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FINAL BASELINE RISK ASSESSMENT AT OPERABLE UNIT 8 (OU 8) SITE 3 NAS CECIL FIELD FL

9/1/1997

ABB ENVIRONMENTAL SERVICES INC

REMEDIAL INVESTIGATION, OPERABLE UNIT 8
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

September 1997

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Appendix P	Appendix P	Revised draft to final based on review comments
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BASELINE RISK ASSESSMENT

OPERABLE UNIT 8

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

UNIT IDENTIFICATION CODE: N60200
CONTRACT NO.: N62467-89-D-0317/090

SEPTEMBER 1997

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA
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OPERABLE UNIT 8

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Unit Identification Code: N60200

Contract No.: N62467-89-D-0317/090

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September 1997

CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

The Contractor, 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-0317/090 are complete and accurate and comply with all requirements of this contract.

DATE: September 22, 1997

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(DFAR 252.227-7036)

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 of. The Preliminary Assessment and Site Inspection identifies the presence of pollutants. The RI/FS analyzes the nature and extent of contamination and determines 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, an RI/FS will be performed to address the extent, magnitude, and impact of possible contamination at these waste sites.

The Baseline Risk Assessment report for Operable Unit 8 provides the results of the assessment of potential human health and ecological risks associated with the contamination identified at Site 3.

Questions regarding this report should be addressed to the Commanding Officer, Code 00B, P.O. Box 111, NAS Cecil Field, Jacksonville, Florida 32215-0111.

EXECUTIVE SUMMARY

A Baseline Risk Assessment (BRA) was completed for Operable Unit (OU) 8, which contains Site 3, at Naval Air Station (NAS) Cecil Field near Jacksonville, Florida. The BRA is based on information collected during the Remedial Investigation (RI). The BRA results are used to develop remedial response objectives in the Feasibility Study (FS). The BRA, RI, and FS are being completed as part of the Navy's Installation Restoration (IR) program. The objective of the IR program is to identify and evaluate past hazardous waste sites and control migration of hazardous contaminants from those sites.

Qualitative and quantitative evaluations of risks to human health and the environment were completed for exposures in surface soil, subsurface soil, sediment, surface water, and groundwater. Following is a summary of the human health and ecological risk associated with Site 3.

Human Health Risks at Site 3. The calculated cancer risks and noncancer hazards associated with surface soil, subsurface soil, sediment, and surface water for current and future-use scenarios are all within the acceptable range of U.S. Environmental Protection Agency (USEPA) guidance (10^{-4} to 10^{-6} for carcinogenic endpoints and less than unity for noncarcinogenic endpoints).

For domestic use of groundwater (ingestion of groundwater and inhalation of volatile organic compounds [VOCs] while showering) by an adult, the cancer risk was $3x10^{-3}$. This value exceeded the USEPA acceptable risk range (10^{-4} to 10^{-6}). The risk was due primarily to ingestion of 1,1-dichloroethene, trichloroethene, 1,4-dichlorobenzene, and arsenic.

A hazard index (HI) of 20 was associated with domestic use of groundwater by an adult. This exceeds the USEPA acceptable noncancer guidance value (HI=1). The major contributors to the HI are trichloroethene, 1,2-dichloroethene (total), 1,2-dichlorobenzene, and 1,1-dichloroethene.

Ecological Risks at Site 3. Potential risks for ecological receptors were evaluated for ecological chemicals of potential concern (ECPCs) in surface soil, surface water, sediment, and groundwater.

No risks associated with exposure to surface soil at Site 3 were identified for wildlife or soil invertebrates. Toxicity tests in lettuce (*Lactuca sativa*) seed showed reduced germination in two surface soil samples. However, results are confounded by low statistical power. Because there was no correlation between any ECPC concentrations and observed responses, it is likely that a nonsite related stressor (i.e., physical or biological stressor) is responsible for the observed adverse response.

There were no risks identified for terrestrial wildlife resulting from exposures to ECPCs in surface water and sediment. No risks to aquatic receptors were attributed to exposure to Site 3 surface water or sediment.

Undiluted, unfiltered groundwater at Site 3 may result in risk to aquatic organisms. Although several groundwater risk contributors were identified, three dichlorobenzene isomers (1,2-dichlorobenzene [DCB], 1,3-DCB and 1,4-DCB) were found to be the primary risk contributors. However, when a dilution factor was

applied to estimate the dilution of groundwater prior to discharge to Rowell Creek, concentrations of chemicals in groundwater were below available aquatic toxicity benchmarks and criteria. Toxicity testing of groundwater with the water flea and fathead minnow supports the contention that diluted groundwater discharging to Rowell Creek poses little risk to aquatic receptors.

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
AQUIRE	Aquatic Information Retrieval
AVS	acid volatile sulfide
AWQC	ambient water quality criteria
BAF	bioaccumulation factor
BCF	bioconcentration factor
bls	below land surface
BRA	Baseline Risk Assessment
BRAC	Base Realignment and Closure
C-NOEC	chronic no observed effect concentration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
CLP	Contract Laboratory Program
CDM	Camp, Dresser and McKee
COC	chemical of concern
CPC	chemical of potential concern
CRAVE	Cancer Risk Assessment Verification Endeavor
CSF	cancer slope factor
°C	degree Celsius
DDT	dichlorodiphenyltrichloroethane
DERP	Defense Environmental Restoration Program
DO	dissolved oxygen
EA	EA Engineering, Science, and Technology
ECPC	ecological chemical of potential concern
EC_{50}	effective concentration for 50 percent of test population
ELCR	excess lifetime cancer risk
EPC	exposure point concentration
EPT	ephemeroptera-plecoptera-trichoptera
ER-L	effects range-low
ER-M	effects range-median
ERA	Ecological Risk Assessment
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection (as of 7/93)
FDER	Florida Department of Environmental Regulation (before 7/93)
FGFWFC	Florida Game and Fresh Water Fish Commission
FGS	Florida Geological Survey
FNAI	Florida Natural Areas Inventory
FOTW	Federally Operated Treatment Works
FS	Feasibility Study
GPC	gel-permeation cleanup

HEAST	Health Effects Assessment Summary Tables
HHCPC	human health chemical of potential concern
HHRA	Human Health Risk Assessment
HI	hazard index
HQ	hazard quotient
IRIS	Integrated Risk Information System
IZS	intermediate zone surficial
K_{ow}	octanol-water partition coefficient
K_p	permeability constants
LC_{50}	lethal concentration where 50 percent of test population dies
LD_{50}	lethal dose where 50 percent of test population dies
LEL	lower explosive limit
LOEC	lowest observed effect concentration
LOAEL	lowest observed adverse effects level
LZS	deep zone surficial
m^2	square meter
MATC	maximum acceptable toxicant concentration
MCL	maximum contaminant level
μmhos/cm	micromhos per centimeter
μg/kg	micrograms per kilogram
μg/ℓ	micrograms per liter
mg/ℓ	milligrams per liter
mg/kg	milligrams per kilogram
mg/day	milligrams per day
mg/kg-day	milligrams per kilogram per day
mg/cm^2	milligrams per square centimeter
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NFD	Naval Fuel Depot
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no observed adverse effect level
NPL	National Priority List
NRC	National Research Council
NTU	nephelometric turbidity units
OLF	outlying landing field
OME	Ontario Ministry of the Environment
OU	Operable Unit
PAH	polynuclear aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, comparability, and completeness
PCBs	polychlorinated biphenyls
PDE	potential dietary exposure

PEF	particulate emissions factor
POL	petroleum, oils, and lubricants
QA/QC	quality assurance and quality control
QC	quality control
RBC	risk based concentration
RBP	rapid bioassessment protocols
RfC	reference concentration
RfD	reference dose
RGOs	remedial goal options
RI/FS	Remedial Investigation and Feasibility Study
RI	Remedial Investigation
RME	reasonable maximum exposure
RPF	Relative Potency Factors
RTVs	reference toxicity values
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SFF	site foraging frequency
SMP	Site Management Plan
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SQGs	Sediment Quality Guidelines
SQL	sample quantitation limit
SSC	species of special concern
SVOC	semivolatile organic compound
TAL	target analyte list
TCL	target compound list
TEF	toxicity equivalence factor
TIC	tentatively identified compound
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
UCL	upper confidence limit
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UZH	upper zone Hawthorn
UZS	upper zone surficial
VOC	volatile organic compound

1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES), has been contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), under Contract No. N62467-89-D-0317, to complete a Baseline Risk Assessment (BRA) as part of a Remedial Investigation and Feasibility Study (RI/FS) for Operable Unit (OU) 8 at Naval Air Station (NAS) Cecil Field in Jacksonville, Florida. In 1990, NAS Cecil Field was placed on the National Priority List (i.e., Superfund), and the Navy entered into a Federal Facility Agreement with the U.S. Environmental Protection Agency (USEPA) and the Florida Department of Environmental Regulation (FDER) (now the Florida Department of Environmental Protection [FDEP]). The RI/FS is being completed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act (SARA) of 1986, which established a series of programs for the cleanup of hazardous waste disposal and spill sites nationwide. One of those programs, the Defense Environmental Restoration Program (DERP), is codified in SARA Section 211 (10 United States Code 2701). The Navy's Installation Restoration (IR) program is a component of the DERP.

Waste sites located at NAS Cecil Field have been divided into eight OUs based on the types of wastes disposed of or typical profiles of suspected chemicals (SOUTHNAVFACENGCOM, 1993). OU 8 is Site 3, the Oil and Sludge Disposal Pit. Human health and ecological risk assessments (ERAs) will be completed for this OU as a component of the RI/FS report.

The goals of the RI/FS are to assess the extent, magnitude, and impact of confirmed contamination at waste disposal sites, to assess qualitatively and quantitatively the risks posed to human health and the environment, and to develop appropriate remedial alternatives for sites that are determined to pose a threat to human health and/or the environment.

The BRA is required as part of the Remedial Investigation (RI) for hazardous waste sites under USEPA guidance (USEPA, 1988b). The risk assessment for OU 8 was completed according to current USEPA guidance for risk assessments at Superfund sites (USEPA, 1989a; 1989b; 1989c; 1991b; 1991c; 1991f; 1992a; 1992b; 1992c; 1992h) and USEPA Region IV guidance for Superfund risk assessments (USEPA, 1991e).

The remainder of the BRA is organized as summarized in the following paragraphs.

- **CHAPTER 2.0, HISTORY AND ENVIRONMENTAL SETTING** - establishes the site history of OU 8 along with the environmental setting of NAS Cecil Field and OU 8 and includes discussions of local topography, surface water and drainage, geology and hydrogeology, demographic information, and groundwater and land usage.

- **CHAPTER 3.0, OPERABLE UNIT 2 INVESTIGATION AND DATA EVALUATION METHODOLOGY** - includes a summary of the OU 8 field investigation and a discussion of the data evaluation methodology used for the human health and ERAs for OU 8.

- **CHAPTER 4.0, HUMAN HEALTH RISK ASSESSMENT** - includes the characterization of the risks associated with potential exposures to site-related chemicals detected at OU 8 for human receptors. To determine if chemicals pose a potential risk to human receptors, four components for the human health evaluation are completed: (1) data evaluation and summarization, including identification of human health chemicals of potential concern (HHCPCs); (2) an exposure assessment covering both present and future uses of the site; (3) a toxicity assessment of HHCPCs; and (4) a risk characterization with an uncertainty analysis.

- **CHAPTER 5.0, ECOLOGICAL RESOURCES** - includes a description of the ecological setting at OU 8 and the results of field investigations completed to support the ecological assessment. Wetland and upland habitats are identified and characterized based on field observations. Aquatic habitats and receptors are characterized, including fish species, physical parameters, and chemical parameters. Benthic macroinvertebrate community structure and function are measured and the results are discussed.

- **CHAPTER 6.0, ERA** - includes an assessment of potential adverse effects for ecological receptors associated with contamination emanating from OU 8. The ecological assessment includes problem formulation, identification of ecological chemicals of potential concern (ECPCs), exposure assessment, ecological effects assessment, risk characterization, and uncertainty analyses.

2.0 HISTORY AND ENVIRONMENTAL SETTING

This chapter briefly discusses the history and setting of NAS Cecil Field and OU 8. A more detailed discussion of these aspects of the site is included in the RI for OU 8 (ABB-ES, 1995).

The main facility of NAS Cecil Field is located in southwestern Duval County, Florida, and is within the Jacksonville, Florida, city limits (Figure 2-1). Land west and north of the base is characterized as rural and is predominantly forested. Cary State Forest is 5 miles to the northwest.

