N60200.AR.009096
NAS CECIL FIELD
5090.3a

FINAL TECHNICAL MEMORANDUM HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

NAS CECIL FIELD FL

9/1/1992

ABB ENVIRONMENTAL

32215.017
03.09.17.0002

FINAL

TECHNICAL MEMORANDUM

HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

NAVAL AIR STATION CECIL FIELD

JACKSONVILLE, FLORIDA

SEPTEMBER 1992

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, SOUTH CAROLINA
29411-0068

DISTRIBUTION

	Final Report
SOUTHNAVFACENGCOM	1
NAS Cecil Field	1

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION: Unclassified	1b. RESTRICTIVE MARKINGS: N/A
2a. SECURITY CLASSIFICATION AUTHORITY: N/A	3. DISTRIBUTION/AVAILABILITY OF REPORT: N/A
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE: N/A	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S): N/A
6a. NAME OF PERFORMING ORGANIZATION: ABB Environmental Services, Inc. / 6b. OFFICE SYMBOL (*if applicable*): ABB-ES	7a. NAME OF MONITORING ORGANIZATION: Naval Air Station Cecil Field, Jacksonville, FL
6c. ADDRESS (*City, State, and ZIP Code*): 2590 Executive Center Circle East Tallahassee, FL 32301	7b. ADDRESS (*City, State, and ZIP Code*): Naval Air Station Cecil Field Cecil Field, FL 32215
8a. NAME OF FUNDING/SPONSORING ORGANIZATION: SOUTHNAVFACENGCOM / 8b. OFFICE SYMBOL (*if applicable*): N/A	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER: N62467-89-D-0317
8c. ADDRESS (*City, State, and ZIP Code*): 2155 Eagle Drive P.O. Box 10068 Charleston, SC 29411-0068	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (*Include Security Classification*)

Human Health Risk Assessment Methodology Technical Memorandum

12. PERSONAL AUTHOR(S)

Michelle A. Silkowski and Gregory A. Beumel

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (*Year, Month, Day*)	15. PAGE COUNT
Final	FROM ____ TO ____	1992 September 9	41

16. SUPPLEMENTARY NOTATION

None

17. COSAT: CODES		
FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS (*Continue on reverse if necessary and identify by block number*)

CERCLA, Baseline Risk Assessment, Remedial Investigation, Feasibility Study, exposure assessment, exposure assumptions, landfill, seepage pit

19. ABSTRACT (*Continue on reverse if necessary and identify by block number*)

Previous investigations have determined that Naval Air Station (NAS) Cecil Field has 18 waste sites that may pose a threat to human health or the environment. This Technical Memorandum (TM) provides information that will be used in an assessment of human health risks for Operable Units 1, 2, and 7 at NAS Cecil Field (7 sites). The TM includes the methodology that will be used in the selection of chemicals of concern, current and future use exposure scenarios, and exposure assumptions for the Baseline Risk Assessment and the No Further Action assessment. The human health risk assessments will be completed as part of the Remedial Investigation and Feasibility Study for these operable units.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☐ Unclassified/Unlimited ■ Same as RPT ☐ DTIC Users	Unclassified

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (*Include Area Code*)	22c. OFFICE SYMBOL
Sid Allison	(803)743-0600	Code 18

FINAL

TECHNICAL MEMORANDUM

HUMAN HEALTH RISK ASSESSMENT METHODOLOGY
OPERABLE UNITS 1, 2, AND 7
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

UIC: N60200

Contract No. N62467-89-D-0317

Prepared by:

ABB Environmental Services, Inc.
2590 Executive Center Circle East
Tallahassee, Florida 32301

Prepared for:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
Charleston, South Carolina 29411-0068

Cliff Casey, Engineer-in-Charge

September 1992

FOREWORD

The Department of the Navy developed the Installation Restoration (IR) program to locate, identify, and remediate environmental contamination from the past disposal of hazardous materials at Navy and Marine Corps installations. The Navy IR program follows the Department of Defense Environmental Restoration Program mandated by the Superfund Amendments and Reauthorization Act of 1986 to address waste sites that may pose a threat to human health or the environment.

The IR program consists of Preliminary Assessment and Site Inspection, Remedial Investigation and Feasibility Study (RI/FS), and Remedial Design and Remedial Action at sites where chemicals were allegedly disposed. The Preliminary Assessment and Site Inspection identifies the presence of pollutants. The RI/FS analyze the nature and extent of contamination and determine the optimum remedial solution. The Remedial Design and Remedial Action complete the implementation of the solution.

Previous investigations have determined that Naval Air Station (NAS) Cecil Field has 18 waste sites that may pose a threat to human health or the environment. Therefore a RI/FS will be performed to address the extent, magnitude, and impact of possible contamination at these waste sites.

This Technical Memorandum provides information to be used for the assessment of human health risks for operable units 1, 2, and 7 at NAS Cecil Field. The information includes the methodology that will be used in the selection of chemicals of concern, exposure scenarios, and exposure assumptions for the human health risk assessment.

Questions regarding this report should be addressed to the Commanding Officer, Code OOB, P.O. Box 111, NAS Cecil Field, Jacksonville, Florida 32215-0111.

EXECUTIVE SUMMARY

This Technical Memorandum (TM) describes the preliminary information gathered for the Baseline Risk Assessment (BRA) of the Remedial Investigation (RI) to be conducted for three operable units containing seven waste sites located at Naval Air Station (NAS) Cecil Field near Jacksonville, Florida. The operable units, grouped according to either similar location or media, contain confirmed sources of contaminants. The RI and Feasibility Study (FS) are being conducted as part of the Navy's Installation Restoration program and the objective is to identify and evaluate past hazardous waste sites and control the migration of hazardous contaminants from those sites.

The TM provides information to be used for the assessment of human health risks for Operable Units (OUs) 1, 2, and 7 at NAS Cecil Field. The information includes the methodology that will be used in the selection of chemicals of concern, exposure scenarios, and exposure assumptions for the human health risk assessment.

The methodology used to select chemicals of concern is based upon comparisons of detected concentrations of each chemical with concentrations in background samples and field blanks. Chemicals will also be compared to the Screening Criteria Values during the selection process. Chemicals considered to be essential nutrients or having low toxicity will not be considered as chemicals of concern.

Exposure scenarios and exposure assumptions for human receptors are identified for evaluation in the BRA. The exposure scenarios chosen are based on current conditions and uses at the operable units.

Exposure scenarios are identified for the three operable units. The exposure scenarios chosen for evaluation in the BRA for OU 1 include incidental ingestion and dermal contact with surface soils for an adult site worker and an adult and child transient. Ingestion and dermal contact with surface waters during swimming or wading and ingestion of fish will be evaluated for both adult and child transients. The fish ingestion and contact with surface waters in the swimming scenario will be evaluated based on data collected from Rowell Creek and Lake Fretwell.

The exposure scenarios for OU 2 will be the same as for OU 1 but will also include inhalation of soil particulates suspended in air for an adult worker, an adult and child transient. The exposure scenarios selected for OU 7 will include incidental ingestion and dermal contact with surface soils and inhalation of volatiles from soil for an adult site worker and an adult occupational worker.

Potential future uses of the operable units are considered in the No Further Action (NFA) assessments. The NFA assessment will evaluate potential future residential exposures at

OUs 1 and 2. Future residential use of OU 7 is unlikely due to the proximity to the NAS Cecil Field runway and the industrial nature of the area.

The ecological assessment for both the BRA and NFA assessment will not be addressed in this document. It will be presented in a separate TM.

TABLE OF CONTENTS

Technical Memorandum
Human Health Risk Assessment Methodology
NAS Cecil Field, Jacksonville, Florida

Section	Title	Page No.
1.0	INTRODUCTION	1-1
2.0	SITE BACKGROUND AND SETTING	2-1
2.1	WASTE SITES AND OPERABLE UNITS	2-1
2.1.1	Operable Unit 1 (Sites 1 and 2)	2-1
2.1.2	Operable Unit 2 (Sites 3, 4, 5, and 17)	2-5
2.1.3	Operable Unit 7 (Site 16)	2-6
2.2	ENVIRONMENTAL SETTING	2-6
2.2.1	Topography	2-6
2.2.2	Surface Hydrology	2-6
2.2.3	Regional Geology	2-9
2.3	DEMOGRAPHIC INFORMATION	2-9
2.3.1	Population	2-9
2.3.2	Navy Supply Wells	2-12
2.3.3	Private Wells	2-12
2.5	MIGRATION POTENTIAL AND EXPOSURE PATHWAYS	2-14
3.0	METHODOLOGY FOR THE SELECTION OF CHEMICALS OF CONCERN	3-1
3.1	EVALUATION PROCESS	3-1
3.1.1	Exposure Point Concentration	3-2
3.1.2	Tentatively Identified Concentrations	3-2
4.0	SCOPE OF BASELINE RISK ASSESSMENT	4-1
4.1	HUMAN HEALTH RISK ASSESSMENT	4-1
4.1.1	Current Use Exposure Assessment	4-1
4.1.1.1	Operable Unit 1	4-7
4.1.1.2	Operable Unit 2	4-7
4.1.1.3	Operable Unit 7	4-10
4.1.1.4	Rowell Creek and Lake Fretwell	4-10
5.0	SCOPE OF NO FURTHER ACTION ASSESSMENT	5-1
5.1	HUMAN HEALTH	5-1
	REFERENCES	

LIST OF FIGURES

Technical Memorandum
Human Health Risk Assessment Methodology
NAS Cecil Field, Jacksonville, Florida

Figure	Title	Page No.
2-1	General Location Map	2-2
2-2	Location of Waste Sites, Operable Units 1, 2, and 7	2-3
2-3	Major and Minor Drainage Basins	2-7
2-4	Geologic Profile for Aquifers	2-10
2-5	Generalized Geologic Column	2-11
2-6	Supply Well Location Map	2-13
2-7	Contaminant Pathway Model, Operable Unit 1	2-15
2-8	Contaminant Pathway Model, Operable Unit 2	2-16
2-9	Contaminant Pathway Model, Operable Unit 7	2-17

LIST OF TABLES

Technical Memorandum
Human Health Risk Assessment Methodology
NAS Cecil Field, Jacksonville, Florida

Tables	Title	Page No.
4-1	Proposed Exposure Pathways, Operable Units 1, 2, and 7	4-3
4-2	Adult Site Worker, Incidental Ingestion and Dermal Contact with Surface Soils	4-4
4-3	Adult Occupational Worker, Incidental Ingestion and Dermal Contact with Surface Soils	4-5
4-4	Adult and Child Transient, Incidental Ingestion and Dermal Contact with Surface Soils	4-6
4-5	Adult and Child Transient, Incidental Ingestion and Dermal Contact with Surface Waters	4-8
4-6	Adult and Child Transient, Fish Ingestion Based on Surface Water Concentrations	4-9
5-1	Adult and Child Future Residents, Incidental Ingestion and Dermal Contact with Surface Soils	5-2
5-2	Adult Future Resident, Ingestion of Groundwater	5-4
5-3	Adult and Child Future Resident, Dermal Contact with Groundwater	5-5
5-4	Adult Future Resident, Inhalation Exposure to Volatile Compounds While Showering	5-6

GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chemical of concern
CSF	cancer slope factor
DCV	detected comparison value
FDER	Florida Department of Environmental Regulation
FG&FWFC	Florida Game & Fresh Water Fish Commission
FS	Feasibility Study
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HRS	Florida Department of Health and Rehabilitative Services
IR	Installation Restoration
IRIS	Integrated Risk Information System
kg	kilograms
µg/dl	micrograms per deciliter
NAS	Naval Air Station
NFA	No Further Action
OLF	Outlying Landing Field
OU	operable unit
PAHs	polycyclicaromatic hydrocarbons
PCBs	polychlorinated biphenyls
PS	public supply
QA/QC	quality assurance/quality control
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
SCV	screening criteria value
SOUTHNAVFAC-ENGCOM	Southern Division Naval Facilities Engineering Command
TICs	Tentatively Identified Compounds
TM	Technical Memorandum
95% UCL	95 percent upper confidence limit
USEPA	U.S. Environmental Protection Agency

1.0 INTRODUCTION

This Technical Memorandum (TM) provides information to be used for the assessment of human health risks for seven hazardous waste sites at Naval Air Station (NAS) Cecil Field. These seven sites have been grouped into three distinct areas called operable units (OUs). The TM identifies the methodology that will be used in the selection of chemicals of concern (COC), exposure scenarios, and exposure assumptions that will be used in the BRA and No Further Action (NFA) risk assessment for each operable unit. The Baseline Risk Assessment (BRA) is required as part of the Remedial Investigation (RI) for hazardous waste sites under U.S. Environmental Protection Agency (USEPA) guidance (USEPA, 1988a). An evaluation of risks associated with the NFA alternative is required as part of the Feasibility Study (FS) for each site.

