receptors, contaminant exposure, and toxicity for completion of risk analyses were available. Pathways not meeting these criteria

were not included in the conceptual model.” No definition of “adequate data” is provided. Exposure pathways that appear to present risk cannot be eliminated from the ERA simply because data specific to the situation are not readily available. Rather, data from related species and similar chemicals can be used, and logical assumptions can be made. At a minimum, risk that cannot be quantified must be addressed qualitatively. This statement should be modified accordingly, and the ERA must address all potential exposure pathways.

Response: Please refer to the response to General Comment #3. All exposure pathways will be either qualitatively or quantitatively evaluated in the ERA. The term “adequate data” will be deleted from Section 7.2.1 as shown in the response to General Comment #3.

Specific Comment 5 Section 7.2.2, Page 7-3, Paragraph 8; and Page 7-4, Figure 7-1: The text states that “The ERA assumed that fur, feathers, or chitinous exoskeleton limit the transfer of contamination across the dermis; therefore, exposures related to dermal contact were not evaluated.” Although fur and other external coverings will reduce exposure to contaminants, they do not completely eliminate exposure. A portion of the skin is not covered (foot pads, ears, nose, etc.), and soil and water will reach the skin surface under any external covering. Dermal exposure must be included as an exposure pathway. If no quantitative exposure data are available, a general discussion of the anticipated risks associated with dermal exposure should be included in Section 7.6, Risk Characterization (which includes a discussion of uncertainties) of the ERA.

Response: Please refer to the response to General Comment #3. In addition, a general discussion of the anticipated risks associated with dermal exposure will be included as part of the Uncertainty Analysis in Section 7.7.

Specific Comment 6 Section 7.2.2, Page 7-4, Figure 7-1: Inhalation of contaminants associated with airborne soil particles is not addressed, but may be an important route of exposure to ground-dwelling and burrowing animals. If no quantitative exposure data are available, a general discussion of the anticipated risks associated with inhalation of dust should be included in Section 7.6, Risk Characterization (which includes a discussion of uncertainties) of the ERA.

Response: Please refer to the response to General Comment #3. In addition, a general discussion of the anticipated risks associated with inhalation exposure will be included as part of the Uncertainty Analysis in Section 7.7.

Specific Comment 7 Section 7.3, Page 7-10 and 7-11, Table 7-2: The third column in Table 7-2 is headed “Reporting limit range”. In Table 5-3 (Summary of Surface Soil Analytical Results, page 5-6), the same data are listed under the heading “Range of detection limits”. The header “Range of detection limits” is more descriptive and should be used in Table 7-2. Also, the headers and other descriptive terms should be consistent throughout the document.

Response: Table 7-2 will be revised as requested. In addition, the headers and other descriptive terms will be revised so that they are consistent throughout the document.

Specific Comment 8 Section 7.3, Page 7-11, Table 7-2: In Table 7-2, the background screening concentration for zinc is reported to be 15.4 mg/kg. In Table 5-3 (Summary of Surface Soil Analytical Results, page 5-7), the background screening concentration for zinc is reported to be 17. The discrepancy regarding zinc should be resolved.

Response: The correct background screening concentration for zinc is 15.4 mg/kg. Table 5-3 will be revised to correct the discrepancy.

Specific Comment 9 Section 7.4.2, Page 7-12, Table 7-3: Regarding Soil Chemical Concentration, the text states "The maximum detected concentration of the ecological contaminants of potential concern (ECPCs) when the sample size is #9, and the lesser of the maximum detected concentration or the 95th percent upper confidence limit (UCL) when the sample size is #10." This statement is not specific to Site 1. Since the sample size at Site 1 is eight, the text should state that the soil chemical concentration is the maximum detected concentration of the ECPCs.

Response: The text will be revised as requested.