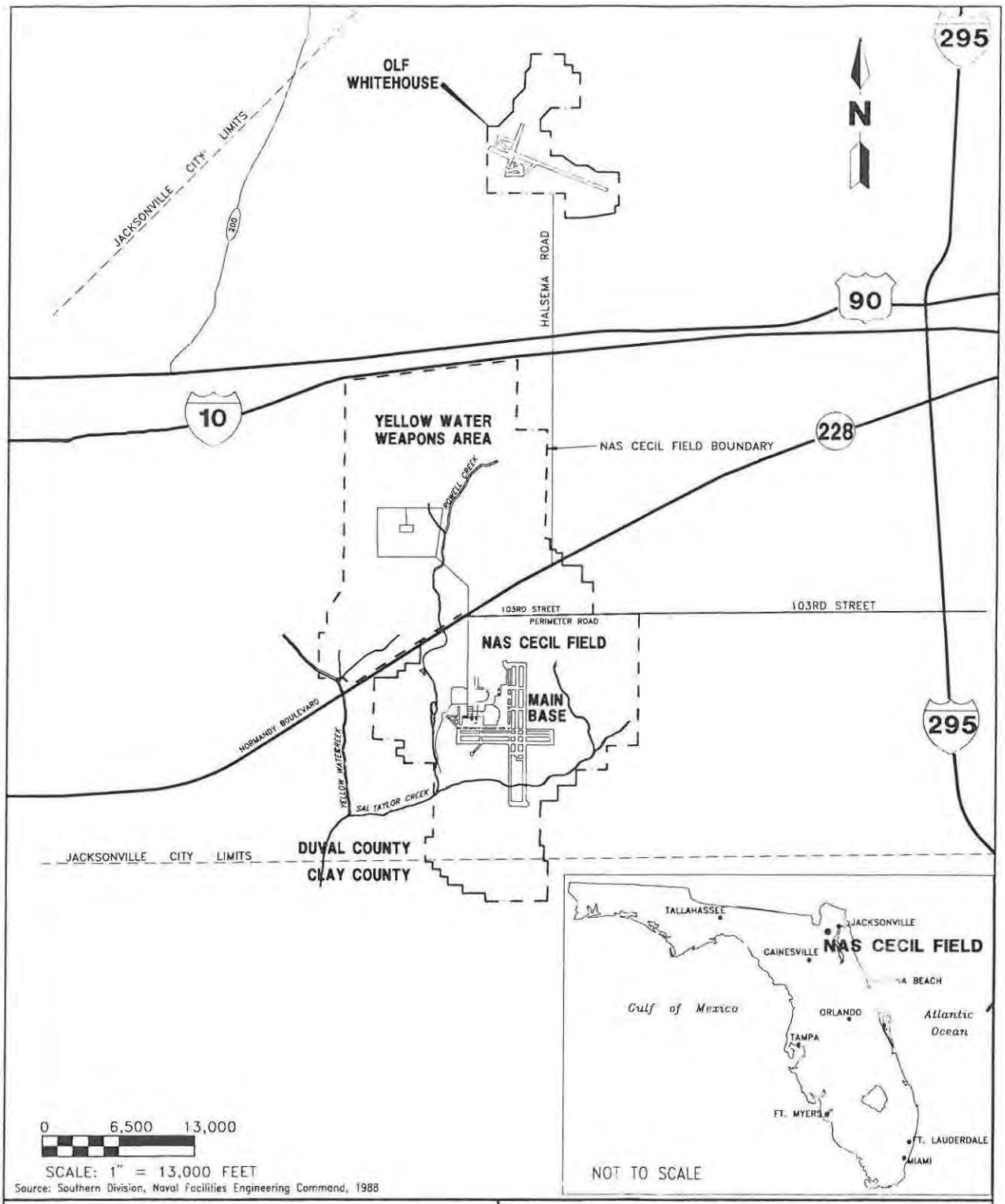
Since NAS Cecil Field was established in 1941, it has grown to more than 31,000 acres. Some of the tasks required to accomplish the NAS Cecil Field mission include (1) operation of fuel storage facilities, (2) provision of facilities and performance of organizational level aircraft maintenance, (3) provision of facilities and performance of intermediate level aircraft maintenance, (4) maintenance and operation of an engine repair facility and test cells for designated turbo-jet engines, and (5) provision of special weapons support. The base has been scheduled for closure in the 1990s as a part of Base Realignment and Closure (BRAC); therefore, many of the operations are being scaled down in preparation for closure. The future use of the facility will be determined under BRAC.

2.1 OU 8 LOCATION AND HISTORY. OU 8 is composed of one site, Site 3, which is located immediately northeast of the intersection of Perimeter Road and the service road leading away from the south end of Lake Fretwell (Figure 2-2). This site consists of the disposal pit and the helicopter crash site.

2.1.1 Site 3 At Site 3 (Figure 2-3), the disposal pit was reported to be approximately 50 to 100 feet in diameter and 3 to 5 feet deep. The periphery of the site is depressed approximately 1 to 2 feet below the roads with a mounded area near the center of the site that is 2 to 4 feet above the roads. Site 3 has an area of relatively featureless terrain; hence, the exact location of the former pit is unknown. Review of aerial photographs indicates approximate pit location and road realignment. This area is currently idle land and is highly vegetated. This vegetation consists of low weeds and briers. To the east, the study area grades into wetlands adjacent to Lake Fretwell and Rowell Creek to the northeast and east. No indication of stressed vegetation has been observed at Site 3.

In previous investigations, Site 3 has been presented as a part of OU 2 (originally containing Sites 3, 5, and 17). In October 1993, at the 1994 Fiscal Year (SMP) meeting, the USEPA, the FDEP, and the Navy decided to investigate Site 3 as a separate OU. The investigations for Sites 5 and 17 of OU 2 were complete, but Site 3 needed more investigation. To facilitate investigative procedures, it was decided to proceed with the remedial process for Sites 5 and 17 under OU remedial 2, and to investigate Site 3 as OU 8. The site-specific history is presented as follows.

OU 8 was used to dispose of liquid wastes and sludge from the mid-1950s until 1975. Liquid wastes were typically taken to the site by the individual shops (i.e., the fuel farm, the Public Works, Aircraft Maintenance Department, and the



Source: Southern Division, Naval Facilities Engineering Command, 1988

FIGURE 2-1
GENERAL LOCATION MAP

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BASELINE RISK ASSESSMENT
OPERABLE UNIT 8

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

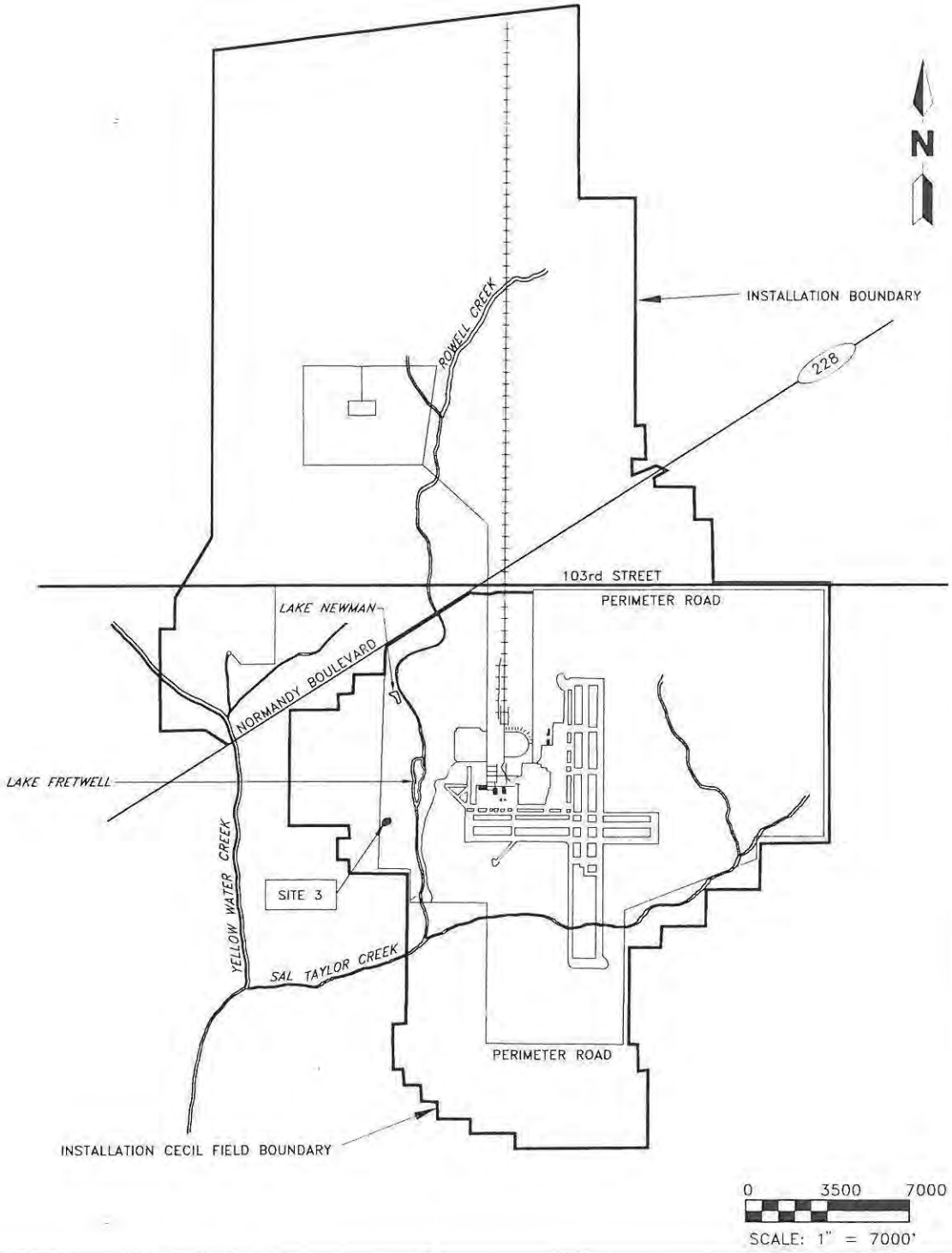

FIGURE 2-2
SITE LOCATION MAP

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BASELINE RISK ASSESSMENT
OPERABLE UNIT 8