The risk assessments conducted for OUs 1, 2, and 7 at NAS Cecil Field will follow the current USEPA guidance for conducting risk assessments at Superfund sites (USEPA, 1988b; 1989a; 1989b; 1989c; 1991b; 1992a; 1992c) and USEPA Region IV guidance for Superfund risk assessments (USEPA, 1991c) as stated in the RI/FS Workplan (ABB-ES, 1991a). A final risk assessment including potential additive risks will be submitted with the RI/FS report for each operable unit.

The hazardous waste sites grouped by operable unit, the environmental setting, demographic information, and migration potential are described in Chapter 2.0. The methodology that will be used to select chemicals of concern is discussed in Chapter 3.0. Chapter 4.0 presents the exposure scenarios and assumptions to be evaluated in the BRA, and Chapter 5.0 describes the exposure scenarios and assumptions to be evaluated for the NFA assessment.

The BRA will include both human health and ecological assessments. The methodology for performing the ecological assessment will be addressed in a separate TM.

2.0 SITE BACKGROUND AND SETTING

NAS Cecil Field is located in the northeastern part of Florida, primarily within Duval County with the remaining located in the southernmost part in Clay County (Figure 2-1). Downtown Jacksonville lies approximately 14 miles northeast of the facility's main entrance. The Georgia state line is located approximately 15 miles north.

NAS Cecil Field was established in 1941 and has grown in size to occupy more than 31,000 acres. The facility can be divided into four distinct areas: the main station (NAS Cecil Field) which occupies 9,516 acres; the Yellow Water Weapons Area, which, occupies 8,091 acres; Outlying Landing Field (OLF) Whitehouse, which occupies 2,587 acres; and the 11,072-acre Land Target Complex Detachment Astor, which includes Pinecastle, Electronic Warfare Range, Stevens Lake, Lake George, and Rodman Ranges (Envirodyne Engineers, 1985). NAS Cecil Field and the Yellow Water Weapons Area are bisected by State Road 228, effectively separating the two areas. OLF Whitehouse lies approximately seven miles north of the main entrance, which is located near the intersection of State Road 228 and 103rd Street.

The official mission of NAS Cecil Field is to provide facilities, services, and material support for the operation and maintenance of naval weapons and aircraft and other units of the operating forces as designated by the Chief of Naval Operations. Some of the tasks required to accomplish this mission include (1) operation of fuel storage facilities, (2) performance of aircraft maintenance, (3) maintenance and operation of an engine repair facility and test cells for designated turbo-jet engines, and (4) support of special weapons systems.

2.1 WASTE SITES AND OPERABLE UNITS. Waste sites located at NAS Cecil Field have been divided into seven operable units based on types of waste disposed or typical profiles of suspected contaminants (SOUTHNAVFACENGCOM, 1991). OU 1 (Sites 1 and 2), OU 2 (Sites 3, 4, 5, and 17), and OU 7 (Site 16) are located at the main station (Figure 2-2). These operable units are included in the first RI set of investigations and will be discussed in this document. The remaining four operable units will be addressed under separate investigations.

2.1.1 Operable Unit 1 (Sites 1 and 2) Sites 1 and 2, the Old and Recent Landfills, respectively, are included in OU 1. These landfills reportedly received solid and liquid wastes from various activities at NAS Cecil Field. The sites physically overlap and have been partially covered with unidentified fill (ABB-ES, 1991a). A significant amount of vegetation has been observed at both sites (ABB-ES, 1991b). A ditch runs along the east side of Site 1 (west side of Site 2) and drains into Rowell Creek. At the time of observation, the ditch contained flowing water (ABB-ES, 1992).

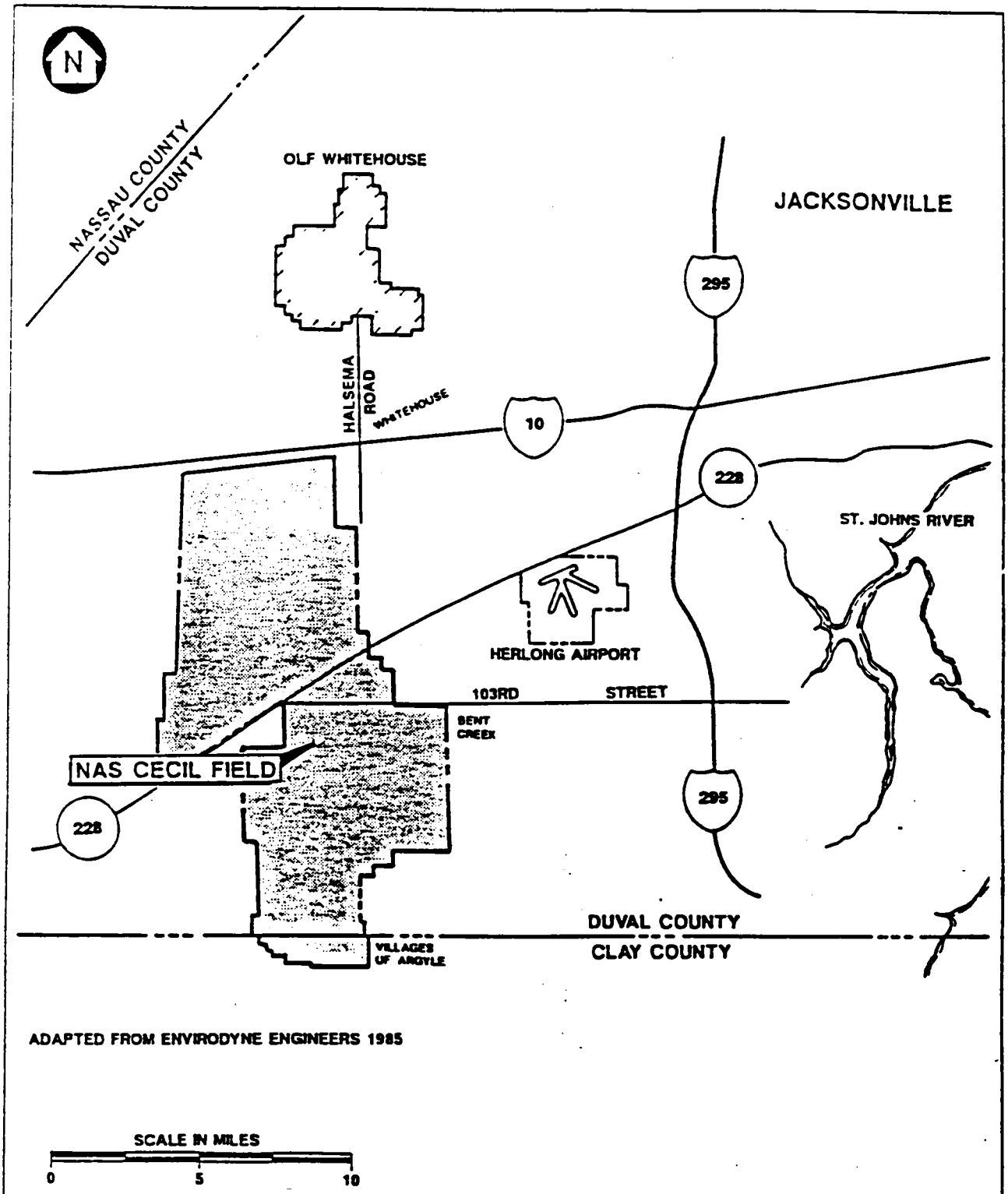


FIGURE 2-1

GENERAL LOCATION MAP

HUMAN HEALTH RISK ASSESSMENT METHODOLOGY TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA

HHRAMTMCF

0753727

PRINTED ON RECYCLED PAPER

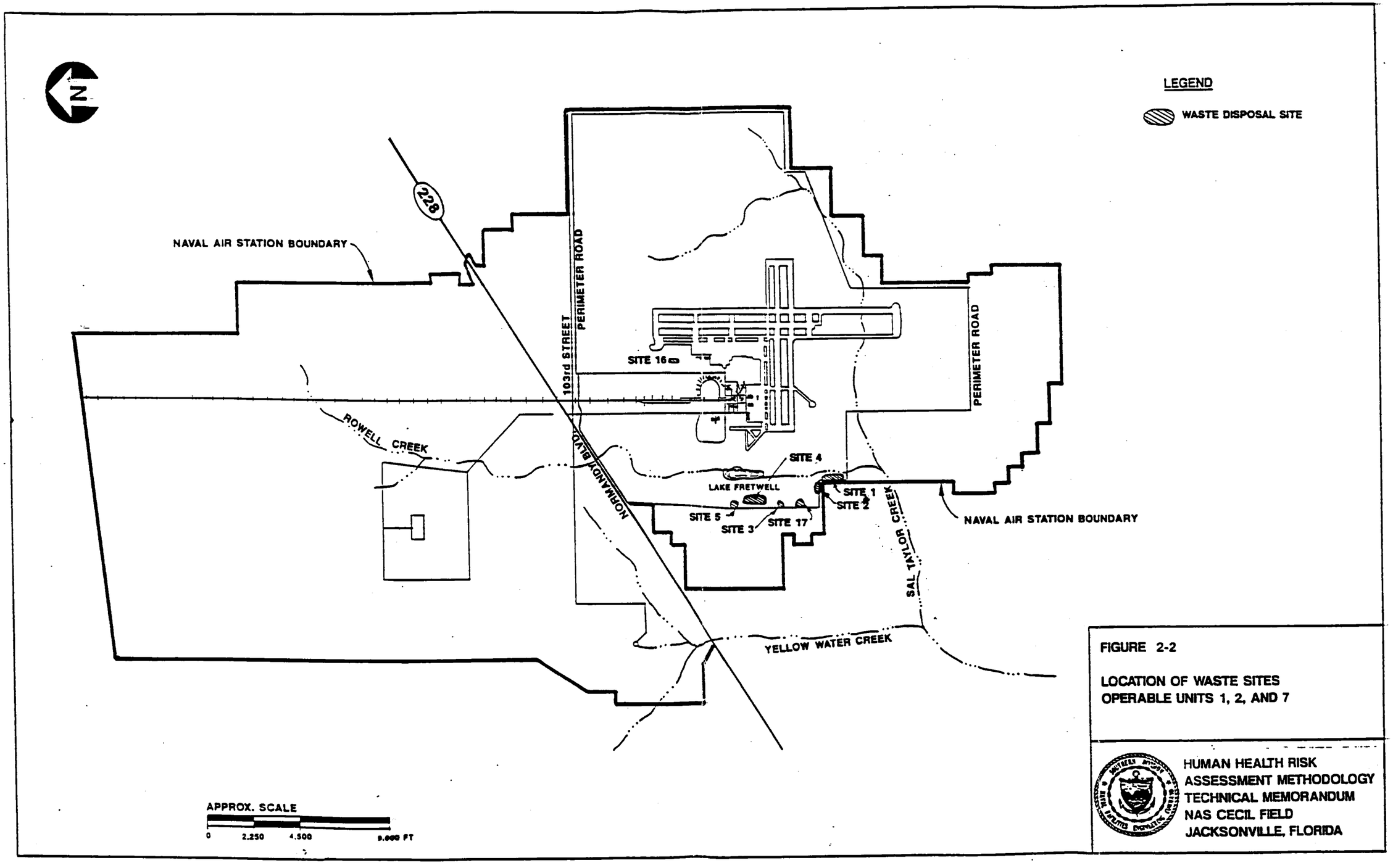


FIGURE 2-2

LOCATION OF WASTE SITES
OPERABLE UNITS 1, 2, AND 7

HUMAN HEALTH RISK
ASSESSMENT METHODOLOGY
TECHNICAL MEMORANDUM
NAS CECIL FIELD
JACKSONVILLE, FLORIDA

0753727

HHRAMTMCF

Site 1 is reported to be a 9-acre trench and fill landfill (1,250 feet north to south by 425 feet east to west) that was used daily for the burning of solid and some liquid and chemical waste from NAS Cecil Field (Envirodyne Engineers, 1985). During its time of operation (early 1950's through 1965), Site 1 was the only landfill operated at the facility. Wastes were placed in direct contact with groundwater at the time of disposal (Envirodyne Engineers, 1985). Vegetation existing at the site includes various herbs, vines, shrubs, saplings, ferns, red maple, slash pine, water oaks, and sweetgum (ABB-ES, 1991b).