Specific Comment 10 Section 7.4.2, Page 7-13: No herbivorous birds are included as receptors in the Site 1 model. It is probable that strictly herbivorous avian species are found at Site 1 and that the calculated risks to these species are different than those to the Eastern Meadowlark, which consumes approximately 20% of its diet as plant materials. An herbivorous bird species should be included as a receptor.

Response: Please refer to the response to General Comment #4.

Specific Comment 11 Section 7.4.2, Page 7-18, Table 7-6: Footnote 2 states that the bioaccumulation factors (BAFs) for plant material are based on the assumption that plants are 80% water. This assumption applies to berries and leafy vegetables, but does not apply to grains, which have a moisture content of only 10%. Since the diet of the cotton mouse consists primarily of grains, the risks to the cotton mouse are underestimated. This source of uncertainty should be discussed in Section 7.6, Risk Characterization (which includes a discussion of uncertainties) of the ERA.

Response: The Uncertainty Section will be revised as requested.

Specific Comment 12 Section 7.5, Page 7-19, Paragraph 2, and Appendix F: The text states that lethal toxicity reference values (TRVs) are based on the LOAEL from an acute study, or, if a LOAEL is not available, on one-fifth of the lowest reported LD50. Based on the information provided in Appendix F, many lethal TRVs are based on one-fifth of the lowest reported LD50. It is unlikely that mammalian acute LOAEL values are unavailable for the very common contaminants of concern present at Site 1. Since acute LOAEL values are preferred, additional review of published toxicity data is warranted in order to identify acute LOAEL values that can be used in determining lethal TRVs.

Response: The Navy acknowledges that lethal TRVs were derived using one-fifth of the lowest reported LD50 because NOAEL values were generally unavailable for the Site 1 ECPCs. According to USEPA (1986), one-fifth of the LD50 value is considered to be protective against lethal effects for 99.9 percent of individuals in a test population. It is the Navy's belief that the extrapolated LD50 values are equivalent to LOAEL data from the literature. Therefore, it is assumed that the selected lethal TRVs are sufficiently protective of wildlife populations at NAS Whiting Field and additional review of published toxicity data is not warranted in this time. The Navy will, however, consider the need for additional review of toxicity data for future ecological risk assessments.

Specific Comment 13 **Section 7.5, Paragraph 3, and Appendix F:** The text states that sublethal TRVs are based on the NOAEL from a chronic or subchronic study or, if a NOAEL is not available, on one-fifth of a LOAEL from a chronic or subchronic study. It is unlikely that mammalian NOAEL values are unavailable for the very common contaminants of concern present at Site 1. Using arsenic as an example, Schroeder and Mitchner (1971, Arch. Environ. Health. 23:102-106) report a reproductive NOAEL based on a 3-generation study in rats, and Byron et al. (1967, Toxicol. Appl. Pharmacol. 10:132-147) report a growth/mortality NOAEL based on a 2-year study in dogs. Since chronic/subchronic NOAEL values are preferred, additional review of published toxicity data is warranted in order to identify NOAEL values that can be used in determining sublethal TRVs.

Response: The Navy believes that further review of published toxicity data is not warranted at this time; however, the need for additional review of toxicity data will be considered for future ecological risk assessments.

Sublethal TRVs for four of the eight Site 1 ECPCs (dieldrin, chromium, lead, and vanadium) are based on NOAEL values. Sublethal TRVs for the other four ECPCs are based on LOAEL data. When only NOAEL data are available (i.e., without corresponding LOAEL values), use of these values may potentially result in an over-estimation of risk to wildlife receptors (because a threshold for effects is not determined), LOAELs provide a better measure of the potential for population-level effects because they are selected based on sensitive individual-level endpoints (including growth rates, statistically significant decreases in the number of progeny, etc.).

The commentor specifically mentions a number of toxicity studies for arsenic. Further review of the background surface soil data for arsenic resulted in a revised background screening concentration for this analytes (see response to FDEP Comment 9). Because the maximum detected concentration of arsenic in surface soil at Site 1 is less than the revised background screening concentration, arsenic was not selected as an ECPC.