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

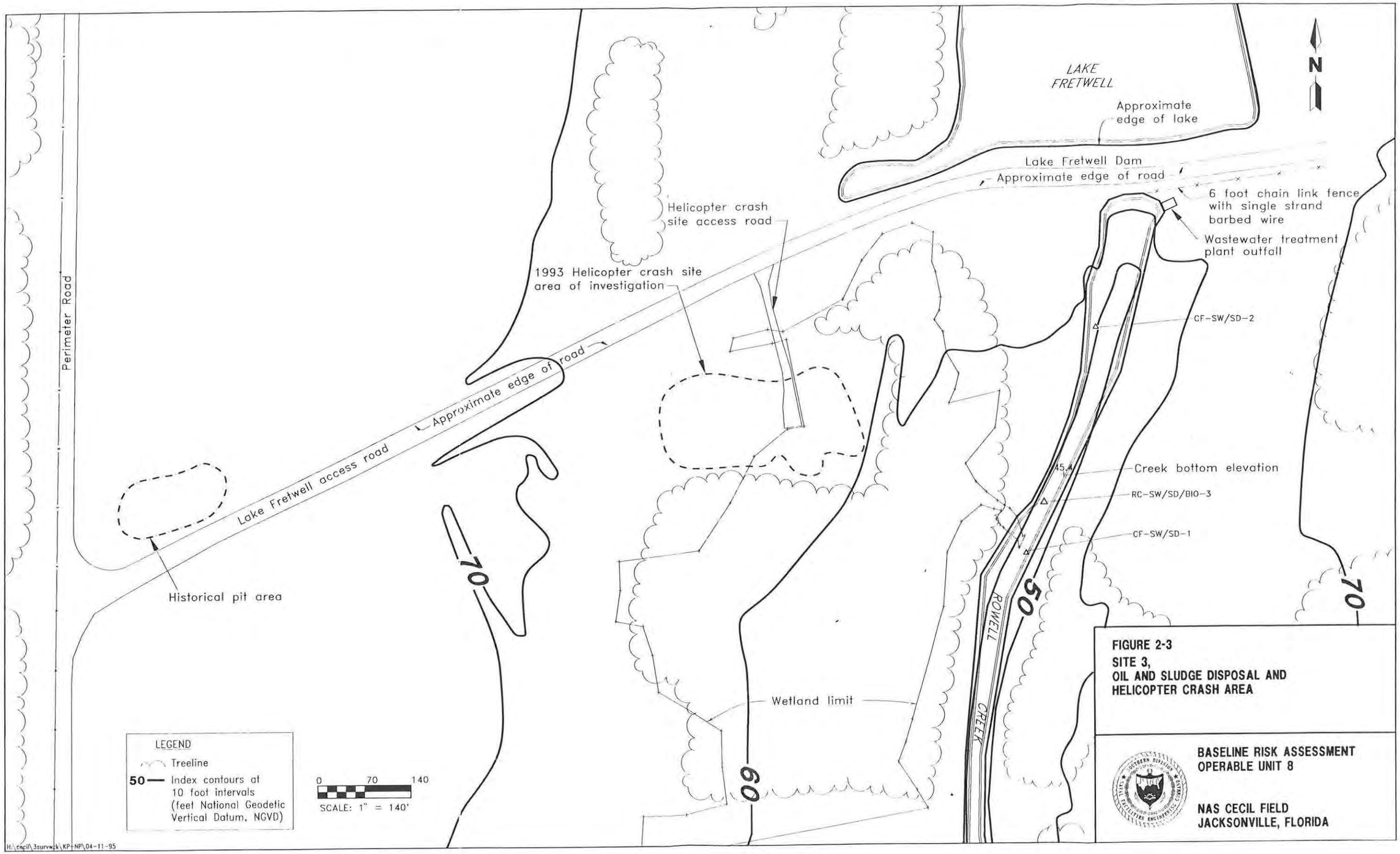

FIGURE 2-3
SITE 3,
OIL AND SLUDGE DISPOSAL AND HELICOPTER CRASH AREA

BASELINE RISK ASSESSMENT
OPERABLE UNIT 8

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

squadrons) in bowsers (trailer mounted tanks) or 55-gallon drums, drained into the pit, and allowed to seep into the soil or evaporate. The pit wastes were burned when the liquid level approached the top. This procedure was repeated approximately once every 3 months by the fire department (Envirodyne Engineers, 1985).

An estimated 200 to 300 gallons of waste oil, fuel, and tank sludge from the fuel farm were disposed of weekly at the site. Although much of this volume consisted of water, it is estimated that between 210,000 and 310,000 gallons of these wastes from the fuel farm were disposed of throughout the operation of the site.

Liquid wastes generated by the squadrons, Aircraft Maintenance Department, and Public Works were also disposed of at OU 8. These wastes included fuels, oils, solvents, paint, and paint strippers. No records were kept on disposal practices and access to the site was uncontrolled; therefore, the amount of the liquid wastes disposed of at OU 8 is unknown.

Estimates of the total quantity dumped from all sources during the site operation are the following: waste paints, 4,200 gallons; spent solvents, 110,000 gallons; paint thinners, 20,000 gallons; petroleum-oil-lubricant wastes, 440,000 gallons; and waste fuel, oil, and sludge contaminated water, 210,000 to 310,000 gallons. Following closure of the site in 1975, the pit was filled and covered with soil.

Currently, the area that was formerly the Site 3 disposal pit is relatively featureless (i.e., the location of the disposal pit is not apparent). The area is vegetated, primarily by briers and weeds.

On February 28, 1992, a helicopter, which had just refueled, malfunctioned and crashed into a marshy area of Site 3 (Figure 2-3). The primary crash site, located south of the Lake Fretwell access road, consists of an area of approximately 20 feet by 20 feet. When the helicopter crashed, there were approximately 1,800 to 2,000 gallons of fuel on board. The helicopter ignited and, during the course of extinguishing the fire, it is believed that much of the fuel migrated downgradient to the east and southeast towards Rowell Creek.

2.2 TOPOGRAPHY AND SURFACE FEATURES. 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).

OU 8 consists of Site 3, the disposal pit and adjacent area and the helicopter crash site. OU 8 covers an area of approximately 25 acres and extends from Perimeter Road to the southern tip of Lake Fretwell and up to 1,000 feet downstream from the Lake Fretwell Dam. The seepage pit is located adjacent to Perimeter Road approximately 1,400 feet west-southwest of Lake Fretwell near the intersection of Perimeter Road and a service road known as the Lake Fretwell access road, which crosses the dam and bisects OU 8. The area west of Rowell Creek and east of Perimeter Road is primarily flat and covered with vegetation ranging from open grassy to heavily wooded areas. Perimeter Road and the Lake

Fretwell access road are maintained, but not paved their entire length. There is indication from the aerial photographs that the Lake Fretwell access road was realigned (straightened) in the vicinity of the pit area in the late 1960s. Surface features and topography are presented on Figure 2-4.

OU 8 is vegetated with grass and covered with briers and branches. Adverse effects, such as surface soil staining or stressed vegetation, from waste activities were not visible during site visits in 1988, 1991, and 1993.

In addition to Lake Fretwell, the primary surface features in the area of OU 8 are Rowell Creek and a wetland west of Rowell Creek. The delineated wetland (Figure 2-3) is about 6.7 acres, of which about 2.7 acres overlie the contaminated groundwater. The topography of OU 8 is relatively flat with no prominent hills or depressions.

The Lake Fretwell access road runs southwest to northeast from the intersection of Perimeter Road to the dam at Lake Fretwell. In the vicinity of Lake Fretwell, remnants of an old bridge crossing Rowell Creek are still visible. A temporary road was erected to create access to the location of the helicopter crash site. This road is primarily overgrown with vegetation, but can still be observed from the Lake Fretwell access road.

The effluent discharge structure for the Federally Operated Treatment Works (FOTW) is approximately 300 feet south of the Lake Fretwell Dam and discharges directly to Rowell Creek. In the vicinity of the effluent discharge structure, concrete rubble (generally greater than 1 foot in diameter) has been spread on the banks of Rowell Creek. This rubble appears to be acting as an erosion control structure intended to stabilize the soil and discharge structure.

2.3 SURFACE HYDROLOGY. NAS Cecil Field is located mostly within the St. Johns River drainage basin with a small part located in the St. Marys River drainage basin. Because of the extremely low gradient and abundance of swampy areas, the surface water divide between the St. Johns River drainage basin and the St. Marys River drainage basin is not well defined.

Most surface water in Duval County is derived from rainfall within the county, except for a small amount of inflow from neighboring Baker County to the west (Anderson, 1972). Groundwater seepage from springs also contribute substantially to base flow in streams.

2.3.1 Drainage at NAS Cecil Field Drainage at NAS Cecil Field consists of sheet flow across areas of low topographic relief combined with streams and canals of low order (having few to no tributaries) (Figure 2-5). In the St. Johns River drainage basin, streams from west to east include Yellow Water Creek, Rowell Creek, and Sal Taylor Creek. Sal Taylor Creek drains the eastern part of the facility, whereas Rowell Creek receives drainage from the central part and flows into Sal Taylor Creek in the south-central part of the facility.

In the St. Marys River drainage basin (the northern part of the Yellow Water Weapons Area), sheet flow and swampy areas eventually drain into Brandy Branch, which is a tributary of the St. Marys River.