Site 2 is reported to be a 5-acre trench and fill landfill (375 feet north to south by 600 feet east to west) that received all of the solid and some of the chemical and liquid waste from NAS Cecil Field from 1965 through 1975. Trenches approximately 600 feet long, averaging 11 feet wide and 11 feet deep, were reported to be oriented from east to west (Envirodyne Engineers, 1985). Burning was not intentionally done, although fires did periodically occur. Portions of the waste were placed in direct contact with groundwater. Suspected waste types disposed of at Site 2 include metals, polychlorinated biphenyls (PCBs), and pesticides (Envirodyne Engineers, 1985). Vegetation at the site includes herbs, shrubs, and numerous slash pine (ABB-ES, 1991b).

2.1.2 Operable Unit 2 (Sites 3, 4, 5, and 17) Sites 3, 4, 5, and 17 were reportedly used for the disposal of oil and/or grease wastes. In general, these sites contain mixed oil, sludge, and grease wastes that were disposed in unlined shallow pits. In some areas, liquids were burned and pits were generally covered with fill when full. The source of this fill was not identified. Portions of each site are cleared while other areas are overgrown with shrubs and slash pines (ABB-ES, 1991b).

The Oil and Sludge Disposal Area (Site 3) is reported to be a 50 to 100-foot diameter pit, 3 to 5 feet deep that was used to dispose of liquid wastes and sludge. The wastes were burned once every 3 months (Envirodyne Engineers, 1985). The disposal pit operated from the mid-1950's through 1975.

The Grease Pits (Site 4) encompass an area of approximately nine acres located to the west of Lake Fretwell along Perimeter Road. Semi-solid wastes (including grease from messes and liquid wastes from shops) were disposed from the 1950's until 1983 (Envirodyne Engineers, 1985). Typical disposal operations at the site consisted of placing wastes into excavated pits where they were allowed to seep into the soil or evaporate. The pit was covered with soil when full and a new pit was excavated. Numerous pits of varying sizes exist throughout the site.

The Oil Disposal Area Northwest (Site 5) is a 100-foot diameter disposal area (0.5 acre) (Envirodyne Engineers, 1985). The area operated in the 1950's. Unknown quantities of petroleum wastes (fuels and oils), solvents, paints, thinners, and waste paint with cadmium, chromium, and lead were disposed of at Site 5. Portions of the site are oil-stained and void of vegetation (ABB-ES, 1992). A petroleum odor was present at the site in 1985. Ponding

of water was also observed (Envirodyne Engineers, 1985). Oil or fuel disposal after the 1950's is probable (Envirodyne Engineers, 1985).

The Oil and Sludge Disposal Pit Southwest (Site 17) is an unlined disposal pit about 50 feet in diameter and 3 to 5 feet deep. The exact location of the pit, within the two-acre site, has not been determined. The pit operated from the late 1960's to the early 1970's (Envirodyne Engineers, 1985).

2.1.3 Operable Unit 7 (Site 16) Site 16 consists of the Aircraft Intermediate Maintenance Department Seepage Pit, which is designated as OU 7. Site 16 reportedly contains a 40-feet long by 3.0-feet wide by 9.5-feet deep, slotted, concrete block seepage pit with a stormwater drainage pipe, which discharges to several open ditches (Envirodyne Engineers, 1985). These drainage ditches eventually discharge to Sal Taylor Creek after passing under the NAS Cecil Field runways.

The seepage pit was used for disposal of liquid waste from an engine maintenance shop and test lab. Adjacent to this pit is a holding tank that was used to hold wastes prior to their discharge into the seepage pit. The surface of Site 16 is grass covered and mown. No additional vegetation is present at the site (ABB-ES, 1991b; ABB-ES, 1992). Suspected wastes estimated to have entered the seepage pit include 26 million gallons of rinse water containing sodium cyanide, trichloroethylene, creosol, phenol, methylene chloride, and oil. Wastes may also include greases, rust, and paint removed during the jet engine parts cleaning process (Envirodyne Engineers, 1985). Although posted warnings exist at the site, barriers to prevent contact (e.g., fences) are not present (ABB-ES, 1992).

2.2 ENVIRONMENTAL SETTING.

2.2.1 Topography The topography of Duval County's 840 square miles is controlled by a series of ancient marine terraces that have been dissected and modified by stream erosion. These terraces were formed during Pleistocene times when the ocean stood at higher levels. As the ocean dropped to a lower level, the ocean floor emerged as a terrace marked by a low scarp. A gently undulating topography is formed by these north to south paralleling terraces. Generally, these terraces are interspaced with poorly drained areas and swamps (Jacksonville Area Planning Board, 1980).

2.2.2 Surface Hydrology At present, drainage in Duval County consists of many short streams, tributary to four major water courses: the St. Johns River, the St. Marys River, the Nassau River, and the Intracoastal Waterway. Along the divides between the major drainage divisions, erosion has not been pronounced and, as a result, relatively wide and flat swampy areas remain. The flat swampy areas make delineation of some drainage areas difficult, if not impossible. The NAS Cecil Field Stormwater Master Plan (Seaburn and Robertson, 1985) identifies two of the sites (Sites 1 and 2) as being within the 100-year floodplain. Surface runoff from NAS Cecil Field is conveyed by a system of storm sewers and vegetated ditches to receiving streams bordering the facility, as indicated on Figure 2-3.

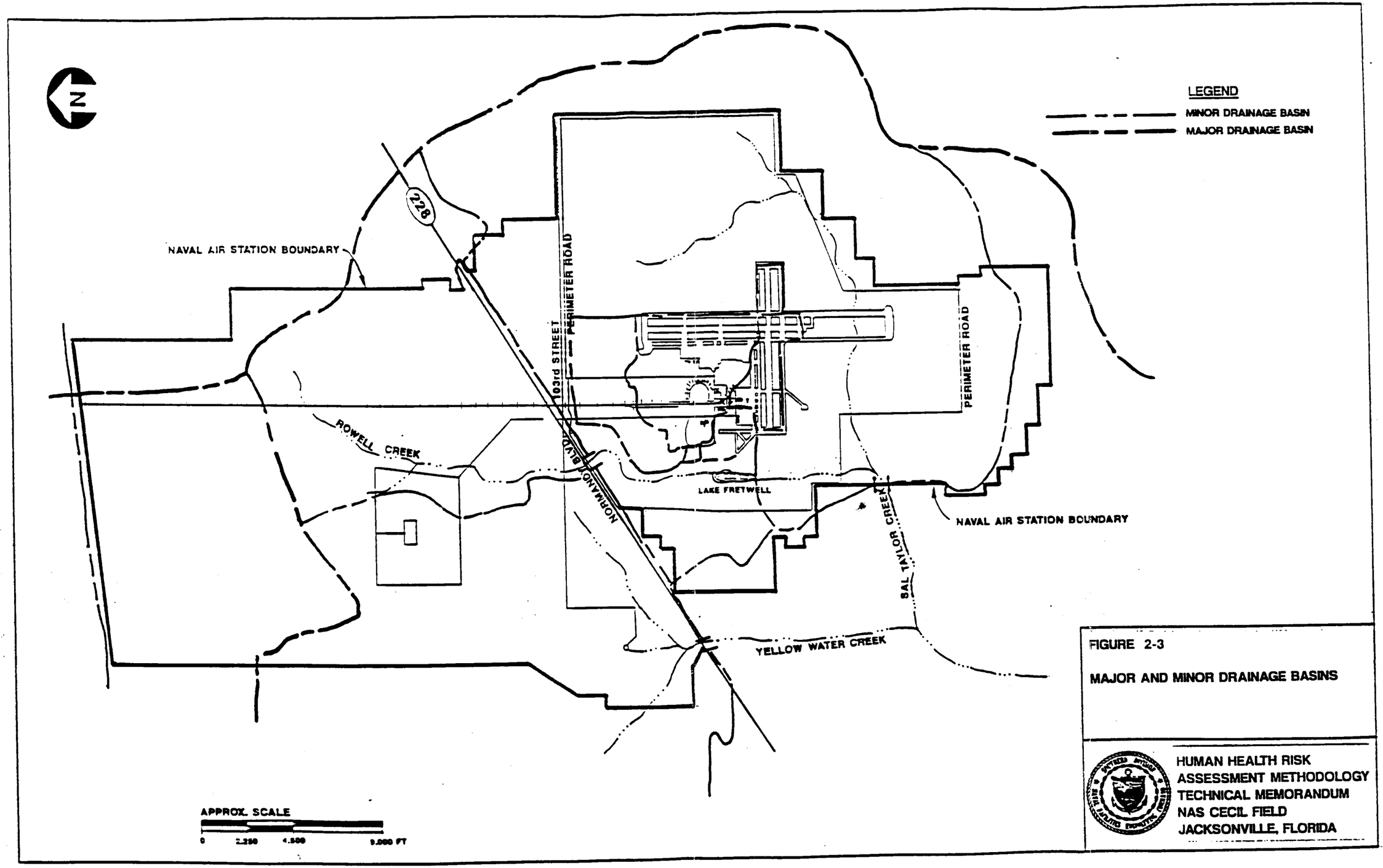


FIGURE 2-3

MAJOR AND MINOR DRAINAGE BASINS

HUMAN HEALTH RISK
ASSESSMENT METHODOLOGY
TECHNICAL MEMORANDUM
NAS CECIL FIELD
JACKSONVILLE, FLORIDA

0753727

HHRAMTMCF

PRINTED ON RECYCLED PAPER

Generally, the eastern and southern parts of NAS Cecil Field drain to Sal Taylor Creek, and the northern and western parts drain to Lake Fretwell or to Rowell Creek, which discharges south to Sal Taylor Creek. Sal Taylor Creek drains in a westerly direction, discharging into Yellow Water Creek, which drains south to the St. Johns River via Black Creek. The St. Johns River drains to the Atlantic Ocean and is influenced by tides.

Sal Taylor Creek, Rowell Creek, Yellow Water Creek, Black Creek, and the St. Johns River are all classified by the Florida Department of Environmental Regulation (FDER) as Class III Waters and as such are designated for recreation, propagation, and management of fish and wildlife (Jacksonville Area Planning Board, 1980; FDER, 1992). Lake Fretwell, approximately eight acres in area, is stocked with bass for sportfishing. A recreational complex has been developed along its northeastern shoreline (SOUTHNAVFACENGCOM, 1989).

2.2.3 Regional Geology NAS Cecil Field is located on the Duval Upland, which is a gently sloping ancient marine terrace that abuts westward into the sand ridges of central Florida. The sedimentary sequence that underlies the Duval Upland consists of unconsolidated sands with layers of clay, silts, and calcareous shells. These deposits range in age from upper Miocene to Holocene and contain the surficial aquifer. The surficial aquifer ranges in depth from 40 to 90 feet below land surface (bls) at the installation. The surficial aquifer sediments grade downward into the Hawthorn group. The Hawthorn group consists of interfingering units of calcareous and phosphatic clays, sands, and limestone and dolomite of middle Miocene age. The Hawthorn deposits are encountered between 75 and 400 feet bls (Geraghty and Miller, 1983).