Specific Comment 14 **Section 7.5, Pages 7-19 and 7-20; Section 7.6, Page 7-23, Paragraph 1:** The text states that the assessment of risks from chromium, lead, and mercury is based on the toxicity values for the chemical species likely to be present at the site. The decision about which chemical species are present at Site 1 is based on environmental conditions, rather than chemical analyses, and the chemicals are always assumed to exist entirely in their least toxic form. The risk assessment should be conducted assuming that the chemicals exist in their most toxic form, and the possible overestimate of risk resulting from this assumption should be discussed.

Response: The risk assessment will be conducted assuming that chromium, lead, and mercury exist in their most toxic form, and the possible overestimation of risk resulting from this assumption will be discussed in the Uncertainty Analysis. In addition, please see the response to General Comment #5.

Specific Comment 15 **Section 7.6, Page 7-20, Paragraph 7:** The text refers to Table 2-5 (Potential Sources of Uncertainty in Ecological Risk Assessment) in the General Information Report (GIR) in lieu of presenting a detailed discussion of some of the uncertainties associated with the Site 1 ERA. However, many of the uncertainties listed in Table 2-5 do not pertain to Site 1, and others are too general to be of use in evaluating risks at Site 1. For example, in Table 2-5, a potential source of uncertainty is the summation of effects (HIs). The direction of the effect is listed as unknown, and the justification for the uncertainty states that

contaminants may be synergistic/antagonistic or conversely may have different mechanisms of actions. Since the toxicity and mechanisms of the nine contaminants of concern at Site 1 are well known, it is possible to confidently discuss whether the effect of these compounds is additive. Table 2-5 from the GIR should be modified to be specific to Site 1 and the modified table should be included in the Site 1 ERA.

Response: A discussion of the uncertainties associated with Site 1 ERA will be added as Section 7.7.

Specific Comment 16 **Section 7.6, Page 7-24 and 7-25:** In the qualitative discussion of risks from chromium and vanadium, the concentrations of these compounds in the surface soil at Site 1 are compared to their mean concentrations in surface soil in the Eastern United States as reported by Shacklette (1984). Soil survey data from such an extensive and varied geographical area should not be used for comparative purposes in an ERA, since most of the ecosystems and soils included in the survey are much different from the site being evaluated. Soil data from a more limited geographical area, such as base- or county-wide surveys, should be used for comparative purposes.

Response: The Navy agrees that the use of the Shacklette (1984) soil survey data may not be appropriate due to differences in soil type. Consequently, background surface soil data collected from NAS Whiting Field will be used to qualitatively evaluate risks from chromium and vanadium.

Specific Comment 17 **Tables E-1 and E-2.** Spot checks of the RBC values presented in these tables indicate that at least some of the concentrations have not been properly adjusted for a hazard index of 0.1. Specifically, the RBCs reported for dieldrin in surface soil and (2-ethylhexyl) phthalate in groundwater are off by a factor of 10. These values should be corrected, and the other RBCs presented in the table should be checked and corrected as necessary.

Response: No errors in the RBC values presented in the screening tables in Appendix C were identified during the Navy's review. The RBC values are adjusted for a hazard index of 0.1 only when that RBC is based on a noncarcinogenic endpoint (indicated by a N next to the value). The RBC values that are based on a carcinogenic endpoint (indicated by a 'C' adjacent to the value) are not adjusted. Therefore, no corrections to Tables C-1 through C-3 are necessary.

Specific Comment 18 **Tables E-1, E-2, and E-3.** Footnote 6 in each of the tables states that the screening value for chromium is based on the valency of chromium IV. This should be changed to chromium VI.

Response: The footnote will be revised as indicated.

Specific Comment 19 **Appendix F, Table F-2:** Several of the cited references, including the Integrated Risk Information System (IRIS) and the Registry of Toxic Effects of Chemical Substances (RTECS), are compilations of published toxicity information. Whenever possible, the original source of NOAEL, LOAEL, and LD50 values used in the ERA should be cited, rather than the secondary source.