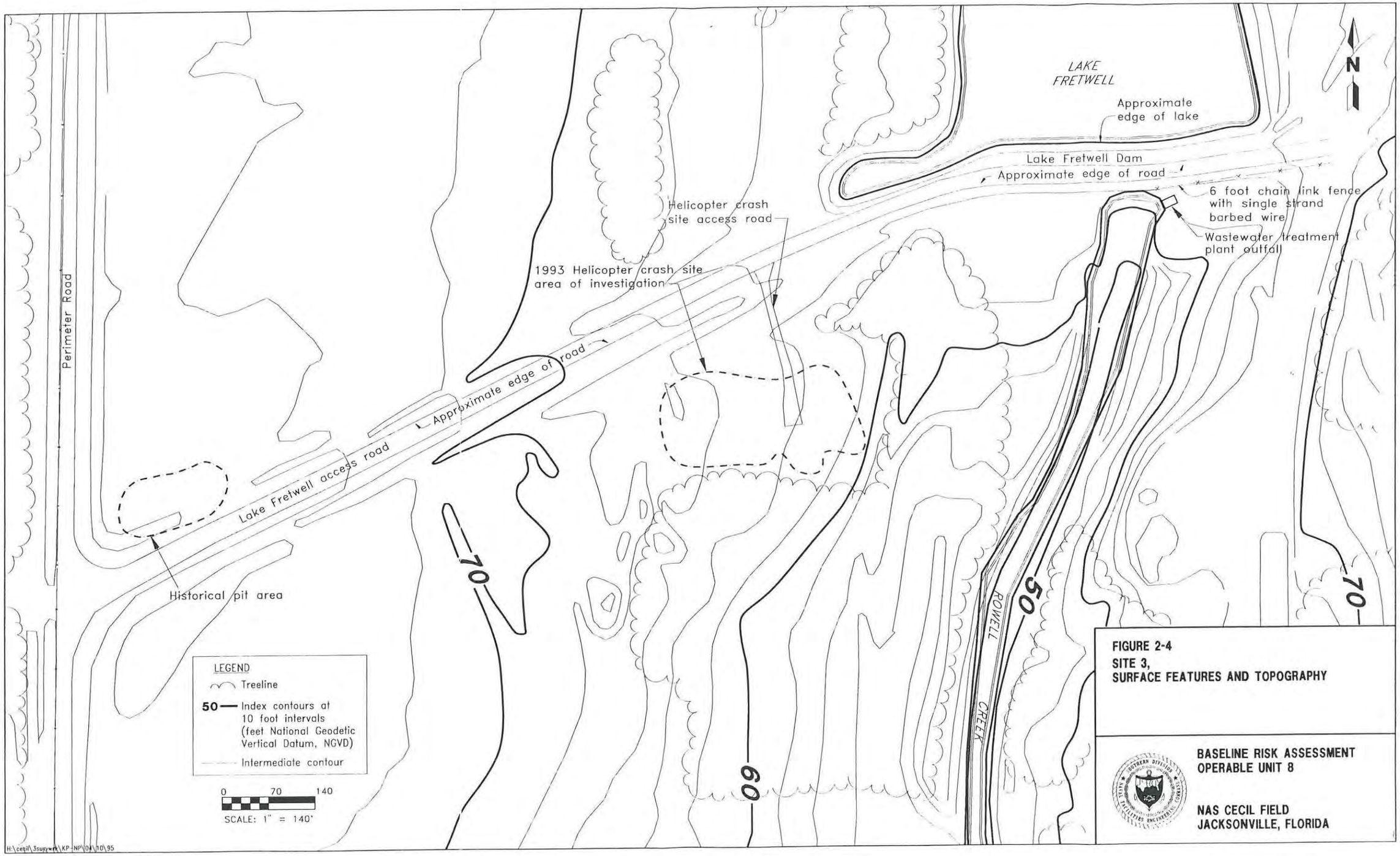

FIGURE 2-4
SITE 3,
SURFACE FEATURES AND TOPOGRAPHY

BASELINE RISK ASSESSMENT
OPERABLE UNIT 8

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

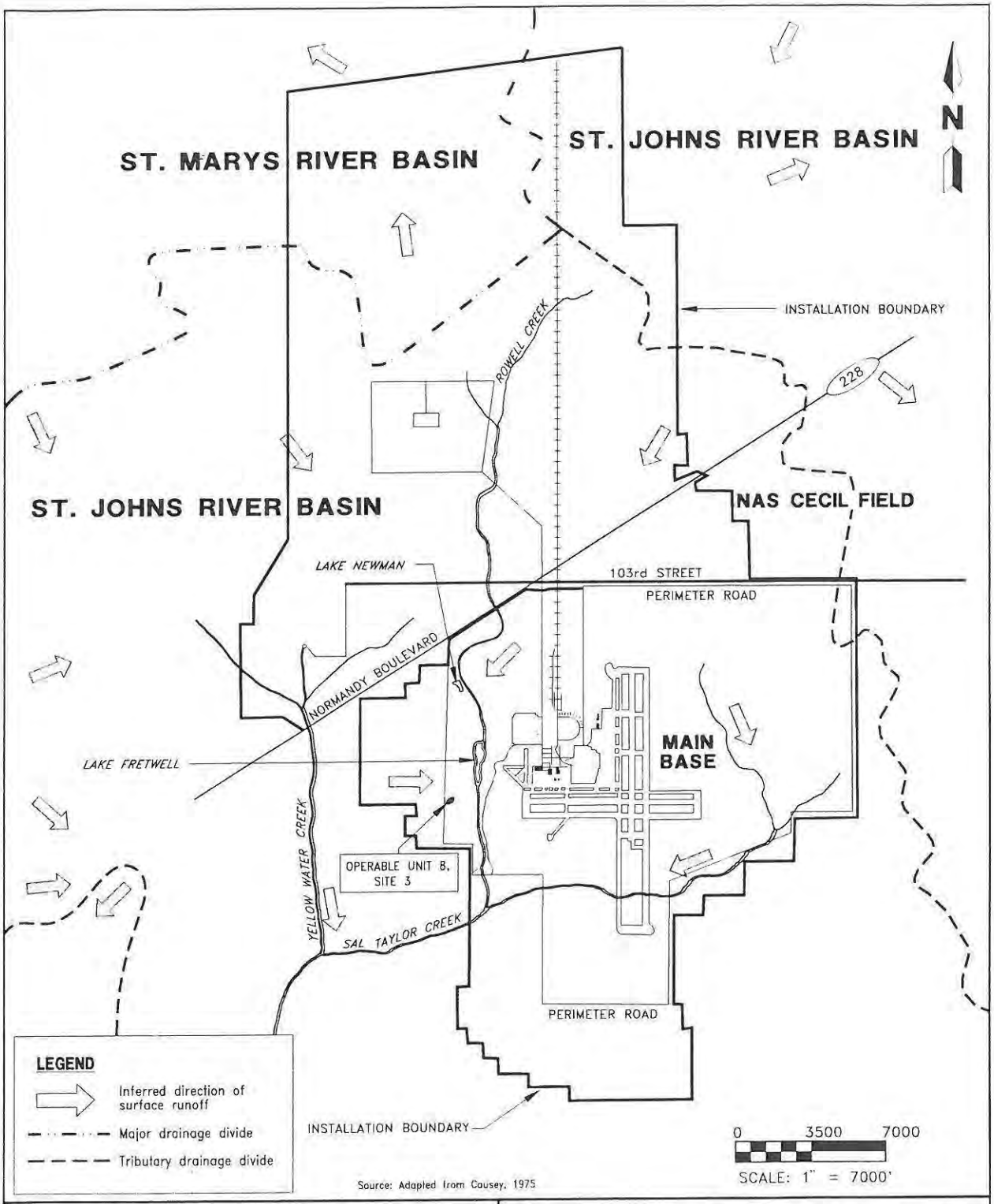

FIGURE 2-5
MAJOR DRAINAGE BASINS AT NAS CECIL FIELD

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BASELINE RISK ASSESSMENT
OPERABLE UNIT 8

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

In the southern half of NAS Cecil Field, swampy areas in the uplands (which are probably perched on locally occurring clayey lenses) are drained by steep gradient (approximately 40 feet per mile), first order unnamed tributaries that flow directly into the major creeks.

Lake Fretwell, Rowell Creek, and Sal Taylor Creek are classified by the FDEP as Class III waters and, as such, are designated for recreation, propagation, and management of fish and wildlife and are not used for drinking water resources (Jacksonville Area Planning Board, 1980). Rowell Creek creates the eastern border of OU 8. Effluent from the FOTW is discharged directly to Rowell Creek approximately 300 feet from the Lake Fretwell Dam and has a flow rate of 1.2 cubic feet per second. The total flow in Rowell Creek is the baseflow combined with the effluent from the FOTW. Lake Fretwell, located upstream of OU 8, is a manmade lake approximately 8 acres in size and is stocked with bass for sportfishing. A recreational complex has been developed along its northeastern shoreline (SOUTHNAVFACENGCOM, 1989).

2.3.2 **Drainage at OU 8** In the vicinity of OU 8, Rowell Creek has a slope of approximately 8 feet per mile. Surface drainage at OU 8 consists of sheet flow from Perimeter Road across the length of the site to Rowell Creek. Major drainage pathways are the roadside culverts along the service road that slopes slightly down toward Lake Fretwell. In its upper reaches, Rowell Creek tends to have a lower gradient (5 feet per mile) and possesses a slightly incised streambed, whereas downstream gradients tend to be greater (approximately 10 feet per mile) with streambeds that are more deeply incised. The wetland area of OU 8 drains into Rowell Creek. Surface water flow is east toward Rowell Creek in the vicinity of OU 8.

A more detailed description of the surface water hydrology and drainage at NAS Cecil Field, and at OU 8 in particular, is contained in the RI report (ABB-ES, 1995).

2.4 **REGIONAL GEOLOGY**. A detailed description of the geology of Duval County and OU 8 is contained in the RI report (ABB-ES, 1995). In general, the area in which NAS Cecil Field is situated consists of mostly quartz sand, with some clayey sand and clay, from the land surface to approximately 100 feet below land surface (bls). Below these sediments lie sediments of the Hawthorn Group, which are generally clay rich and are over 300 feet thick in the area of NAS Cecil Field. Locally, the upper part of the Hawthorn Group sediment consists of a carbonate-rich unit of dolostone or shell that has been called the "rock aquifer" or "secondary artesian aquifer." In the vicinity of NAS Cecil Field, this unit is approximately 20 to 25 feet thick and occurs at a depth of 60 to 120 feet bls. Below the Hawthorn Group is a series of carbonate-rich units that form the Floridan aquifer system.

2.5 **HYDROGEOLOGY**. A detailed description of the hydrogeology in this area of investigation is included in the RI report (ABB-ES, 1995). In the area of NAS Cecil Field, there are three water-bearing systems. According to the Florida code of hydrostratigraphic nomenclature, as described in Florida Geological Survey (FGS) Special Publication 28 (Southeastern Geological Society, 1986), these units, from most shallowest to deepest, are the surficial aquifer system,

the intermediate aquifer system and confining unit, and the carbonate-rich Floridan aquifer system.

The surficial aquifer system in the area of OU 8 is composed of undifferentiated sediments. It is not separated into an upper and lower zone based on geology, but rather is considered as one unit. Although the surficial aquifer at OU 8 will be discussed as a single unit, well screens were placed to investigate conditions in the shallow (UZS), intermediate (IZS), and deep (LZS) parts of the surficial aquifer system.

The historical "rock aquifer" or "secondary artesian aquifer" is a water-bearing unit widely used in this region as a private drinking water source. For this report, this unit will be referred to as the upper water-bearing zone of the Hawthorn Group (UZH). It is included as a zone within the intermediate aquifer system and confining unit.

The Floridan aquifer system was not encountered during the investigation at OU 8.

The general groundwater flow direction in the surficial aquifer is to the southeast. This general flow direction indicates that the groundwater discharges to Rowell Creek. However, there is a dramatic upward vertical gradient in the surficial aquifer before groundwater even reaches Rowell Creek. The groundwater appears to be upwelling from the intermediate aquifer to the surficial aquifer.

Regional groundwater flow in the UZH is to the east (Fairchild, 1972). There is the potential for upward leakage of water from this unit to the surficial aquifer system, which is particularly true near Rowell Creek. At OU 8, the groundwater flow direction in the intermediate aquifer is to the southeast, toward Rowell Creek.

Leve (1966) and Geraghty & Miller (1983) report that groundwater within the Floridan aquifer system flows east-northeast in the vicinity of NAS Cecil Field.

More detailed information on the hydrogeology of NAS Cecil Field, and at OU 8, is contained in the RI report (ABB-ES, 1995).

2.6 DEMOGRAPHY AND LAND-USE INFORMATION. Information presented in this section was collected to identify, enumerate, and characterize human populations potentially exposed to chemicals present at and released from Site 3. This information is necessary to support the human health risk assessment for the sites.

2.6.1 Population In the Resource Availability Inventory Report distributed by the St. Johns River Water Management District (1990), the population of Duval County is reported to be increasing with time and continued growth is projected through the year 2000. The military personnel at NAS Cecil Field and surrounding military bases, such as NAS Jacksonville, Naval Station Mayport, and Naval Fuel Depot Jacksonville contribute significantly to this population. NAS Cecil Field supports a workforce of approximately 10,000 civilian and military personnel and can accommodate approximately 3,500 residents in base quarters and housing (ABB-ES, 1992a).

2.6.2 Groundwater Use The surficial aquifer system is described in Section 2.5. Water obtained from the surficial aquifer system is primarily used for lawn irrigation and domestic purposes, including heat exchange units in heating and air conditioning systems. The yield of the wells is typically between 30 and 100 gallons per minute, and water-use estimates for the surficial aquifer system are approximately 10 to 25 million gallons per day for the city of Jacksonville (Jacksonville Area Planning Board, 1990). The surficial aquifer water level and flow directions have been altered over time because of increased water use and pumping rates.

The intermediate aquifer system is described in Section 2.5. The water from the limestone, shell, and sand part of the UZH is hard to very hard and has moderate dissolved solids levels. The iron content is variable, and some areas contain hydrogen sulfide (Geraghty & Miller, 1985). At least 50,000 homes in the Jacksonville area obtain water from private wells set in the UZH.

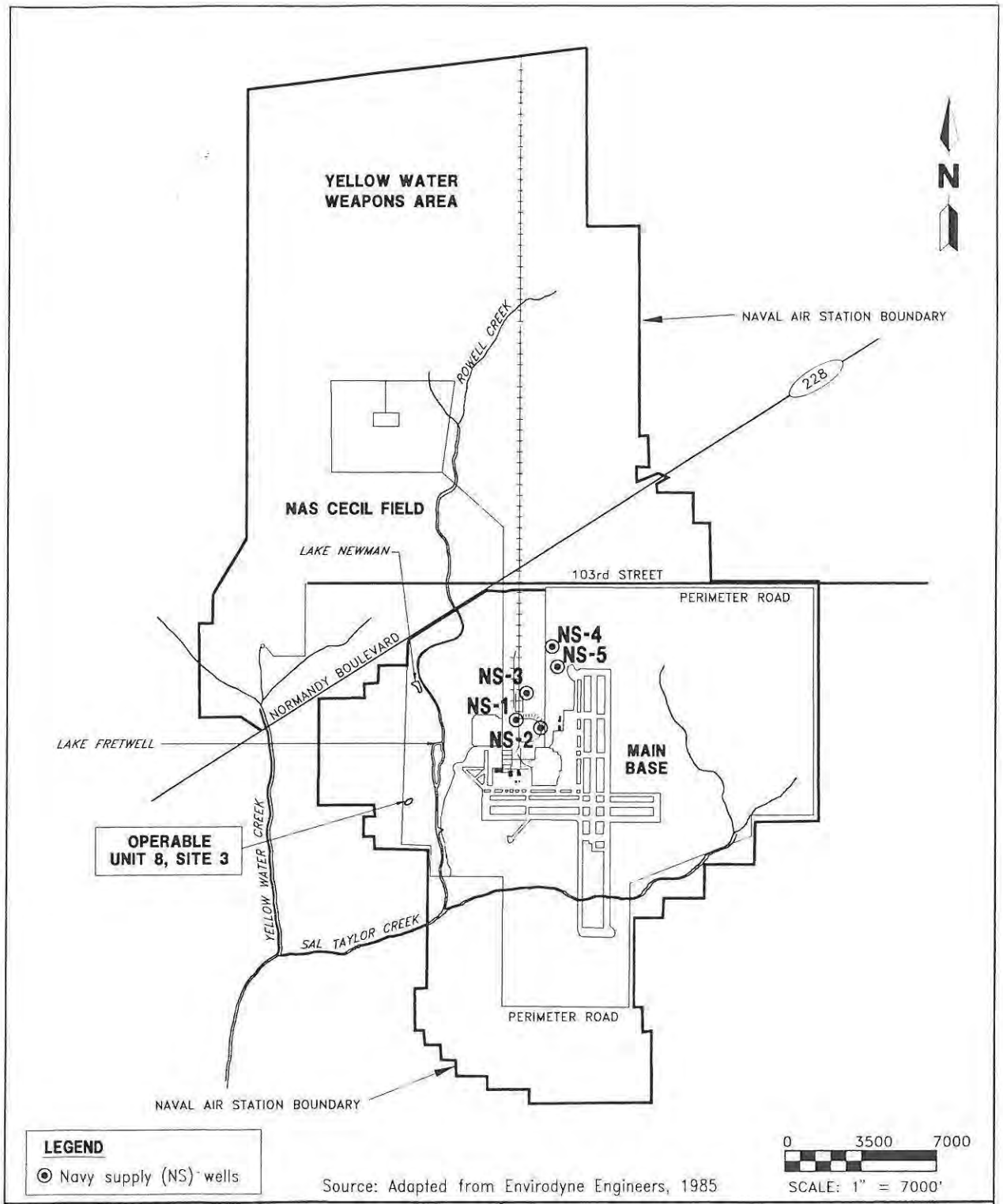
The Floridan aquifer system is one of the most productive aquifers in the world and is the primary source of water in Jacksonville for all uses.