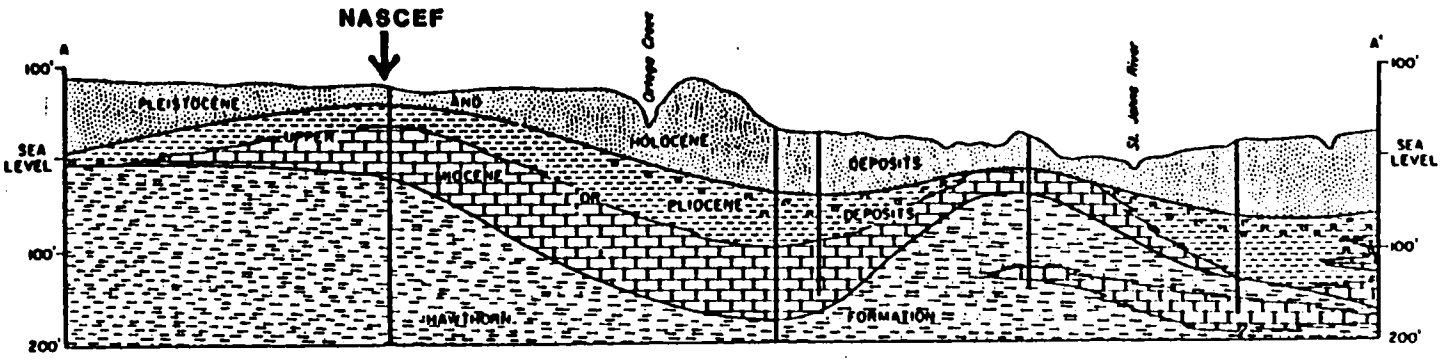
The upper units in the Hawthorn constitute the secondary artesian aquifer. The lower units in the Hawthorn function as confining units, thus separating and confining the Floridan Aquifer from the secondary artesian aquifer. Figures 2-4 and 2-5 provide a geologic profile of the aquifers in the NAS Cecil Field area.

2.3 DEMOGRAPHIC INFORMATION.

2.3.1 Population NAS Cecil Field is a subordinate command under the Commander Strikefighter Wings, Atlantic Fleet. The facility supports a workforce of approximately 10,000 civilian and military personnel and can accommodate approximately 3,500 residents in base quarters and housing (SOUTHNAVFACENGCOM, 1991).

The area surrounding the NAS Cecil Field is rural and sparsely populated. The city of Jacksonville lies approximately 14 miles to the northeast. Surrounding land use is primarily forestry with some light agriculture and ranching use. Small communities and scattered dwellings associated with these activities are located in the vicinity. A small residential area on Nathan Hale Road, which abuts the NAS Cecil Field property to the west, typifies these rural communities. The nearest incorporated municipality is the town of Baldwin, whose center lies approximately 6.4 miles to the northwest of the main station entrance.

HYDROGEOLOGICAL SETTING IN THE NAS CECIL FIELD AREA



EXPLANATION

- Sand
- Clay, sandy, shelly
- Clay, sandy, phosphatic
- Limestone

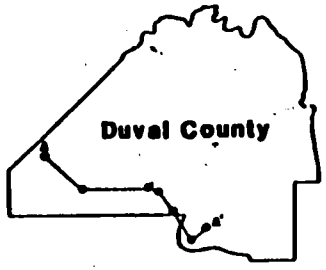
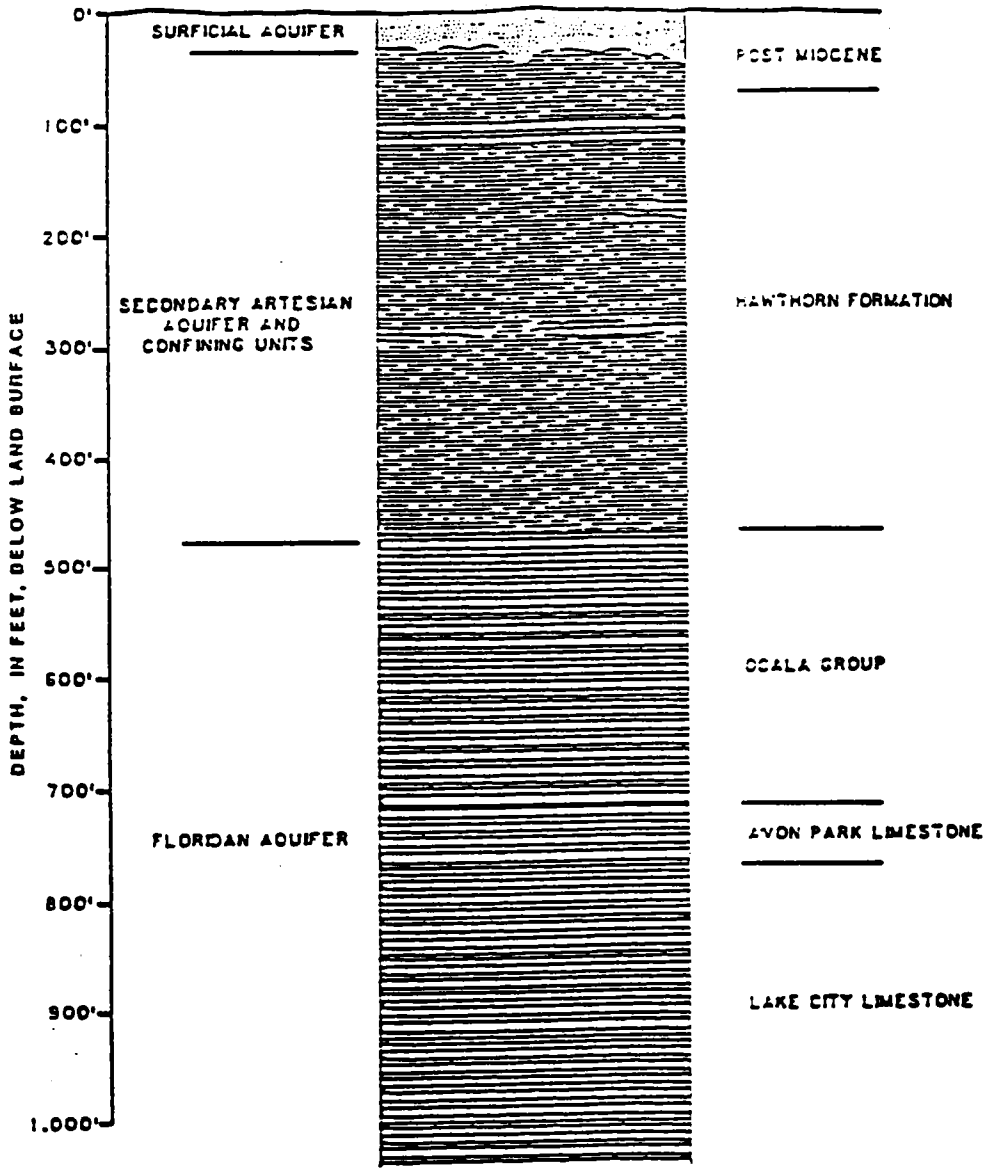


FIGURE 2-4

GEOLOGIC PROFILE FOR AQUIFERS

HUMAN HEALTH RISK ASSESSMENT METHODOLOGY TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA



ADAPTED FROM ENVIRODYNE ENGINEERS 1985

FIGURE 2-5

GENERALIZED GEOLOGIC COLUMN

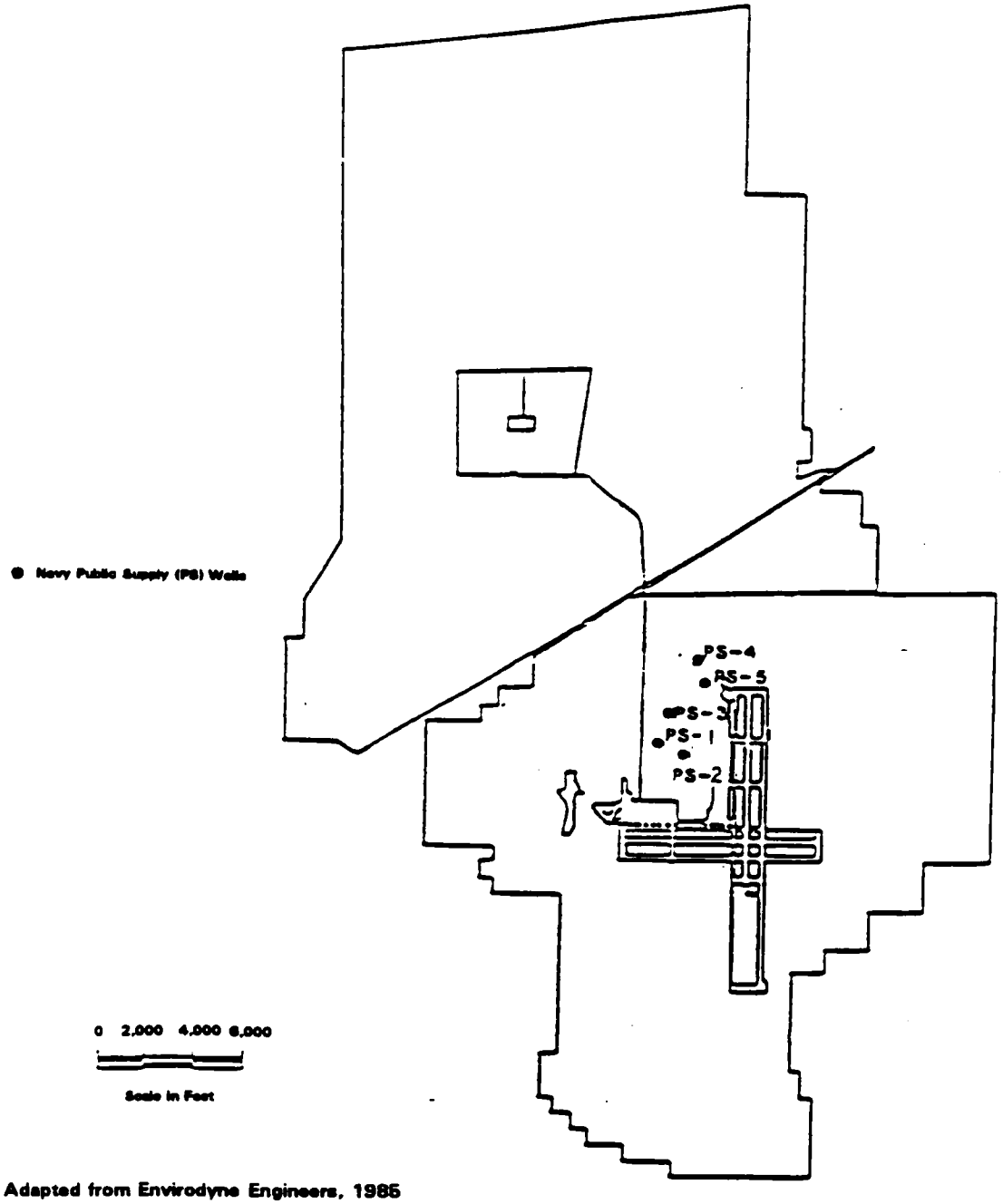
HUMAN HEALTH RISK ASSESSMENT METHODOLOGY TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA

To the east, the rural surroundings grade into a suburban fringe bordering the major east-west roadways. Low commercial use, such as convenience stores, and low density residential areas characterize the land use (Jacksonville Area Planning Board, 1979). Herlong Airport lies approximately 4.5 miles to the east of NAS Cecil Field along State Road 228. Beyond this point, the region becomes progressively urbanized approaching Jacksonville (Jacksonville Area Planning Board, 1979). A development called Villages of Argyle, when complete, will consisting of seven separate villages or communities that will ultimately abut NAS Cecil Field to the south and southeast. A Professional Golf Association golf course and residential area border NAS Cecil Field to the east (SOUTHNAVFACENGCOM, 1989).

2.3.2 Navy Supply Wells NAS Cecil Field's potable water supply system includes five Public Supply (PS) wells (PS-1 through PS-5) that tap the Floridan aquifer at depths ranging from 400 to 800 feet below the Hawthorn (NAS Cecil Field, 1990; Geraghty and Miller, 1983) (Figure 2-6). The water is pumped from the deep wells and stored in reservoirs and elevated water tanks. There is one 500,000-gallon reservoir, one 200,000-gallon reservoir, and two 250,000-gallon elevated water tanks at NAS Cecil Field (SOUTHNAVFACENGCOM, 1989). The five wells have a combined capacity of approximately 4.8 million gallons per day (Envirodyne Engineers, 1985). Water from these wells is used for potable, industrial, and heating purposes. Treatment consists of chlorination and aeration (Envirodyne Engineers, 1985). In addition, phosphate is added to boiler plant water. There was no reportedly incidence of groundwater contamination in any of the wells at NAS Cecil Field tapping the Floridan aquifer system. The most recent analytical result from the PS wells indicate no groundwater contamination at NAS Cecil Field (NAS Cecil Field, 1991). There are no backup supplies of potable water.