Response: The citations from IRIS and RTECS refer to database searches that were performed to identify ingestion toxicity values for several analytes, many for which literature data are difficult to obtain. Primary literature citations were not provided with the search results; therefore, the articles were not obtained or reviewed. These ingestion toxicity data have been incorporated into numerous

ERAs completed by the Navy and reviewed by USEPA. Although the Navy agrees that reviewing the primary literature is preferable for deriving toxicity information, it does not believe that the cost and schedule implications are warranted. These data were used to reduce the uncertainty associated with potential data gaps; however, there are additional uncertainties associated with using the ingestion toxicity data without reviewing the articles first. Consequently, the following bullet will be added to the discussion of uncertainties:

“There is uncertainty associated with the ingestion toxicity data derived from the IRIS and RTECS database. The IRIS and RTECS data were obtained in 1993 and 1995, respectively, and the primary literature citation was not provided; therefore, the primary literature for these studies were not reviewed. This may have resulted in the selection of TRVs that may over-estimate or under-estimate potential risks to wildlife receptors. TRVs for xylene and dieldrin were obtained from IRIS, and arsenic and cadmium TRVs were obtained from RTECS.”

Specific Comment 20 **Appendix F, Table F-2, Page F-3:** For dieldrin, a sublethal TRV value of 0.1 mg/kg/day was selected for use in calculating risks to predatory mammals; this value is identified as one-fifth of a LOAEL. However, 0.1 mg/kg/day is not the lowest TRV value identified in Table F-2 for a comparable species (dog). Table F-2 lists a second dog study that resulted in a LOAEL of 0.05 mg/kg/day and a NOAEL of 0.005 mg/kg/day; these values were confirmed in IRIS 1997. Neither dog study is more applicable to the stated assessment endpoints since neither study was concerned with effects on reproduction and neither noted reductions in growth. Therefore, 0.005 mg/kg/day must be used as the TRV for dieldrin when calculating risks to predatory mammals, since it is derived from a NOAEL and it is the lowest TRV identified. The risk to predatory mammals from dieldrin must be recalculated.

Response: The sublethal TRV for dieldrin will be revised, and risks to predatory mammals will be recalculated as requested.

FDEP Review Comments for Remedial Investigation Report for Site 1, Northwest Disposal Area January 1998

Comment 1. Section 6.1: please elaborate on the reason that the 1993 sampling data were not utilized in the document.

Response: The report text will be amended as follows:

“The data set used for the HHRA is consistent with the data set described in the RI report. However, the groundwater evaluated in the HHRA is only from Phase IIB RI sampling event, the most recent sampling event (July 1996). The Phase IIB sampling event included low-flow groundwater sampling techniques as opposed to using a bailer. The low-flow sampling produced groundwater samples of low turbidity that are more representative of the actual aquifer conditions and were therefore indicated as the preferred data set.”

Comment 2. Section 6.2: In the last paragraph: concerning less than risk-based screening concentrations, the guidance followed in the selection of HHCPs may be counter to the latest guidance in a memo from Ted Simon, USEPA, dated November 10, 1997 concerning

Risk Assessments with the HSWA/RCRA Program. I recognize that the memo post-dates the document, but this should be checked. These comments also apply to footnote S in Table 6-1 (and perhaps others).

Response: The memorandum from Ted Simon, USEPA, dated November 10, 1997 concerning Risk Assessments with the HSWA/RCRA Program is not counter to the screening approach for NAS Whiting Field. The recent memorandum will not affect the outcome of the screening process used at NAS Whiting Field, because the lower of the MCL and the other risk-based screening values was selected as the screening value. The HHCP selection process at NAS Whiting Field is both conservative and consistent with the intent of Dr. Simon's memo. Dr. Simon's memo is intended to prevent the screening out of chemicals that are below promulgated standards but above risk-based screening criteria. The HHCP selection process used at Whiting Field retains all analytes that are above any risk based screening criteria. Therefore, revisions to the NAS Whiting Field HHCP selection process is not necessary.