2.6.2.1 Navy Supply Wells NAS Cecil Field obtains its potable water from five public supply wells set within the Floridan aquifer system within the property boundary (Figure 2-6). These wells are located approximately 7,000 feet upgradient from Site 3. These wells are set at depths ranging from 400 to 800 feet bls (NAS Cecil Field, 1990). Water is extracted from these 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. 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. There was no reported incidence of groundwater contamination in any of the wells at NAS Cecil Field tapping the Floridan aquifer system. There are no backup supplies of potable water.

Other wells on NAS Cecil Field reportedly tap the UZH (Geraghty & Miller, 1983). These wells are not a part of the NAS Cecil Field water supply system and are not used for drinking water. These wells are used as individual water supplies along the outlying areas of the base that are not served by the main water system. Water from these wells is used for sanitation (e.g., flushing toilets) and irrigation (Envirodyne Engineers, 1985).

2.6.2.2 Private Water Supply Wells The Florida Department of Health and Rehabilitative Services estimates that there are approximately 75 private wells located within a 2-mile radius of NAS Cecil Field and they reportedly produce from within the UZH. These wells are located both upgradient and cross gradient of the Site 3. The closest of these wells to Site 3 is approximately 4,500 feet to the southwest. 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 set at 64 and 125 feet deep (Geraghty & Miller, 1983).

2.6.3 Land Use The land use at NAS Cecil Field and the surrounding area is described in this section.



Source: Adapted from Envirodyne Engineers, 1985

FIGURE 2-6
POTABLE WATER SUPPLY WELLS AT NAS CECIL FIELD

H:\CECIL\RI-FACIL\NP\04-11-95

BASELINE RISK ASSESSMENT
OPERABLE UNIT 8

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

2.6.3.1 **Current Facility Land Use** NAS Cecil Field occupies more than 31,000 acres and consists of four distinct areas: (1) the main facility (NAS Cecil Field), which occupies 9,516 acres; (2) the Yellow Water Weapons Department, which occupies 8,091 acres; (3) Outlying Landing Field (OLF) Whitehouse, which occupies 2,587 acres; and (4) the 11,072-acre Land Target Complex Detachment Astor. The main facility, the Yellow Water Weapons Department, and OLF Whitehouse are shown on Figure 2-1.

The main facility consists of intersecting north to south and east to west runways bracketing the flightline and support facilities. These facilities occupy approximately 1,000 acres in the southeast quadrant of NAS Cecil Field. The remaining acreage of the main base is mostly undeveloped (SOUTHNAVFACENGCOM, 1989) (Figure 2-2).

OU 8 is located within the controlled access part of NAS Cecil Field and security passes are needed for admittance onto the base. However, the OU is accessible once entrance to NAS Cecil Field has been attained because fences have not been constructed around Site 3. No housing is present in the immediate vicinity of OU 8. The closest housing is approximately 5,000 feet to the west. Because this site is undeveloped, Navy personnel do not routinely frequent the area except for Perimeter Road fence maintenance and security patrols.

2.6.3.2 **Current Adjacent Land Use** The downtown center of the city of Jacksonville lies approximately 14 miles to the northeast and is the most heavily developed area of Duval County. Urban development tends to decrease across Duval County from the coastal areas (east) to the western boundary. Low commercial use, such as convenience stores, and low density residential areas characterize the land use (ABB-ES, 1992a). A development called Villages of Argyle, when complete, will consist of seven separate villages or communities that will ultimately abut NAS Cecil Field to the south and southeast. A golf course and residential area also border NAS Cecil Field to the east (SOUTHNAVFACENGCOM, 1989).

Generally, the area surrounding NAS Cecil Field is rural and sparsely populated. Surrounding land use is primarily forestry with some light agricultural 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 miles to the northwest of the main facility entrance.

2.6.3.3 **Future Facility Land Use** As discussed in Chapter 2.0, NAS Cecil Field is currently scheduled for closure under BRAC. Future zoning by the local reuse commission for the land currently owned by the facility is scheduled for completion in 1995. Therefore, the future use of land encompassing NAS Cecil Field, and in particular the area encompassing and immediately surrounding OU 8, is unknown at this time. It is unlikely that structures would be erected on OU 8 due to the surrounding undeveloped land and the geotechnically challenging conditions posed by the disposal pit. Though it is possible that the areas immediately surrounding OU 8 could be used as residential property, the presence of disposal pits in the area may be a deterrent for developers.

3.0 OPERABLE UNIT 8 INVESTIGATION AND DATA EVALUATION METHODOLOGY

This chapter presents the purpose of the RI field program as it relates to the BRA, the media sampled and analyzed to support the BRA effort, and a brief discussion of the methodology used for evaluating data during the BRA. It also includes a discussion of the characterization of background concentrations for media at OU 8, which was scoped as part of the RI field program. More detailed information is provided in the RI report for OU 8 (ABB-ES, 1995).

Investigations completed during the RI field program at OU 8 that supported the BRA efforts included

- site reconnaissance;
- sampling and chemical analyses of surface water, sediment, surface soil, and subsurface soil;
- monitoring well installation;
- groundwater sampling and chemical analyses;
- hydraulic conductivity testing;
- water-level elevation determination; and
- biological testing.

The wetlands and habitat delineation will be discussed in Chapter 5.0 of this report.

3.1 SOIL INVESTIGATION. The surface soil and vadose zone (subsurface soil) investigations were completed in 1994 to characterize the nature and extent of contamination. Data from the field screening program (see RI report for OU 8; ABB-ES, 1995) were used to assist in the selection of confirmatory sampling locations. Historical data are presented in Appendix A. Data from the confirmatory sample analyses will be used to evaluate and characterize risk posed by the existing soil to human health and the environment and to support the Feasibility Study (FS) recommended remedial technology.

Surface soil samples were collected from 24 locations at Site 3. Surface soil sample locations are shown on Figure 3-1. All surface soil samples were collected from a depth of zero to 12 inches bls. All surface soil samples were analyzed for target compound list (TCL) organics, target analyte list (TAL) inorganics, and total petroleum hydrocarbons (TPH). Toxicity testing (earthworm and seed germination tests) was performed on selected samples.

Subsurface soil samples at Site 3 were collected from the locations in 1991 and 1994 indicated on Figures 3-2 and 3-1, respectively. A total of 21 subsurface soil samples was collected in 1994. One sample was collected immediately above the water table from the locations identified on Figure 3-1. All samples were analyzed for TCL organics, TAL inorganics, and TPH. In addition, selected samples were analyzed for geotechnical parameters that include grain size,