Other Navy supply wells throughout NAS Cecil Field reportedly tap the secondary artesian aquifer (Geraghty and Miller, 1983). The wells are not part of the NAS Cecil Field water supply system and are not used for drinking water. The wells are used as individual water supplies along outlying areas of the base that are not served by the main water system. Water from these wells is used for flushing of toilets and irrigation (Envirodyne Engineers, 1985).

2.3.3 Private Wells The Florida Department of Health and Rehabilitative Services (HRS) estimates there are approximately 75 private wells located within a 2 mile radius of the NAS Cecil Field property line and reported tap the secondary artesian aquifer (Geraghty and Miller, 1983). Two potable supply wells are present in a small unincorporated community on Nathan Hale Road, immediately west of NAS Cecil Field and south of Normandy Boulevard (State Road 228). These private wells are 64 and 125 feet deep and tap the secondary artesian aquifer (Geraghty and Miller, 1983).



Adapted from Envirodyne Engineers, 1985

FIGURE 2-6

SUPPLY WELL LOCATION MAP

HUMAN HEALTH RISK ASSESSMENT METHODOLOGY
TECHNICAL MEMORANDUM
NAS CECIL FIELD
JACKSONVILLE, FLORIDA

2.5 MIGRATION POTENTIAL AND EXPOSURE PATHWAYS. The major migration pathways for contamination from sites at NAS Cecil Field to receptors are shown as conceptual models for each operable unit in Figures 2-7 through 2-9. The conceptual models describe the potential sources, migration pathways, and receptors for contamination at each operable unit.

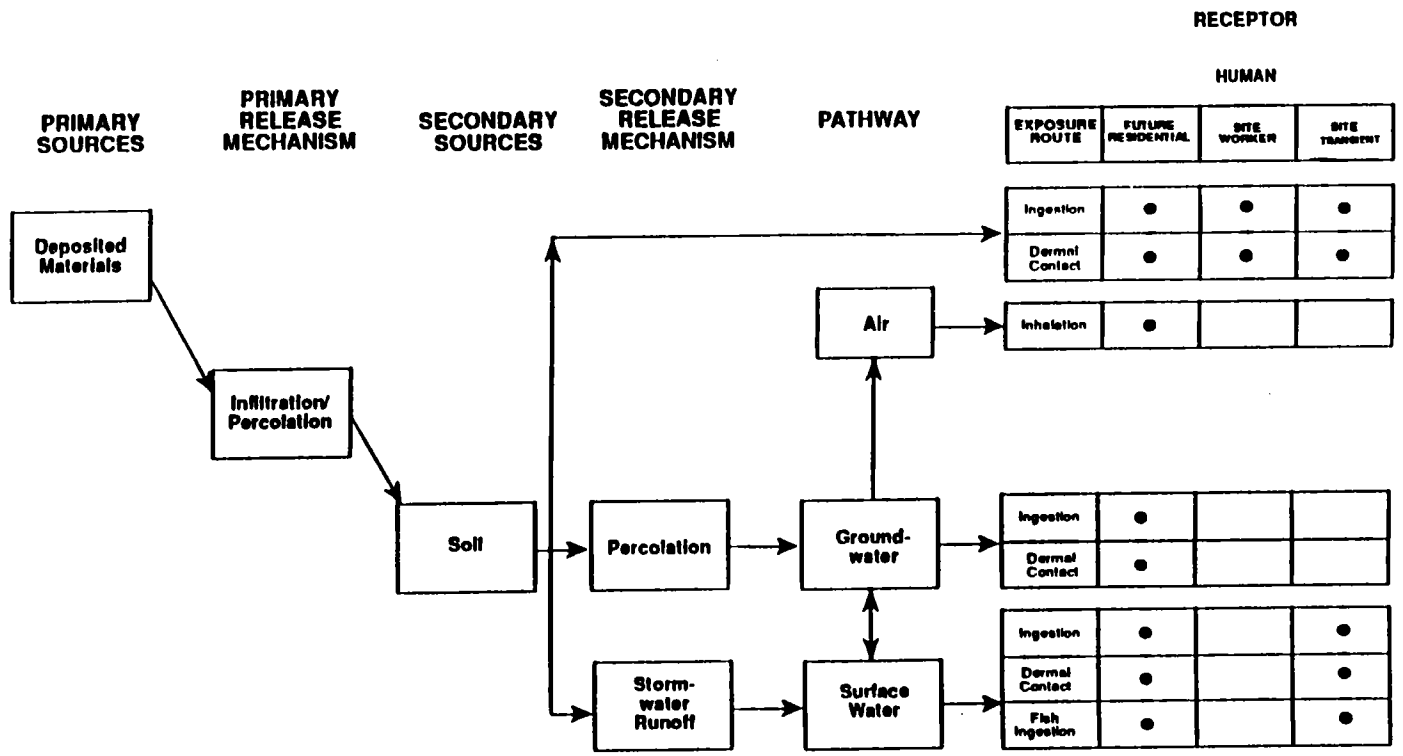


FIGURE 2-7

CONTAMINANT PATHWAY MODEL-
OPERABLE UNIT 1
SITES 1 AND 2 (LANDFILLS)

HUMAN HEALTH RISK
ASSESSMENT METHODOLOGY
TECHNICAL MEMORANDUM
NAS CECIL FIELD
JACKSONVILLE, FLORIDA

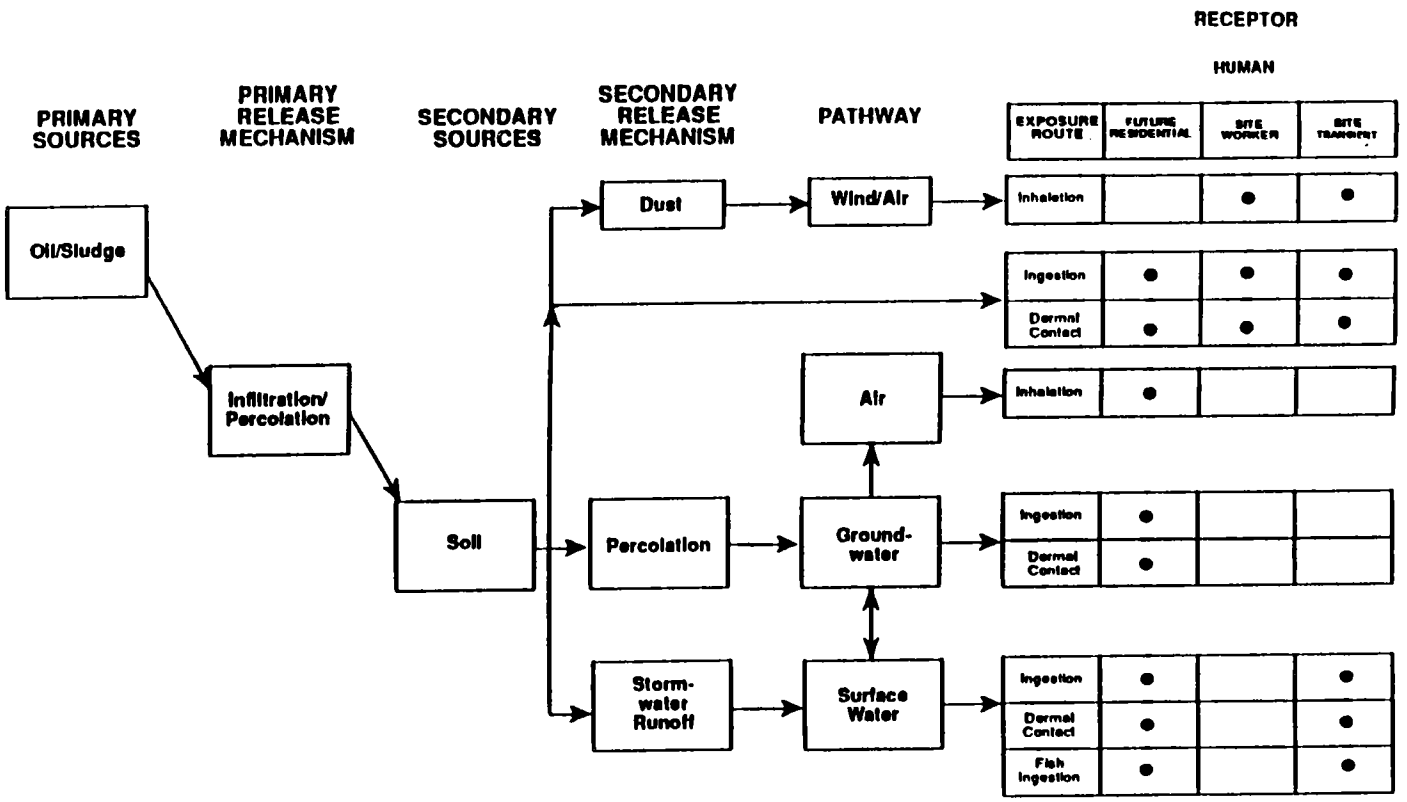


FIGURE 2-8

CONTAMINANT PATHWAY MODEL-OPERABLE UNIT 2 SITES 3, 4, 5, AND 17 (OIL/SLUDGE DISPOSAL PITS)

HUMAN HEALTH RISK ASSESSMENT METHODOLOGY TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA

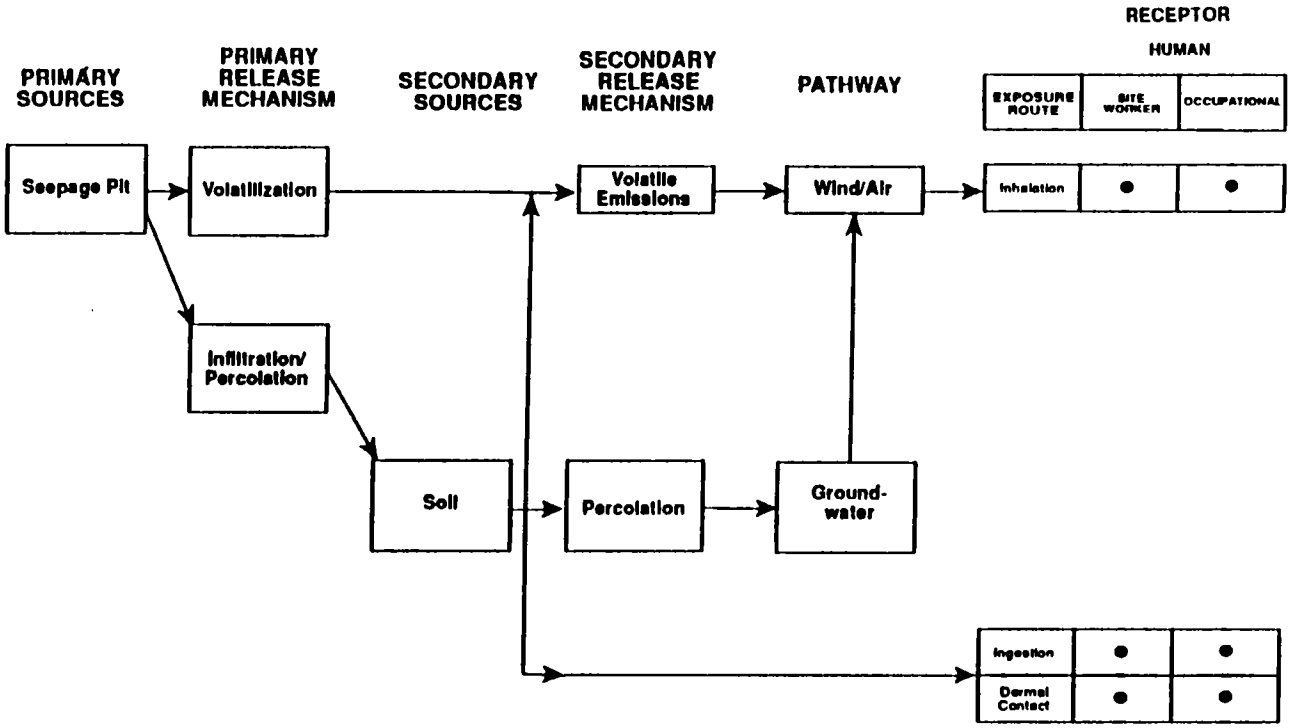


FIGURE 2-9

CONTAMINANT PATHWAY MODEL-OPERABLE UNIT 7
SITE 16 (AIMD SEEPAGE PIT)

HUMAN HEALTH RISK ASSESSMENT METHODOLOGY TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA

3.0 METHODOLOGY FOR THE SELECTION OF CHEMICALS OF CONCERN

The following sections describe the methodology that will be used to select COC for inclusion in the BRA at NAS Cecil Field. COC will be determined on a per site basis for each medium (surface soils, subsurface soils, surficial aquifer groundwater, secondary artesian aquifer groundwater, and surface water). Sediments will not be addressed as part of the human health risk assessment. The COC will be selected from validated analytical data. Historical non-validated data will not be used in the human health risk assessment.