Comment 3. Section 6.5: this section indicates that the risk characterization methodology follows Subsection 2.5.5 of the GIR. To my knowledge, this document has not been finalized. The Navy should assure that discrepancies do not exist because of this.

Response: The GIR was finalized in January 1998. There were no comments or resulting revisions to the GIR human health risk characterization methodology that would result in a discrepancy to the approach or results presented in the NAS Whiting Field Site 1 RI report

Comment 4. Section 6.5.1: The FDEP target risk should be corrected to 1×10^{-6} .

Response: The text will be revised as indicated.

Comment 5. Figures 6-2, et. seq.: the FDEP Target Risk should be added, as appropriate.

Response: The figures will be revised to include the FDEP Target Risk Value.

Comment 6. Table 6-9: the Florida Industrial SCGs should be added, as appropriate.

Response: Table 6-9 will be revised to include the Florida Industrial Soil Clean-up Goal.

Comment 8 Page 7-7: The use of the general term "inorganics" seems to border on "scientific slang." We are usually talking about selected inorganic species. I suggest the use of "selected" or other identifiers; for instance, "Toxicity resulting from selected inorganic exposures may.." or some similar usage. This is not a "burning issue" but it seems our publication would be improved by specificity since, after all, the soil on which we live and in which plants live is a mixture of "inorganics and organics" and represents a natural and beneficial arrangement. It is the specific organic and inorganic species which are sometimes detrimental.

Response: The term "inorganics" will be revised as requested.

Comment 9. I suggest that the recommendations in Section 9.2 be withheld until the materials leading to excess cancer risks (primarily Arsenic in surface soil) are adequately addressed.

The statement (bullet # 11) that the HHRA indicated that “chemicals detected in soil and ground water...are not likely to pose an unacceptable carcinogenic or noncancer risk to...a future resident of the site” is not consistent with State guidelines, considering the Arsenic content of surface soils; we should reconsider the statement. A similar conclusion is also made in the Executive Summary.

Response: The presence of arsenic in onsite surface soils will be addressed by the re-evaluation of the appropriate background data set for soils. An discussion of the modified background data set and its rationale will be included as an additional appendix (attached) to this report and to the GIR.. The report text will be modified to reflect this change.

**SOUTHDIV - Review Comments for
Remedial Investigation Report for Site 1, Northwest Disposal Area_
Linda Martin**

Comment: The document should be written in a more positive and conclusive tone not in a non-conclusive tone. In most case in the executive summary, chapters 6, 7, & 9 phrases like “thought to be, easily, primarily ect,” should be taken out. Another example of this is the whole paragraph on 8-8 stating “It is important.....an actual transport route. Also do a word search for “that’ and “which” and delete them from your sentences.

Response: The document is written in a tone that expresses the inconclusive nature of any and all Remedial Investigations. Phrases such as “thought to be, easily, primarily ect,” express the fact that although the site conditions indicated are believed to be accurate other conditions may be present and contributing to interpretations. Without unlimited funds and time all conditions can not be fully explored nor should be explored.

The referenced paragraph on page 8-8 will be deleted. ABB-ES editors will perform a word search for the occurrence of “that” and “which” and evaluate the appropriate usage of each occurrence. If the appropriateness of the occurrence is questionable, the word will be deleted and the sentence will be reworded.

Comment: Change section 7.1: Site Characterization to reflect the information in the Nature Conservancy Report 1997.

Response: Section 7.1 will be revised as follows: “Observations made during an ecological survey of NAS Whiting Field indicate that no State or federally listed rare, threatened, or endangered species or species of concern are known to inhabit Site 2 (Nature Conservancy, 1997).”

Comment: The 1993 groundwater data should not be used in any data set including risk assessment. In some places in the document you say the data is not used and in other places you say it is used.