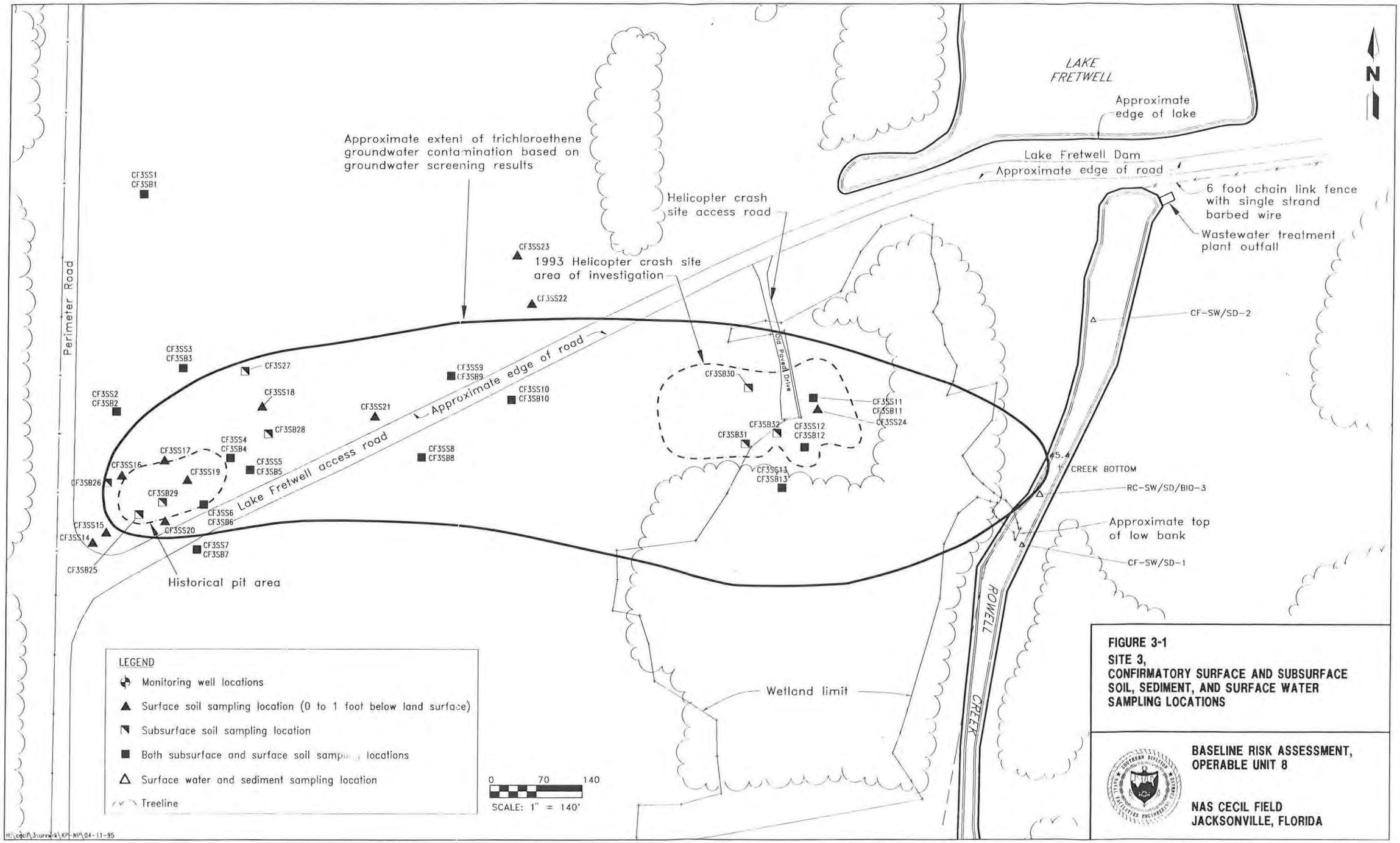


FIGURE 3-1
SITE 3,
CONFIRMATORY SURFACE AND SUBSURFACE SOIL, SEDIMENT, AND SURFACE WATER SAMPLING LOCATIONS

BASELINE RISK ASSESSMENT, OPERABLE UNIT 8

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

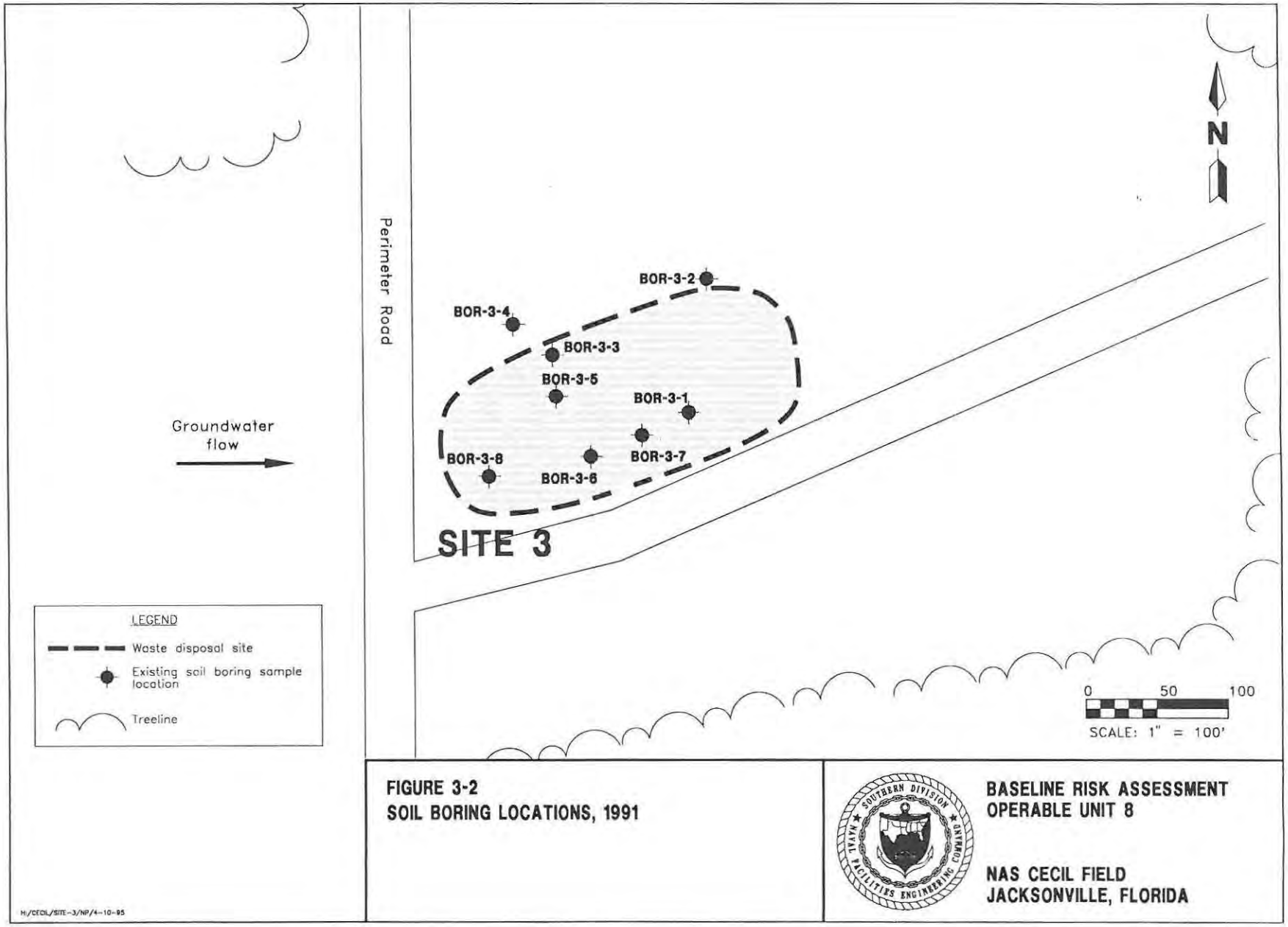


FIGURE 3-2
SOIL BORING LOCATIONS, 1991

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moisture content, and Atterberg limits. Sixteen subsurface soil samples were collected in 1991. Two subsurface soil samples were collected from each boring location indicated on Figure 3-2. One sample was collected immediately above the water table. The depth of the second sample was selected based upon elevated OVA readings, visible evidence of contamination, or, in the case that neither above-mentioned method is conclusive, a sample arbitrarily selected by the field geologist from mid-depth of the borehole. These samples were analyzed for TCL organics and TAL inorganics.

Data validation was performed on all laboratory analytical results for OU 8 surface and subsurface soil samples in accordance with USEPA functional guidelines (USEPA, 1991a) following USEPA Level 4 (Naval Energy and Environmental Support Activity [NEESA] Level D) data validation protocol.

3.2 SURFACE WATER AND SEDIMENT INVESTIGATIONS. To better define the reach of Rowell Creek into which contaminated groundwater from OU 8 discharges, surface water and sediment samples were collected on November 21, 1994, from two locations in the vicinity of OU 8. The locations were upgradient and downgradient of biological monitoring station BIO-3 (Figure 3-1). The surface water and sediment data obtained from this one station, RC-SW/SD/BIO-3, in 1993 will also be included in the data set. The purpose of the surface water and sediment investigation was to assess potential contaminant migration through groundwater-surface water interaction, surface runoff, and/or soil erosion and to assess potential human health and ecological risks. In the sampling location nomenclature, "SD" and "SW" denote sediment and surface water, respectively.

Field measurements of surface water pH, temperature, depth, conductivity, and dissolved oxygen were recorded at each sample location by field personnel. Surface water and sediment samples were analyzed for target compound list TCL organics and TAL inorganics. Lower detection limits were used for all volatile organic compounds (VOCs) and selected metals during the surface water and sediment analytical program. These lower levels were used to obtain detection levels below available criteria, when practical. The metals with lowered detection limits are beryllium, 0.2 micrograms per liter ($\mu g/\ell$); cadmium, 0.2 $\mu g/\ell$; and silver, 0.1 $\mu g/\ell$.

Total organic carbon (TOC) analyses were completed for all sediment samples. TPH analyses were completed from samples collected at selected sediment sampling locations. Wet chemistry analyses were performed on the surface water samples, which included hardness and nutrients analyses, for evaluating compliance with regulatory limits. Acid volatile sulfide (AVS) analyses were performed on select sediment samples to determine inorganic chemical bonding capabilities of the sediment. The bioavailability of the inorganic chemicals is determined by their tendency to bond (not bioavailable) or not bond (bioavailable) with the sediment. Hexavalent chromium analyses were performed on select surface water and sediment samples for evaluating whether or not this more toxic form of chromium was present.

Data validation was performed on all laboratory analytical results for OU 8 surface water and sediment samples in accordance with USEPA functional guidelines (USEPA, 1991a) following USEPA Level 4 (NEESA Level D) data validation protocol.

3.3 GROUNDWATER INVESTIGATION. Groundwater monitoring wells were installed to assess the nature and extent of contamination in groundwater at OU 8, to determine migration of possible chemicals, and to observe and periodically measure piezometric and aquifer conditions to estimate groundwater flow direction, patterns, and rate.

Thirty-six monitoring wells are located at Site 3 (Figure 3-3). Monitoring wells CEF-3-1 and CEF-3-2 were installed by a previous contractor and will not be used in this report. CEF-3-2 has since been abandoned due to an unusually long screen length (30 feet). The 16 shallow monitoring wells were installed to investigate the groundwater in the upper zone of the surficial (UZS) aquifer. All "S" wells are screened across the water table, from approximately 5 feet to 15 feet bls. The five intermediate depth monitoring wells were installed in the intermediate zone of the surficial (IZS) aquifer. The 12 deep monitoring wells were installed in the lower zone of the surficial (LZS) aquifer. There were three dolomitic wells that were installed to investigate the groundwater in the dolomite in the intermediate aquifer, or the upper zone of the Hawthorn (UZH) Group at Site 3.

Unfiltered and filtered groundwater samples were collected from all monitoring wells during the 1993-94 investigation. All samples collected were analyzed according to USEPA Contract Laboratory program (CLP) procedures for TCL organics, TAL inorganics, TPH, and major cations and anions. Turbidity measures were taken for all unfiltered samples at OU 8. There were three wells (CF3MW14I, CF3MW23S, and CFMW326I) that had turbidity measurements higher then 5.0 nephelometric turbidity units. Sample collection and analyses were performed in accordance with NEESA Level D requirements. Data validation was performed on all analytical results in accordance with USEPA functional guidelines (USEPA, 1991a).

3.4 BIOLOGICAL INVESTIGATION. A biological sampling program was implemented to provide information necessary for completion of the ERA and FS. The biological investigation included a wetlands assessment and habitat mapping, toxicity testing of surface soil and sediment and an aquatic sampling field program. Each of these components is described in the following subsections. Information from the biological investigation was used to identify ecological receptors, characterize the ecotoxicity of contamination in surface soil and sediment, and to identify risks in the ERA. Information on the extent of wetlands was used in the FS to evaluate remedial alternatives.

3.4.1 **Wetlands Assessment and Habitat Mapping** A wetlands assessment and mapping of upland vegetative communities were completed for OU 8 at NAS Cecil Field (ABB-ES, 1994b). The wetlands assessment included identification of wetlands on and adjacent to Site 3, characterization of the vegetative communities, and delineation of the extent of the wetlands. Upland plant communities were also characterized and mapped. The information on vegetative cover was used in the ERA to identify ecological receptors and identify exposure pathways. The wetlands assessment and mapping of upland vegetative communities are further described in Section 5.1 of this report.

3.4.2 **Toxicity Testing** Toxicity testing of surface soil and sediment was completed in coordination with the sampling of these media for chemical analyses as described in Sections 3.1 and 3.2, respectively. The sediment samples for toxicity testing were collected with the samples for chemical analyses,

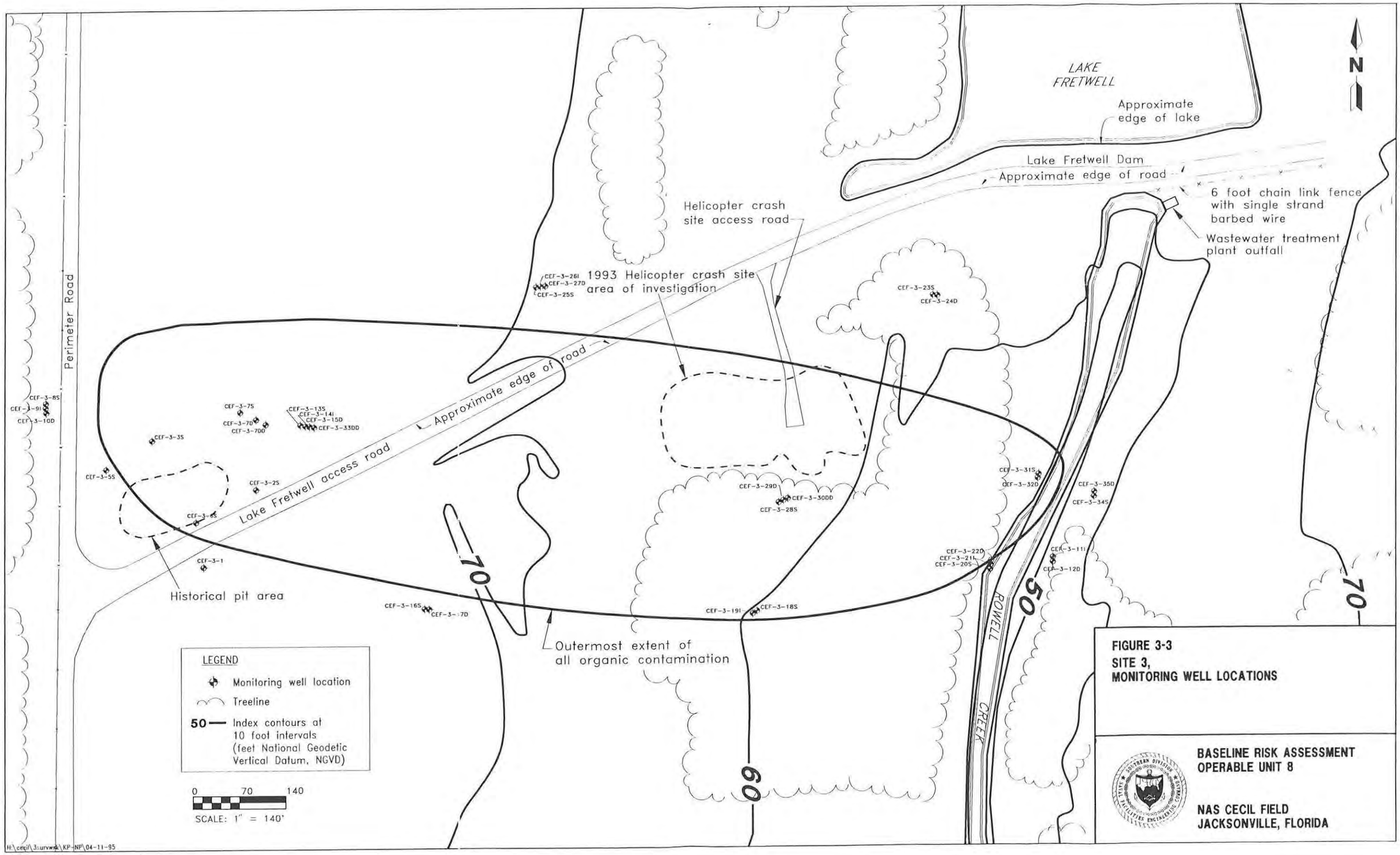

FIGURE 3-3
SITE 3,
MONITORING WELL LOCATIONS

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homogenized, and split. The sediment samples were submitted for toxicity testing with two organisms: the water flea *Ceriodaphnia dubia* and the small crustacean amphipod *Hyallela azteca*. The purposes of the toxicity testing were to determine a location-specific toxicity of sediment and risk for aquatic receptors in the ERA and to determine, if necessary, the concentrations of chemicals in the sediment at OU 8 at which no adverse effects (i.e., death) to the test organisms were observed. The toxicity testing of sediment and results are presented in Chapter 6.0 of this report.