3.1 EVALUATION PROCESS. The analytical results will be summarized for each site and will include the frequency of detection, the range of sample quantitation limits, and the maximum and minimum concentrations for all detected analytes in each medium. Once the data from each site specific medium are summarized, the maximum detect of each analyte will be used as the detected comparison value (DCV) to determine COCs (for an explanation of the methodology used to determine the exposure point concentration, see Section 3.1.1). COCs will be selected based on the following screening procedures.

Each DCV will be compared to procedure control "blank data" (e.g., trip blank, field blank, laboratory calibration blank, laboratory method blank) according to procedures recommended in USEPA guidance (1989a). The blank data will be compared to the DCVs with which the blanks are associated. Common laboratory contaminants will be retained if the DCV exceeds 5 times the maximum amount detected in the blank. Chemicals that are not common laboratory blanks will be retained if the DCV exceeds ten times the maximum amount detected in a blank. The difference between "common" and "not common" contaminants is described in USEPA guidance (1989a).

The DCV for each inorganic chemical will be compared to the background levels determined from samples taken from each medium in areas that have not been influenced by anthropogenic sources at NAS Cecil Field. If the DCV of an inorganic chemical is present at a site at less than 2 times the naturally occurring levels (2 times the geometric mean), that chemical will be eliminated from the risk assessment (USEPA, 1991c). Generally, organic chemicals will not be considered as naturally occurring. However, pesticides may be considered as a constituent of background in some cases.

DCVs will also be compared to screening criteria values (SCVs). A SCV is determined by using toxicity constants obtained from the USEPA Integrated Risk Information System (IRIS) or the USEPA Health Effects Assessment Summary Tables (HEAST) that will be combined with "standard" exposure scenarios to calculate chemical concentrations that correspond to fixed levels of risk. The SCV is the concentration of a contaminant in a media (air, water, soil, or fish tissue) that by using standard USEPA exposure scenarios corresponds to an upper bound cancer risk of 1×10^{-6} (one in a million) or a Hazard Index

(HI) equal to 1. SCVs will not consider the toxicity associated with the inhalation of vapors released from soils or the inhalation of soil particulates to which chemicals are absorbed.

Professional judgement will be exercised during the risk characterization portion of the assessment if it appears that chemicals not considered as COC may in fact have an impact on risks associated with exposure. This discussion will be presented in the risk characterization of the assessment when it is appropriate (see also Chapter 4.0).

Those chemicals present in concentrations not considered to be harmful to human health will be removed from the list of COC. In general, calcium, potassium, sodium and magnesium will be eliminated from consideration in this manner because they are essential nutrients and are not considered to be hazardous (USEPA, 1989a).

Lead in soil will be evaluated by means of the Uptake/Biokinetic Model (USEPA, 1991a). The Lead Uptake/Biokinetic Model was developed by USEPA as a method to predict blood lead levels in children exposed to lead in air, diet, drinking water, indoor dust, soil, and paint. The computerized lead program estimates lead uptake and blood lead levels in children ages 0-7 years old. The target blood level for children is 10 μg/dl.

If detected, polycyclicaromatic hydrocarbons (PAHs) will be retained as COC and addressed by the toxicity equivalence factor methodology for carcinogenic PAHs based on each compound's relative potency to the potency of benzo(a)pyrene as stated in interim USEPA guidance (USEPA, 1992b).

3.1.1 Exposure Point Concentration. Exposure point concentrations will be calculated for each COC in each medium based on the analytical information. The exposure point concentration will be the 95% UCL of the mean unless that value is higher than the maximum detected concentration within a specified medium, in accordance with USEPA risk assessment guidance (USEPA, 1989a; 1991c) as follows:

$$95\%\ UCL = e^{\left(mean + 0.5s^2 + \frac{sH}{\sqrt{n-1}}\right)} \qquad (1)$$

If data is not found to be normally distributed, it will be log transformed before determination of the exposure point concentration. Non-detects will be included in calculations at one-half their sample quantitation limit. Duplicates of samples will be averaged, and only one value will be entered into the calculation of the mean and the 95% UCL.

3.1.2 Tentatively Identified Concentrations. Tentatively identified compounds (TICs) will be screened based on suspected presence at the site under consideration, contaminant concentration, migration potential via each of the identified exposure pathways, and the

chemical's toxicity. A list of TICs of concern will be formulated after consideration of these factors. The TICs of concern will be evaluated qualitatively in the BRA.

4.0 SCOPE OF BASELINE RISK ASSESSMENT

The BRA evaluates risks associated with current conditions and uses of the operable units. Human health risk assessments will be conducted in accordance with USEPA guidance for Superfund sites (USEPA, 1989a) and will include: (1) data evaluation, (2) identification of COC, (3) exposure assessment, (4) toxicity assessment, and (5) risk characterization.

The methods that will be used to evaluate data and select the COC were described in Chapter 3.0. Chapter 4.0 identifies the exposure scenarios and assumptions that will be evaluated in the final BRA for each operable unit. The toxicity assessment and risk characterization are not addressed in this document, but will be included in the RI/FS reports of each operable unit as they are completed. The toxicity assessment will identify a set of quantitative toxicity factors, cancer slope factors (CSFs) and reference doses, that will be used to estimate the potential for adverse health effects as a function of exposure. Toxicity values will be identified for all COCs in IRIS or HEAST. In cases where values are not available for a chemical in IRIS or HEAST, USEPA Region IV will be consulted to identify any available dose-response values. A risk characterization will be performed to estimate the likelihood of an adverse health effect resulting from a chemical by considering both toxicity data and potential exposures at each site. The risk characterization will include a discussion of chemical additivity as described in USEPA guidance (1989a) and an uncertainty analysis.

4.1 HUMAN HEALTH RISK ASSESSMENT. In this section, the methods used to determine the frequency and duration of receptor exposure to a chemical substance present in the environment via multiple exposure pathways will be described. Exposure assessment involves two basic steps. The first step is to identify all populations that might come in contact with contaminated media and the pathways through which exposure could occur at the site. The second step is to quantify exposure in terms of the amount of chemical either ingested, inhaled, or absorbed through the skin from all complete exposure pathways. This section will define the potential pathways of exposure and exposure scenarios that may reasonably be expected to occur at each operable unit under current site conditions at NAS Cecil Field. For those pathways (e.g., inhalation of soil particulates) for which data will not specificly be collected, fate and transport models will be employed to model exposure point concentrations. Site specific data will be used in the models when possible. The choice of model will depend on the information available and the level of model refinement necessary.

4.1.1 Current Use Exposure Assessment. Potential exposure pathways are identified for each contaminated medium based on current site uses. The media that individuals may contact based on current site uses are soils, surface water, soil particles suspended in air, and volatilized chemicals. Groundwater is not presently being used at any of the operable units, but potential future exposures to groundwater will be addressed as part of the NFA assessments (Chapter 5.0). Conceptual models of the operable units are presented in

Figures 2-7 to 2-9 and include exposure pathways that will be addressed in the BRA. The following paragraphs summarize the rationale for selection of exposure scenarios at each site.

Although permission is required to obtain access to NAS Cecil Field, the operable units are all located in areas that can be accessed by Navy personnel and families, and adult and child civilians. Current exposures at OUs 1, 2, and 7 may include exposures encountered by site workers, occupational workers, and site transients. Site workers are adults that complete monthly (1 day/month; 12 days/year) land maintenance on each site (e.g., mowing and marking of tree growth). Occupational workers include those individuals that currently work in close proximity (less than 200 feet) to a site a minimum of 250 days per year (USEPA, 1991b). These individuals may walk over a site monthly (1 day/month; 12 days/year) and be exposed to potentially contaminated surface soils from contact with soiled footwear. These working individuals are all assumed to be adult Navy personnel.

Adult transients may include those individuals that engage in hunting activities on NAS Cecil Field property. This class of individuals may include adult Navy personnel, Navy guests, or civilians. A hunter's exposure is estimated to be 2 days per week (8 days/month) for the 3-month deer and hog hunting season (November through January) (24 days/year) based on information provided by the Florida Game & Fresh Water Fish Commission (FG&FWFC, 1992) and is likely an overestimate of hunting activities for Navy guests and civilians at NAS Cecil Field. Child transients include children that currently live at the facility, visit the facility as guests of Navy personnel, or trespass onto the facility. All of these children are assumed to contact any one site with the same frequency. The children will be assumed to contact any one site 30 times per year for a period of 6 years. This assumption is likely to be an overestimate, because children do not always play at the same location, however, this estimate should account for those children who most frequently contact a specific site such as those children living at the facility. No one site is more accessible than another to adult or child transient contact. The exposure scenarios chosen for evaluation in the human health assessment are summarized in Table 4-1 and discussed below.

Surface soils. Individuals who obtain access to sites may be exposed to surface soils (defined as the top 12 inches of soil). Individuals that may contact contaminated media under current conditions include site workers, occupational workers, and adult and child transients. The BRA will evaluate dermal contact and incidental ingestion of surface soils for those individuals who currently have access to the sites at OUs 1, 2, and 7. The equations used to estimate intake from these exposure routes are presented in Tables 4-2, 4-3, and 4-4.

Soil Particulates Suspended in Air. For those operable units without ample vegetation, the inhalation of soil particulates suspended by wind will be evaluated. Site workers and adult and child transients, as described above, may come into contact with soil particles if they contact a site. Exposure point concentrations of soil particulates will be modeled by using

Table 4-1
Proposed Exposure Pathways, Operable Units 1, 2, and 7

Technical Memorandum
Human Health Risk Assessment Methodology
NAS Cecil Field, Jacksonville, Florida

Exposure Medium, Exposure Route	Operable Unit 1 Exposure Pathways			Operable Unit 2 Exposure Pathways			Operable Unit 7 Exposure Pathways	
	Site Worker (adult)	Site Transient (adult/child)	Future Resident (adult/child)	Site Worker (adult)	Site Transient (adult/child)	Future Resident (adult/child)	Site Worker (adult)	Occupational (adult)
Soil								
Incidental Ingestion	X	X	X	X	X	X	X	X
Dermal Contact	X	X	X	X	X	X	X	X
Groundwater								
Ingestion			X			X		
Dermal Contact			X			X		
Air								
Inhalation (volatiles from groundwater)			X			X		
Inhalation (particles from soil)				X	X			
Inhalation (volatiles from soil)							X	X
Surface Water								
Incidental Ingestion		X	X		X	X		
Dermal Contact		X	X		X	X		
Biota								
Fish Ingestion		X	X		X	X		

Table 4-2
Adult Site Worker,
Incidental Ingestion and Dermal Contact with Surface Soils

Technical Memorandum
Human Health Risk Assessment Methodology
NAS Cecil Field, Jacksonville, Florida

Equations:

$$INTAKE_{INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$INTAKE_{DERMAL} = \frac{CS \times SA \times SAF \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

Parameter	Symbol	Value	Units	Source
Concentration in soil	CS	site specific	mg/kg	
Ingestion rate	IR	100	mg/day	USEPA, 1991b
Fraction ingested	FI	100	%	Assumption†
Soil adherence factor	SAF	1.45	mg/cm^2	USEPA, 1989c
Surface area exposed	SA	3,160 (hands, head, and forearms)	cm^2	USEPA, 1989c
Body weight	BW	70	kg	USEPA, 1991b
Conversion factor	CF	10^{-6}	kg/mg	
Exposure frequency	EF	12	days/year	Assumption‡
Exposure duration	ED	25	years	USEPA, 1991b
Averaging time				
Carcinogenic	AT	70	years	USEPA, 1991c; USEPA, 1989a
Noncarcinogenic	AT	25	years	USEPA, 1991b