Response: Agreed. The data was not used in the risk assessment and any references to such in the text will be deleted.

Appendix I

Evaluation of Background Arsenic Concentrations for Covered Landfill Sites

Naval Air Station (NAS) Whiting Field, Milton, Florida

At NAS Whiting Field nine soil types, as identified by the U. S. Department of Agriculture, Soil Conservation Service (USSCS), are present. The Remedial Investigation (RI) sites at NAS Whiting Field are associated with seven of the nine soil types. The background surface soil data set for each RI site was initially determined to be comprised of background surface soil samples from the same USSCS soil types as occur on the individual sites. However, available information and review of historical aerial photographs indicated that in the construction of landfills at the facility, a borrow pit was dug to an approximate depth of 10 to 15 feet below land surface (bls) and the excavated soil was piled to the side. Following landfill operations, the borrow materials comprised of undifferentiated surface and subsurface soils, were used for the landfill cover. Any additional soils required to complete the landfill cover are believed to have been obtained from other borrow pits located at the facility.

If a mix of surface and subsurface soils were used in the cover for landfills, it would be appropriate to use the combined data set of surface and subsurface soil samples as the background screening value. However in order to be protective of human health and the environment, it is proposed that the background surface and subsurface data set be combined to a single value as be used as the "Industrial Use Soil Cleanup Goal". This modified "Industrial Use Soil Cleanup Goal" is specifically limited to the covered landfill sites including: Site 1, 2, 9, 10, 11, 13, 14, 15, and 16 and to the inorganic analyte arsenic.

Tables 3-8 through 3-18 in the General Information Report present the detected concentrations and summarize the analytical data for the individual background soil samples collected at NAS Whiting Field. A summary of the arsenic background data set and the modified "Industrial Use Soil Cleanup Goal" for arsenic is presented Table I-1. As indicated on the table the modified "Industrial Use Soil Cleanup Goal" for arsenic to be used at covered landfill sites is 4.62 mg/kg.

**Table I - 1
Summary of Arsenic Detected in
Surface and Subsurface Background Soil Samples**

**Remedial Investigation
Naval Air Station
Whiting Field, Florida**

Analyte	Frequency of Detection Surface Soil Samples ¹	Mean of Detected Concentrations Surface Soil Samples ²	Frequency of Detection Subsurface Soil Samples ¹	Mean of Detected Concentrations Subsurface Soil Samples ²	Frequency of Detection Surface and Subsurface Soil Samples ¹	Mean of Detected Concentrations Surface and Subsurface Soil Samples ²	Surface and Subsurface Soil Background Screening Concentration (modified Industrial Use Cleanup Goal)
Inorganic Analytes (mg/kg)							
Arsenic	15/15	1.54	14/14	3.14	29/29	2.31	4.62

¹ Frequency of detection is the number of samples in which the analyte was detected divided by the total number of samples analyzed.

² The mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

Notes: mg/kg = milligram per kilogram.

Table I - 2
Comparison of Detected Arsenic Concentrations in Surface and Subsurface Soil Samples
to Florida Soil Cleanup Goals

Remedial Investigation
 Naval Air Station
 Whiting Field, Florida

Analyte	Minimum Detected Concentration	Maximum Detected Concentration	Mean of Detected Concentrations	Soil Cleanup Goals for Florida (Residential) ¹	Soil Cleanup Goals for Florida (Industrial) ¹	modified Industrial Use Cleanup Goal ²
Inorganic Analyte (mg/kg)						
Arsenic	0.52	6.3	2.31	0.8	3.7	4.62

¹ Source: FDEP Memorandum from John Ruddell, Director Division of Waste Management, to District Directors and Waste Program Administrators. Subject: Applicability of Soil Cleanup Goals for Florida, January 19, 1996.

² The modified Industrial Use Cleanup Goal for arsenic is twice the mean of detected concentrations in the surface and subsurface soil samples.

Notes: mg/kg = milligram per kilogram.