The surface soil sampling program is described in Section 3.1. Nine surface soil samples were submitted for toxicity analyses. The toxicity of surface soil samples was evaluated by use of a subacute toxicity test with earthworms (*Eisenia foetida*) and a seed germination toxicity test with lettuce (*Lactuca sativa*). The purposes of toxicity testing of surface soil were to determine the site-specific toxicity of contamination present, to measure adverse effects (risks) for soil invertebrates and plants associated with contamination, and, if necessary, to determine a concentration of contaminant(s) in the surface soil at OU 8 at which no adverse effects (i.e., survival and reproduction) to the test populations were observed. This information could be used to make decisions regarding cleanup levels for remedial alternatives. The toxicity testing of soil and results are further described in Chapter 6.0.

3.4.3 **Aquatic Invertebrate and Fish Sampling** The aquatic field sampling completed for OU 8 included sampling of the benthic macroinvertebrate community, fish, water quality parameters, and aquatic habitat quality parameters. The benthic macroinvertebrate community was sampled at each of the surface water and sediment sampling locations shown on Figure 3-1. The sampling procedures and results are included in Chapter 6.0. The purpose of the biological investigation was to determine the status of the structure and function of the existing benthic macroinvertebrate community in the area of OU 8 and to ascertain if chemicals present at OU 8 may be having an adverse effect on the health of that community.

3.5 **BACKGROUND INVESTIGATION**. A sampling program was designed to characterize existing background conditions for NAS Cecil Field and to support the RI, RA, and FS for each OU (See Appendix B for a more detailed description). The background monitoring network consisted of monitoring well installation and the collection of surface soil, subsurface soil, and groundwater samples. Surface water and sediment sampling was also completed over much of the drainage system for NAS Cecil Field. For the BRA for OU 8, the facilitywide background samples are used for surface and subsurface soil evaluations. Upgradient or upstream samples specific to OU 8 will be used for groundwater, surface water, and sediment evaluations.

The objectives of the background sampling program were to (1) develop an accurate representation of existing physical and chemical background conditions at NAS Cecil Field, (2) establish a database for these physical and chemical measurements to be used during the OU 8 investigation (and investigation of other OUs), and (3) provide permanent and representative monitoring stations in the upper and lower surficial aquifer. The establishment of existing background conditions is important for inorganics (metals), which are naturally occurring and will be detected (at varying concentrations) in all surface soil, subsurface soil, and groundwater samples collected. Characterization of existing background

conditions is also important for interpretation of certain organic analyses, such as pesticides, naturally occurring hydrocarbons, and organic carbon.

A detailed summary of the entire background sampling program for NAS Cecil Field is contained in Appendix B. The following sections summarize the background sampling programs used at OU 8 for surface soil, subsurface soil, groundwater, sediment, and surface water.

3.5.1 **Surface Soil** Fourteen background surface soil samples and one duplicate were selected for use in the OU 8 BRA. Background surface soil samples BSS01, BSS02, BSS03, BSS04, BSS05, BSS06, BSS07, BSS08, BSS10, BSS11, BSS12, BSS13, BSS14, and BSS15 were obtained from media locations E2, S1, S2, W1, and W2 and are illustrated on Figure 3-4. One background surface soil sample (E1-BSS09) was not included because the soil type, Wesconnett, was not determined to be present at OU 8. The RI report for OU 8 indicates that the majority of the soil present at OU 8 consists of the Albany and Ridgeland fine sands. There is a small percentage of soil at OU 8 that has been classified as Arents. For the purpose of the BRA, the average detected concentrations of inorganic analytes in the 14 surface soil samples were used as the baseline concentrations for OU 8. These baseline surface soil concentrations are shown in Table 3-1.

3.5.2 **Subsurface Soil** Subsurface soil samples were collected during the installation of background monitoring wells from the background monitoring network, as described in Appendix B. Eighteen subsurface samples were collected from locations E1, E2, S1, S2, W1, and W2 and are depicted on Figure 3-4. Samples were collected from above the water table and from the screened interval of monitoring wells. Samples collected above the water table were analyzed for full TCL organics and TAL inorganics, and other samples were only submitted for sieve or TOC analysis. Table 3-2 presents the background subsurface soil concentrations used for the BRA.

3.5.3 **Groundwater** A cluster of three monitoring wells located upgradient of OU 8 was selected as the location for the collection of background groundwater samples for Site 3. The three monitoring wells (CEF-3-8S, CEF-3-9I, and CEF-3-10D), shown on Figure 3-3, are located at the western edge of Site 3. These wells were selected because they are upgradient of OU 8. Average concentrations of detected analytes in unfiltered samples from the upgradient wells set in the surficial aquifer system (CEF-3-8S, CEF-3-9I, and CEF-3-10D) were used as the baseline concentrations. Table 3-3 lists the baseline concentrations used for this comparison.

3.5.4 **Surface Water and Sediment** One location was selected as representative of conditions upstream of OU 8 for concentrations of analytes in surface water and sediment in Rowell Creek. This location, CF3SD2, is shown on Figure 3-1. For the purposes of the BRA, the average detected concentrations of analytes in this surface water and sediment sample were used as the baseline or upstream concentrations. These baseline concentrations for surface water and sediment are shown in Tables 3-4 and 3-5, respectively.

3.6 DATA EVALUATION. This section presents the methodology used to evaluate analytical data collected to support the BRA. Additionally, some considerations and uncertainties concerning specific conditions at OU 8 will be discussed in Chapters 4.0 and 6.0.

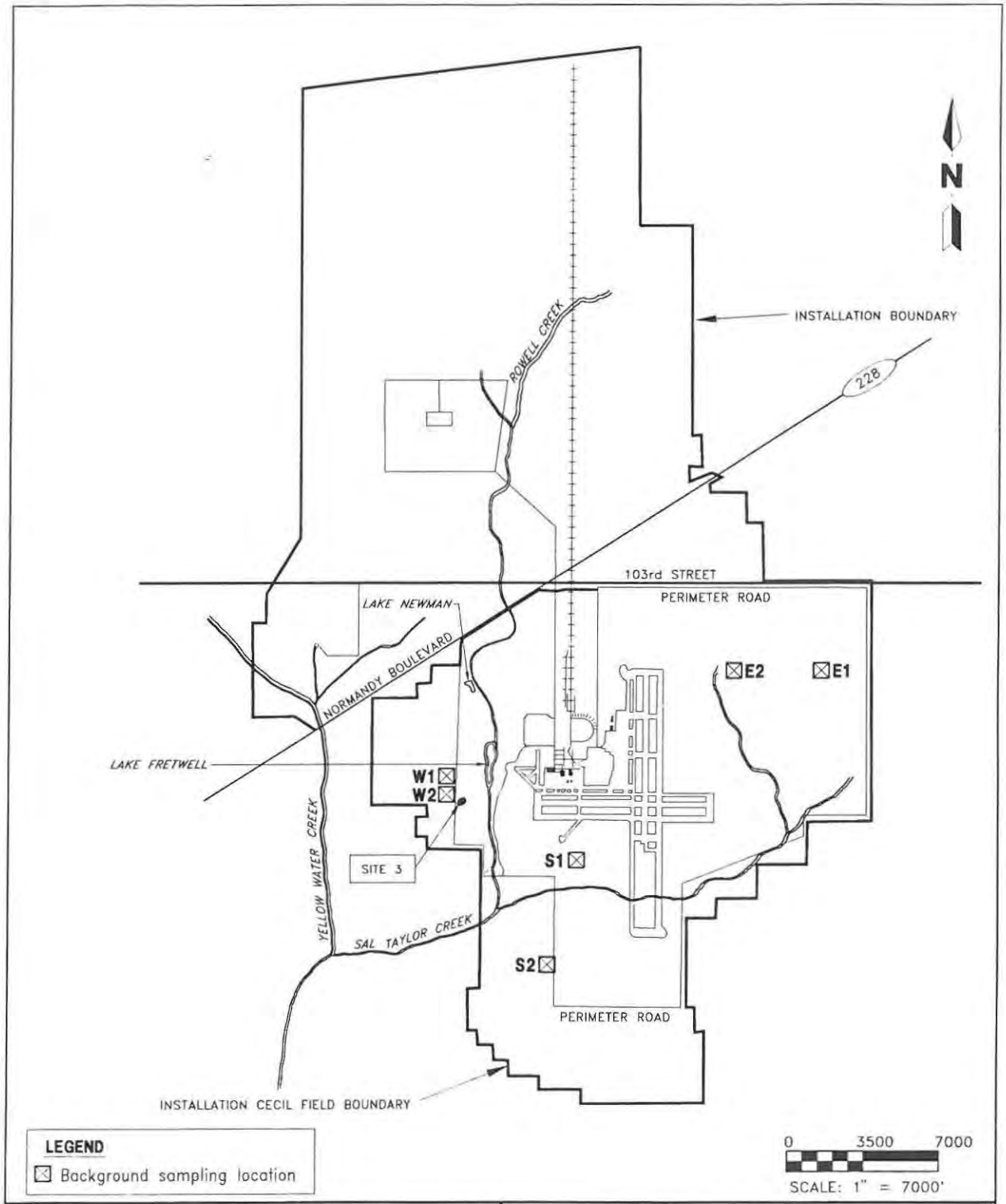

FIGURE 3-4
BACKGROUND SAMPLING LOCATIONS, SOIL AND GROUNDWATER

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Table 3-1
Background Concentrations of Analytes in Surface Soil

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations	Mean of Detected Concentrations[3]
Volatile Organic Compounds (μg/kg)				
No analytes detected				
Semivolatile Organic Compounds (μg/kg)				
Di-n-butylphthalate	1/14	350 to 390	34	34
Diethylphthalate	1/14	350 to 390	19	19
Phenol	3/14	350 to 390	23 to 190	88.3
bis(2-Ethylhexyl)phthalate	5/14	350 to 390	17 to 52	42.3
Pesticides and PCBs (μg/kg)				
4,4-DDE	3/14	3 to 4	0.21 to 0.51	0.33
Endosulfan II	1/14	3.5 to 4	0.33	0.33
Endrin	1/14	0.7 to 3.85	[2]1.085	1.085
Endrin aldehyde	1/14	0.3 to 4	0.45	0.45
Inorganic Analytes (mg/kg)				
Aluminum	14/14	40 to 40	183 to 24,000	5,050
Arsenic	2/14	2 to 2	[2]1.2 to 2.2	1.7
Barium	12/14	40 to 40	2.1 to [2]16.35	5.9
Calcium	4/14	1,000 to 1,000	211 to 269	229
Chromium	5/14	2 to 2	2.3 to 24.9	12.9
Iron	14/14	20 to 20	69.6 to 7,140	1,396
Lead	13/14	1 to 1	2.3 to [2]10.45	4.7
Magnesium	12/14	1,000 to 1,000	24.4 to [2]375.5	115
Manganese	14/14	3 to 3	2.5 to 10.9	5.5
Nickel	4/14	8 to 8	1.5 to [2]5.65	3.6
Potassium	4/14	1,000 to 1,000	69.7 to 236	155
Vanadium	14/14	10 to 10	1.3 to 30.7	6.6

[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).
[2] Value is the average of a sample and its duplicate. For nondetected values, 1/2 the contract-required quantitation limit or contract-required detection limit is used as a surrogate.
[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 a "U" or "UJ" validation qualifier for that analyte.

Notes: Sample locations include CEFBSS01, CEFBSS02, CEFBSS03, CEFBSS04, CEFBSS05, CEFBBSS06, CEFBBSS07, CEFBBSS08, CEFBBSS10, CEFBBSS11, CEFBBSS12, CEFBBSS13, CEFBBSS14, and CEFBBSS15, and duplicate sample CEFBSS02D.

μg/kg = micrograms per kilogram.
PCB = polychlorinated biphenyl.
DDE = dichlorodiphenyldichloroethene.
mg/kg = milligrams per kilogram.