Notes:
mg/kg = milligrams per kilogram
mg/day = milligrams per day
mg/cm^2 = milligrams per square centimeter
†to be discussed in the uncertainty section of the BRA
kg/mg = kilograms per milligram
days/year = days per year
cm^2 = square centimeters
kg = kilograms
‡see Section 4.1.1

Table 4-3
Adult Occupational Worker,
Incidental Ingestion and Dermal Contact with Surface Soils

Technical Memorandum
Human Health Risk Assessment Methodology
NAS Cecil Field, Jacksonville, Florida

Equations:

$$INTAKE_{INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$INTAKE_{DERMAL} = \frac{CS \times SA \times SAF \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

Parameter	Symbol	Value	Units	Source
Concentration in soil	CS	site specific	mg/kg	
Ingestion rate	IR	100	mg/day	USEPA, 1991b
Fraction ingested	FI	100	%	Assumption†
Soil adherence factor	SAF	1.45	mg/cm^2	USEPA, 1989c
Surface area exposed	SA	840 (hands)	cm^2	USEPA, 1989c
Body weight	BW	70	kg	USEPA, 1991b
Conversion factor	CF	10^{-6}	kg/mg	
Exposure frequency	EF	12	days/year	Assumption‡
Exposure duration	ED	25	years	USEPA, 1991b
Averaging time				
Carcinogenic	AT	70	years	USEPA, 1991c; USEPA, 1989a
Noncarcinogenic	AT	25	years	USEPA, 1991b

Notes:
mg/kg = milligrams per kilogram
mg/day = milligrams per day
mg/cm^2 = milligrams per square centimeter
†to be discussed in the uncertainty section of the BRA
kg/mg = kilograms per milligram
days/year = days per year
cm^2 = square centimeters
kg = kilograms
‡see Section 4.1.1

Table 4-4
Adult and Child Transient,
Incidental Ingestion and Dermal Contact with Surface Soils

Technical Memorandum
Human Health Risk Assessment Methodology
NAS Cecil Field, Jacksonville, Florida

Equations:

$$INTAKE_{INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$INTAKE_{DERMAL} = \frac{CS \times SA \times SAF \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

Parameter	Symbol	Value	Units	Source
Concentration in soil	CS	site specific	mg/kg	
Ingestion rate	IR	100 (adult) 200 (child)	mg/day	USEPA, 1991b
Fraction ingested	FI	100	%	Assumption†
Soil adherence factor	SAF	1.45	mg/cm^2	USEPA, 1989c
Surface area exposed	SA	3,160 (adult) (head, hands, and forearms) 2,890 (child) (head, hands, forearms, and lower legs)	cm^2	USEPA, 1989c
Body weight	BW	70 (adult) 15 (child)	kg	USEPA, 1991b
Conversion factor	CF	10^{-6}	kg/mg	
Exposure frequency	EF	24 (adult) 30 (child)	days/year	Assumption‡
Exposure duration	ED	24 (adult) 6 (child)	years	USEPA, 1991b
Averaging time				
Carcinogenic	AT	70	years	USEPA, 1991c; USEPA, 1989a
Noncarcinogenic	AT	24(adult) 6 (child)	years	USEPA, 1991b

Notes:
mg/kg = milligrams per kilogram
mg/day = milligrams per day
kg/mg = kilograms per milligram
kg = kilograms
mg/cm^2 = milligrams per square centimeter
days/year = days per year
†to be discussed in the uncertainty section of the BRA
‡see Section 4.1.1

the Cowherd model (1985). This exposure will be assessed at OU 2 because of the bare soil in contaminated areas.

Volatilization from Soil. For those operable units with data indicating high levels of volatile or semi-volatile chemicals on site, the inhalation of volatiles will be addressed. Exposure point concentrations of volatiles emitted from soils will be modeled from surface and subsurface soil concentrations by using methodology described in USEPA guidance (1991d). This exposure pathway is only anticipated to be evaluated at OU 7 for site workers and occupational workers because of the high volumes of solvents associated with the site's history, and its close proximity (less than 400 feet) to Navy facilities that house occupational workers.

Ingestion of Surface Water and Fish. The use of Lake Fretwell as a recreational facility is encouraged by the Navy through (1) the maintenance of a changing house used for lake activities, and (2) by annual stocking of the lake with edible fish. The use of Rowell Creek is restricted on the facility, but it is a recreational body of water as defined by the State of Florida and is frequently fished by Navy personnel. Individuals that may be exposed to surface waters at Rowell Creek or Lake Fretwell include adult and child transients (Navy personnel, Navy guests, or civilians) defined as individuals that infrequently contact a site that is within 1,000 feet of surface water. Transients are anticipated to come into dermal contact with surface waters, ingest water, and ingest fish. Site workers are not anticipated to come into contact with surface waters during completion of tasks at individual sites nor are occupational workers anticipated to come into contact with surface waters during their normal work activities. The equations used to estimate dermal contact with surface waters and ingestion of surface water and fish are presented in Table 4-5 and 4-6.

The following paragraphs summarize the rationale for selection of exposure pathways at each site.

4.1.1.1 Operable Unit 1 Potential human exposures to contamination under the current uses of the area on and around the landfills at OU 1 are limited to dermal contact with soils, ingestion and dermal contact with surface waters, and fish ingestion. The BRA will evaluate exposure to surface soils for an adult site worker and an adult and child transient. Exposures to surface water and fish ingestion will only be evaluated for the transient scenario.

4.1.1.2 Operable Unit 2 OU 2 contains Sites 3, 4, 5, and 17. Under current uses, the potential for exposures to contamination include contact with surface soils, inhalation of soil particles, ingestion and dermal contact with surface water, and fish ingestion. Exposures related to soil contact and soil particles will be assessed for an adult site worker, adult transients and child transients. Exposures to surface water and fish ingestion will be limited to the adult and child transients.

Table 4-5
Adult and Child Transient,
Incidental Ingestion and Dermal Contact with Surface Waters

Technical Memorandum
Human Health Risk Assessment Methodology
NAS Cecil Field, Jacksonville, Florida

Equations:

$$INTAKE_{INGESTION} = \frac{CW \times IR \times ET \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$INTAKE_{DERMAL} = \frac{CW \times SA \times PC \times CF \times ET \times EF \times ED}{BW \times AT \times 365\ days/year}$$

Parameter	Symbol	Value	Units	Source
Concentration in water	CW	site specific	mg/liter	
Ingestion rate	IR	50 (adult) 50 (child)	ml/hour	USEPA, 1989c
Surface area exposed	SA	19,400 (adult) 7,280 (child)	cm^2	USEPA, 1989c
Permeability constant	PC	Chemical specific	cm/hour	
Body weight	BW	70 (adult) 15 (child)	kg	USEPA, 1991b
Conversion factor	CF	10^{-3}	liter/cm^3	
Exposure time	ET	2.6	hours/day	USEPA, 1989c
Exposure frequency	EF	45	days/year	USEPA, 1991c
Exposure duration	ED	24 (adult) 6 (child)	years	USEPA, 1991b
Averaging time				
Carcinogenic	AT	70	years	USEPA, 1991c; USEPA, 1989a
Noncarcinogenic	AT	24 (adult) 6 (child)	years	USEPA, 1991b

Notes:
mg/liter = milligrams per liter
liters/day = liters per day
cm^2 = square centimeters
cm/hour = centimeters per hour
kg = kilogram
liter/cm^3 = liter per cubic centimeter
hours/day = hours per day
days/year = days per year

Table 4-6
Adult and Child Transient,
Fish Ingestion Based on Surface Water Concentrations

Technical Memorandum
Human Health Risk Assessment Methodology
NAS Cecil Field, Jacksonville, Florida

Equation:

$$INTAKE = \frac{CW \times BCF \times IR \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/year}}$$

Parameter	Symbol	Value	Units	Source
Concentration in water	CW	site specific	mg/liter	
Fish ingestion rate	IR	54 (adult) 17 (child)	g/day	USEPA, 1991b USEPA, 1989c
Fraction ingested	FI	100	%	Assumption†
Bioconcentration factor	BCF	Chemical specific		
Body weight	BW	70 (adult) 15 (child)	kg	USEPA, 1991b
Conversion factor	CF	10^{-3}	kg/g	
Exposure frequency	EF	350	days/year	USEPA, 1991b
Exposure duration	ED	24 (adult) 6 (child)	years	USEPA, 1991b
Averaging time				
Carcinogenic	AT	70	years	USEPA, 1991c; USEPA, 1989a
Noncarcinogenic	AT	24 (adult) 6 (child)	years	USEPA, 1991b

Notes: mg/liter = milligrams per liter
g/day = grams per day
kg = kilograms
kg/g = kilograms per kilograms per gram
days/year = days per year
†to be discussed in the uncertainty section of the BRA

4.1.1.3 Operable Unit 7 Exposures to surface soils and volatiles emitted from soils at site 16 will be assessed for an adult site worker and an adult occupational worker. Child exposure at this site is highly unlikely because the site is located in close proximity (within 400 feet) to jet hangers and jet maintenance areas.

Adult site workers and occupational workers will both be assumed to contact surface soils by ingestion or dermal contact 12 times per year. However, an occupational worker is assumed to expose less skin surface area per exposure period than the site worker (see Figures 4-2 and 4-3) based on site activities described in Section 4.1.1 (e.g., land maintenance activities versus walking across the site). Site workers and occupational workers are both also assumed to be exposed to volatilized chemicals from the site. Exposure point concentrations will be modeled for each site, however, occupational workers are estimated to be exposed 250 days per year while the site worker is estimated to be exposed 12 days per year. Adult transients (guests at NAS Cecil Field) that may enter the area would be exposed at a significantly lower frequency than would site workers or occupational workers. If the risks calculated for either set of workers suggest that adult transients may also be at an unacceptable risk, then an adult transient exposure scenario will also be analyzed at OU 7.

4.1.1.4 Rowell Creek and Lake Fretwell Rowell Creek and Lake Fretwell are potential sites of recreational swimming and fishing by Navy personnel and civilians (adult and child transients) at OUs 1 and 2 because of the close proximity (less than 1,000 feet) of surface waters to the sites. Swimming in Rowell Creek and Lake Fretwell will be evaluated by using surface water data. The maximum concentration of chemicals in surface water samples will be used as the exposure point concentration. The frequency of exposure used in the evaluations will be 45 days per year as recommended by USEPA Region IV (USEPA, 1991c). This frequency reflects the number of days that a resident would use the recreational waters and is likely an overestimate for transient exposure. The ingestion of fish will be included as an exposure pathway for all transients at OUs 1 and 2. Site workers and occupational workers at OU 7 are not anticipated to come into contact with recreational waters during their normal work activities.

5.0 SCOPE OF NO FURTHER ACTION ASSESSMENT

An NFA assessment will include an evaluation of future uses at sites at NAS Cecil Field. The assessment will rely on data evaluation, identification of COC, and the toxicity assessment that will be conducted as part of the BRA. Separate exposure assessments and risk characterizations will be performed to assess the risks associated with future uses of the operable units.

5.1 HUMAN HEALTH. Potential exposure pathways are identified for each contaminated medium based on possible future site uses. Future site uses may result in exposure to all media at OUs 1 and 2: soils, surface water, and ground water (Figure 4-1). The only receptor[5] that will be evaluated for future site use will be possible future residents, adults and children. Occasional visitors and maintenance personnel that might be part of future site use will be adequately addressed in the BRA. An NFA assessment will not be completed for OU 7 because of the low probability that a future resident will ever be associated with the site. OU 7 is in an active industrial setting located between the NAS Cecil Field hangers, power plant, and non-destructive inspection laboratory (SOUTHNAVFACENGCOM, 1991). It is also in close proximity (400 feet) to the NAS Cecil Field air strip that serves the Navy (SOUTHNAVFACENGCOM, 1991). Because of the dimensions of the runways (8,000 feet east/west runways and 12,500 feet north/south runways) (SOUTHNAVFACENGCOM, 1989), it is highly unlikely that the area surrounding the runways (including OU 7) would be converted from airport/industrial use to residential property.

Surface soils. The NFA assessment will evaluate incidental ingestion and dermal contact with surface soils for both adult and child residents. Incidental ingestion may occur following consumption of food handled with soiled hands, or through incidental contact with soiled fingers through activities such as smoking. Children may incidentally ingest soil during play activities. Dermal exposure to soil may occur during gardening and other recreational activities at or near the site. Contaminants adsorbed to the soil particles may come in contact with and be absorbed by the skin. Children especially may be exposed to soil contaminants while playing or digging in soil. The equations used to estimate intake from these exposure routes are presented in Table 5-1.

Groundwater. If housing is built on the sites in the future, their drinking water may be supplied by private drinking water wells. The private wells would likely tap the secondary artesian aquifer as identified in Sections 2.2. and 2.3. As a result of the domestic use of groundwater, a future resident could be exposed to contaminants via three exposure routes: (1) ingestion of water or beverages made with water, (2) dermal absorption during showering or bathing, and (3) inhalation of volatile compounds during showering. As recommended by USEPA Region IV, only adult exposure to groundwater will be evaluated

Table 5-1
Adult and Child Future Residents,
Incidental Ingestion and Dermal Contact with Surface Soils

Technical Memorandum
Human Health Risk Assessment Methodology
NAS Cecil Field, Jacksonville, Florida

Equations:

$$INTAKE_{INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$INTAKE_{DERMAL} = \frac{CS \times SA \times SAF \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

Parameter	Symbol	Value	Units	Source
Concentration in soil	CS	site specific	mg/kg	
Ingestion rate	IR	100 (adult) 200 (child)	mg/day	USEPA, 1991b
Fraction ingested	FI	100	%	Assumption†
Soil adherence factor	SAF	1.45	mg/cm^2	USEPA, 1989c
Surface area exposed	SA	3,160 (adult) (head, hands, and forearms) 2,890 (child) (head, hands, forearms, and lower legs)	cm^2	USEPA, 1989c
Body weight	BW	70 (adult) 15 (child)	kg	USEPA, 1991b
Conversion factor	CF	10^{-3}	kg/mg	
Exposure frequency	EF	350	days/year	USEPA, 1991b
Exposure duration	ED	24 (adult) 6 (child)	years	USEPA, 1991b
Averaging time				
Carcinogenic	AT	70	years	USEPA, 1991c; USEPA, 1989a
Noncarcinogenic	AT	24 (adult) 6 (child)	years	USEPA, 1991b

Notes:
mg/kg = milligrams per kilogram
mg/day = milligrams per day
mg/cm^2 = milligrams per square centimeter
kg = kilograms
cm^2 = squared centimeters
kg/mg = kilograms per milligram
days/year = days per year
†to be discussed in the uncertainty section of the BRA

during the NFA assessment (USEPA, 1991d). The equations used to estimate intake from these exposure routes are presented in Table 5-2 through 5-4.

Surface water and fish ingestion. Future site uses may also involve continued use of Lake Fretwell and Rowell Creek as recreational facilities. In the future, individuals may, therefore, be exposed to surface waters (ingestion and dermal contact) and the ingestion of fish tissues at Rowell Creek or Lake Fretwell. These exposure scenarios will be evaluated as presented in Section 4.1.1.4 (Table 4-4 and 4-5).

If borderline risk levels are approached in the residential scenario (a CSF of 10^{-6} or an HI of 1) the produce ingestion scenario will be included in the residential scenario as recommended in USEPA guidance (USEPA, 1989a).

Table 5-2
Adult Future Resident,
Ingestion of Groundwater

Technical Memorandum
Human Health Risk Assessment Methodology
NAS Cecil Field, Jacksonville, Florida

Equation:

$$INTAKE_{INGESTION} = \frac{CW \times IR \times EF \times ED}{BW \times AT \times 365 \text{ days/year}}$$

Parameter	Symbol	Value	Units	Source
Concentration in water	CW	site specific	mg/liter	
Ingestion rate	IR	2	liters/day	USEPA, 1991b
Body weight	BW	70	kg	USEPA, 1991b
Conversion factor	CF	10^{-3}	liter/cm^3	
Exposure frequency	EF	350	days/year	USEPA, 1991b
Exposure duration	ED	30	years	USEPA, 1991b
Averaging time				
Carcinogenic	AT	70	years	USEPA, 1991c; USEPA, 1989a
Noncarcinogenic	AT	30	years	USEPA, 1991b

Notes: mg/liter = milligrams per liter
liters/day = liters per day
kg = kilograms
liter/cm^3 = liter per square centimeter
hours/day = hours per day
days/year = days per year

Table 5-3
Adult and Child Future Resident, Dermal Contact with Groundwater

Technical Memorandum
Human Health Risk Assessment Methodology
NAS Cecil Field, Jacksonville, Florida

Equations:

$$INTAKE_{DERMAL} = \frac{CW \times SA \times PC \times CF \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/year}}$$

Parameter	Symbol	Value	Units	Source
Concentration in water	CW	site specific	mg/liter	
Surface area exposed	SA	19,400 (adult) 7,280 (child)	cm^2	USEPA, 1989c
Permeability constant	PC	Chemical specific	cm/hour	
Body weight	BW	70 (adult) 15 (child)	kg	USEPA, 1991b
Conversion factor	CF	10^{-3}	liter/cm^3	
Exposure time	ET	0.2	hours/day	USEPA, 1989c
Exposure frequency	EF	350	days/year	USEPA, 1991b
Exposure duration	ED	24 (adult) 6 (child)	years	USEPA, 1991b
Averaging time				
Carcinogenic	AT	70	years	USEPA, 1991c; USEPA, 1989a
Noncarcinogenic	AT	24 (adult) 6 (child)	years	USEPA, 1991b

Notes:
mg/liter = milligrams per liter
liters/day = liters per day
cm^2 = square centimeters
cm/hour = centimeters per hour
liter/cm^3 = liter per cubic centimeter
hours/day = hours per day
days/year = days per year
kg = kilogram

Table 5-4
Adult Future Resident,
Inhalation Exposure to Volatile Compounds While Showering

Technical Memorandum
Human Health Risk Assessment Methodology
NAS Cecil Field, Jacksonville, Florida

Equation:

$$\text{INTAKE} = \frac{\text{CA x IR x ET x EF x ED}}{\text{BW x AT X 365 days/year}}$$

Parameter	Symbol	Value	Units	Source
Concentration in air	CA	site specific	mg/liter	
Inhalation rate	IR	0.625	m^3/hour	USEPA, 1991d
Body weight	BW	70	kg	USEPA, 1991b
Exposure time	ET	0.2	hours/day	USEPA, 1989a
Exposure frequency	EF	350	days/year	USEPA, 1991b
Exposure duration	ED	30	years	USEPA, 1991b
Averaging time				
Carcinogenic	AT	70	years	USEPA, 1991c; USEPA, 1989a
Noncarcinogenic	AT	30	years	USEPA, 1991b

Notes: mg/liter = milligrams per liter
m^3/hour = cubic meters per hour
kg = kilograms
hours/day = hours per day
days/year = days per year

REFERENCES

ABB Environmental Services Inc. (ABB-ES), 1991a. "Naval Air Station, Cecil Field, Jacksonville, Florida, Remedial Investigation/Feasibility Study Workplan, Operable Units 1, 2, and 7"; Tallahassee, Florida; September 1991.

ABB Environmental Services Inc. (ABB-ES), 1991b. Site observation by Norman Richardson of ABB Environmental Services, Inc., Wakefield, MA; October 30, 1991.

ABB Environmental Services Inc. (ABB-ES), 1992. Site observation by Michelle Silkowski and Shannon Buckley of ABB Environmental Services, Inc., Washington, DC; August 19, 1992.

Cowherd, C., G.E. Muleski, P.J. Englehart, and D.A. Gillette. 1985. "Rapid assessment of exposure to particle emissions from surface contamination sites"; Government Reports Announcements and Index, Issue 16, 1985.

Envirodyne Engineers, 1985. "Initial Assessment Study of Naval Air Station Cecil Field"; Jacksonville, Florida; prepared for Naval Energy and Environmental Support Activity, Port Hueneme, California; July 1985.

Florida Department of Environmental Regulations (FDER), 1992. Florida Administrative Code 17-302. Surface Water Quality Standards. February 13, 1992.

Florida Game & Fresh Water Fish Commission (FG&FWFC), 1992. "Hunting Handbook Regulations Summary"; Tallahassee, Florida.

Geraghty and Miller, 1983. "Hydrogeologic Assessment and Ground Water Monitoring Plan, NAS Cecil Field, Jacksonville, Florida"; prepared for Naval Facilities Engineering Command, Southern Division, Charleston, North Carolina; October 1983.

Jacksonville Area Planning Board, 1979. "2005 Comprehensive Plan, Jacksonville, Florida"; Map 15.

Jacksonville Area Planning Board, 1980. "2005 Comprehensive Plan, Jacksonville, Florida"; Comprehensive Plan Supplement.

REFERENCES (Continued)

NAS Cecil Field, 1990. Letter from Deane E. Leidholt, Commander, CEC, U.S. Navy, to St. Johns River Water Management District, Jay C. Lawrence, Palatka, Florida, re., Consumptive use Permit Application No. 2-031-0113AUSGM2; NAS Cecil Field, Jacksonville, Florida, file no. 5000, 18400, May 29, 1990.

NAS Cecil Field, 1991. Letter from T.L. Rayback, Commander, CEC, U. S. Navy, to State of Florida Department of Environmental Regulation, Jacksonville, Florida, re., Potable Water analysis; NAS Cecil Field, Jacksonville, Florida, file no. 5090, 18400; November 22, 1991.

Seaburn and Robertson Inc., 1985. "Cecil Field Stormwater Master Plan"; November 1985.

Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), 1989. "NAS Cecil Field, Master Plan"; August 1989.

Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), 1991. "NAS Cecil Field, Site Management Plan"; May 1991.

U.S. Environmental Protection Agency (USEPA), 1988a. "Guidance for Conducting Remedial Investigations and Feasibility studies under CERCLA"; Office of Emergency and Remedial Response, Washington, DC, USEPA/540/G-89/004.

U.S. Environmental Protection Agency (USEPA), 1988b. "Superfund Exposure Assessment Manual"; Office of Emergency and Remedial Response, Washington, D.C., USEPA/540/1-88/001.

U.S. Environmental Protection Agency (USEPA), 1989a. "Risk Assessment Guidance for Superfund, Vol. I, Human Health Evaluation Manual"; Office of Emergency and Remedial Response, Washington, D.C., USEPA/540/1-89/002.

U.S. Environmental Protection Agency (USEPA), 1989b. "Risk Assessment Guidance for Superfund, Vol. II, Environmental Evaluation Manual"; Office of Emergency and Remedial Response, Washington, D.C., USEPA/540-1-89/001.

U.S. Environmental Protection Agency (USEPA), 1989c. "Exposure Factors Handbook"; Office of Health and Environmental Assessment, Washington, D.C., USEPA/600/8-89/043.

U.S. Environmental Protection Agency (USEPA), 1991a. "Users Guide for Lead: A PC Software Application of the Uptake/Biokinetic Model"; Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Cincinnati, OH.

U.S. Environmental Protection Agency (USEPA), 1991b. "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors"; Office of Emergency and Remedial Response, Toxics Integration Branch, Washington, D.C., OSWER Directive 9285.6-03; Interim final.

U.S. Environmental Protection Agency (USEPA), 1991c. Letter from Elmer W. Aiken, Health Assessment Officer, to Hazardous Waste Contractors, re., Region IV Risk Assessment Guidance; Atlanta, GA; March 20, 1991.

U.S. Environmental Protection Agency (USEPA), 1991d. "Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals)," Interim; Office of Emergency and Remedial Response, Office of Solid Waste and Emergency Response, Washington, D.C., Publication 9285.7-01B, NTIS PB92-963333.

U.S. Environmental Protection Agency (USEPA), 1992a. "Framework for Ecological Risk Assessment"; United States Environmental Protection Agency, Risk Assessment Forum. Washington, D.C., Publication EPA/630/R-62/001.

U.S. Environmental Protection Agency (USEPA), 1992b. "New Interim IV Guidance. Toxicity Equivalence Factor Methodology for Carcinogenic PAHs." February 10, 1992.

U.S. Environmental Protection Agency (USEPA), 1992c. "Dermal Exposure Assessment: Principles and Applications"; United States Environmental Protection Agency, Office of Health and Environmental Assessment. Washington, D.C., Publication EPA/600/8-91/011F.