Table 3-2
Background Concentrations of Analytes in Subsurface Soil

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations	Mean of Detected Concentrations[3]
Volatile Organic Compounds (µg/kg)				
No analytes detected				
Semivolatile Organic Compounds (µg/kg)				
Pentachlorophenol	3/18	820 to 950	180 to 420	320
Pesticides and PCBs (µg/kg)				
4,4-DDD	1/18	3.4 to 4	0.68	0.68
4,4-DDT	1/18	2.1 to 4	0.73	0.73
Aroclor-1260	1/18	34 to 40	9.7	9.7
Inorganic Analytes (mg/kg)				
Aluminum	18/18	40 to 40	[2]628.5 to 15,600	5,615
Arsenic	2/18	2 to 2	0.65 to 0.98	0.82
Barium	11/18	40 to 40	2.2 to [2]12.2	7.7
Calcium	8/18	1,000 to 1,000	102 to 277	160
Chromium	14/18	2 to 2	[2]1.6 to 17.4	7.5
Copper	1/18	5 to 5	0.58	0.58
Iron	18/18	20 to 20	104 to 5,660	1,419
Lead	15/18	1 to 1	1.6 to 18.8	6.6
Magnesium	10/18	1,000 to 1,000	60.1 to [2]255.75	134
Manganese	5/18	3 to 3	3.2 to 4.5	3.9
Mercury	1/18	0.1 to 0.1	0.55	0.55
Nickel	5/18	8 to 8	1.8 to 3.9	2.7
Potassium	10/18	1,000 to 1,000	17 to 158	76.4
Sodium	6/18	1,000 to 1,000	117 to 225	156
Vanadium	10/18	10 to 10	1.4 to 15.1	7.7

[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).
[2] Value is the average of a sample and its duplicate. For nondetected values, 1/2 the contract-required quantitation limit or contract-required detection limit is used as a surrogate.
[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 a "U" or "UJ" validation qualifier for that analyte.

Notes: Sample locations include CFBBMS1S0, CFBBMS1S6, CFBBMS2S2, CFBBMS2S6, CFBBMS3I2, CFBBMS3I6, CFBBMS4S2, CFBBMS4S4, CFBBMS5S2, CFBBMS5S6, CFBBMS6I0, CFBBMS6I6, CFBBMS7S0, CFBBMS7S4, CFBBMS8S2, CFBBMS8S6, CFBBMS9I0, and CFBBMS9I6, and duplicate sample CFBBMS7S0D.

µg/kg = micrograms per kilogram.
PCB = polychlorinated biphenyl.
DDD = dichlorodiphenyldichloroethane.
DDT = dichlorodiphenyltrichloroethane.
mg/kg = milligrams per kilogram.

Table 3-3
Background Concentrations of Analytes in Unfiltered Groundwater

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations[2]	Mean of Detected Concentrations[3]
Volatile Organic Compounds (μg/ℓ)				
No analytes detected				
Semivolatile Organic Compounds (μg/ℓ)				
Phenol	1/3	10 to 10	0.8	0.8
bis (2-Ethylhexyl)phthalate	2/3	10 to 10	1 to 2	1.5
Pesticides and PCBs (μg/ℓ)				
No analytes detected				
Inorganic Analytes (μg/ℓ)				
Aluminum	2/3	200 to 200	1,960 to 15,200	8,580
Arsenic	2/3	10 to 10	1 to 6.6	3.8
Barium	3/3	200 to 200	11 to 29.8	21
Calcium	3/3	5,000 to 5,000	918 to 67,200	23,559
Cobalt	1/3	50 to 50	9.9	9.9
Iron	2/3	100 to 100	720 to 1,780	1,250
Lead	1/3	3 to 3	6.3	6.3
Magnesium	2/3	5,000 to 5,000	1,200 to 5,620	3,410
Manganese	1/3	15 to 15	49.5	49.5
Nickel	1/3	40 to 40	19	19
Potassium	1/3	5,000 to 5,000	1,960	1,960
Selenium	1/3	5 to 5	2	2
Sodium	3/3	5,000 to 5,000	2,970 to 8,760	6,210

[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).
[2] For nondetected values, 1/2 the contract-required quantitation limit or contract-required detection limit is used as a surrogate.
[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 a "U" or "UJ" validation qualifier for that analyte.

Notes: Sample locations include CF3MW8S, CF3MW9I, and CF3MW10D.

μg/ℓ = micrograms per liter.
PCB = polychlorinated biphenyl.

Table 3-4
Background Concentrations of Analytes in Surface Water

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations[2]	Mean of Detected Concentrations[3]
Volatile Organic Compounds (μg/ℓ)				
Dibromochloromethane	1/1	2 to 2	2	2
Bromodichloromethane	1/1	1 to 1	5	5
Chloroform	1/1	2 to 2	7	7
Methylene chloride	1/1	2 to 2	3	3
Semivolatile Organic Compounds (μg/ℓ)				
No analytes detected				
Pesticides and PCBs (μg/ℓ)				
Endosulfan I	1/1	0.05 to 0.05	0.008	0.008
Inorganic Analytes (μg/ℓ)				
Barium	1/1	200 to 200	27.8	27.8
Calcium	1/1	5,000 to 5,000	23,200	23,200
Copper	1/1	25 to 25	2.3	2.3
Iron	1/1	100 to 100	455	455
Magnesium	1/1	5,000 to 5,000	6,050	6,050
Manganese	1/1	15 to 15	17.8	17.8
Potassium	1/1	5,000 to 5,000	2,690	2,690
Sodium	1/1	5,000 to 5,000	19,000	19,000
Vanadium	1/1	50 to 50	1.4	1.4

[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).
[2] For nondetected values, 1/2 the contract-required quantitation limit and contract-required detection limit is used as a surrogate.
[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 a "U" or "UJ" validation qualifier for that analyte.

Notes: The average of a sample and its duplicate is used for all calculations.
Sample location includes CF3SW2.

μg/ℓ = micrograms per liter.
PCB = polychlorinated biphenyl.

Table 3-5
Background Concentrations of Analytes in Sediment

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations[2]	Mean of Detected Concentrations[3]
Volatile Organic Compounds (μg/kg)				
No analytes detected				
Semivolatile Organic Compounds (μg/kg)				
No analytes detected				
Pesticides and PCBs (μg/kg)				
No analytes detected				
Inorganic Analytes (mg/kg)				
Aluminum	1/1	40 to 40	568	568
Calcium	1/1	1,000 to 1,000	520	520
Iron	1/1	20 to 20	263	263
Lead	1/1	0.6 to 0.6	2.9	2.9
Magnesium	1/1	1,000 to 1,000	49.8	49.8
Manganese	1/1	3 to 3	4.3	4.3
Vanadium	1/1	10 to 10	1.1	1.1

[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).
[2] For nondetected values, 1/2 the contract-required quantitation limit or contract-required detection limit is used as a surrogate.
[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 a "U" or "UJ" validation qualifier for that analyte.

Notes: The average of a sample and its duplicate is used for all calculations.
Sample location includes CF3SD2.

μg/kg = micrograms per kilogram.
PCB = polychlorinated biphenyl.
mg/kg = milligrams per kilogram.

The data evaluation involves numerous activities including, combining data from available investigations and then sorting it by medium, evaluating analytical methods, evaluating quantitation limits, evaluating quality of data with respect to qualifiers and codes, evaluating tentatively identified compounds, comparing potential site-related contamination with background, developing data sets for use in risk assessment, and identifying chemicals of potential concern (CPCs). These activities are further discussed in Chapter 4.0.

The data from Site 3 were evaluated independently to determine (1) which data were of sufficient quality for use in quantitative risk assessment and (2) which detected chemicals were believed to be site related. Data from the RI were first compiled and sorted by environmental medium (i.e., surface soil, subsurface soil, groundwater, surface water, and sediment). Then, based on results of the data validation (only data validated based on USEPA guidelines were used in the BRA), overall quality of the data was reviewed to determine which data were of sufficient quality for use in a quantitative risk assessment. The analytical precision, accuracy, representativeness, comparability, and completeness (PARCC) of the data were used to evaluate data useability.

Precision is a measure of the agreement or repeatability of a set of replicate results obtained from duplicate laboratory analyses of samples collected from the same location onsite. Precision was calculated from laboratory analytical data and cannot be measured directly.

Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. Accuracy is used to identify the bias in a given measurement system (i.e., laboratory conditions, sample matrix, and sampling conditions).

Representativeness is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition. Representativeness was evaluated using the field and laboratory quality control sample results (i.e., rinsate blanks, field blanks, trip blanks, and laboratory method blanks). Positive detections of target analytes in the QC blank samples identify chemicals that possibly were introduced to the associated environmental sample during sample collection or transport or laboratory analysis.

Comparability is a qualitative measure designed to express the confidence with which one data set may be compared with another. Factors affecting comparability are sample collection and handling techniques, sample matrix types, and analytical method.

Completeness is defined as the percentage of measurements that are judged to be valid compared to the total number of measurements made in the laboratory. Valid useable data are values that were not qualified as rejected ("R" qualifier) during data validation. Valid useable data either have no qualifier or they are qualified with a J, U, or UJ qualifier.

The PARCC report for the data from OU 8 is located in Appendix C.

The product of the data evaluation was a data set suitable for use in the quantitative risk assessments. Appendix D contains the validated data used in this report. The analytical data were used to select CPCs.

4.0 HUMAN HEALTH RISK ASSESSMENT

A human health risk assessment (HHRA) was conducted as part of the BRA for OU 8 (Site 3) at NAS Cecil Field. The purpose of the HHRA is to characterize the risks associated with the potential exposures to site-related chemicals at Site 3. An overview of the HHRA methodology used in this evaluation is presented here as a means of an introduction to the HHRA.

4.1 HHRA APPROACH. The HHRA is conducted according to both National and Region IV USEPA guidelines including the following:

- Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A (USEPA, 1989f) the following;
- Supplemental Region IV Risk Assessment Guidance (USEPA, 1991e);
- New Interim Region IV Risk Assessment Guidance (USEPA, 1992d);
- Exposure Factors Handbook (USEPA, 1989b);
- Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors (USEPA, 1991f); and
- Guidance for Data Useability in Risk Assessment (USEPA, 1992e).

The HHRA also considers State of Florida standards and guidance (FDEP, 1995a, 1995b).

In an HHRA, risks (current and future) associated with potential exposures to site-related chemicals are characterized. The HHRA is composed of four parts: (1) data evaluation and summarization, including identification of HHCPCs; (2) an exposure assessment covering both present and future uses of the site; (3) a toxicity assessment of HHCPCs; and (4) a risk characterization, including an uncertainty analysis.

4.1.1 Data Evaluation and Summarization This subsection describes the data evaluation and summarization approach as it applies to the HHRA.

4.1.1.1 Combining Data Available from Site Investigations For Site 3, there are two (1991 and 1993-1994) sampling events that will be included in the risk assessment. Although groundwater samples were collected during the 1991 sampling event, only the most recent data (from the 1993-1994 sampling event) will be evaluated in the HHRA. No sediment or surface water samples were collected during the 1991 sampling event, so only sediment and surface water samples from the 1993-1994 sampling event will be evaluated in the HHRA. During the 1991 sampling event, surface soil samples were collected between zero to 2 feet. Only samples collected between zero and 1 foot are appropriate for use in the HHRA, so surface soil data from the 1993-1994 sampling event will be evaluated in the HHRA. Subsurface soil samples were collected from 2 to 4 feet during the 1991 sampling event and from 1 to 3 feet during the 1993-1994 sampling event. Data from both sampling events will be evaluated in the HHRA to provide greater

representation of any contamination in the subsurface soil. Chapter 3.0 discusses the sampling and analyses for each medium.

4.1.1.2 **Evaluation of Analytical Methods** A detailed discussion of the analytical methods employed in developing analytical environmental data is presented in the RI report (ABB-ES, 1995). The data used in this risk assessment is the result of the analyses conducted under the CLP with documented quality assurance and quality control (QA/QC) procedures. The analytical data will be further evaluated for useability in the quantitative risk assessment by evaluating quantitation limits, evaluating qualified and coded data, comparing concentrations detected in samples to concentrations detected in blanks, and by evaluating tentatively identified compounds.

4.1.1.3 **Evaluation of Quantitation Limits** Sample Quantitation Limits (SQLs) will be compared to corresponding standards and criteria. For soil, SQLs will be compared to the USEPA risk-based concentrations and State of Florida cleanup goals. The groundwater SQLs will be compared to State and Federal maximum contaminant levels (MCLs).

4.1.1.4 **Evaluation of Qualified and Coded Data** The laboratories and data validators may attach qualifiers and codes to the analytical data. The qualifiers usually pertain to QA/QC problems in the identification of the chemical or the concentration of the chemical. When data have both laboratory and validation qualifiers, the validation qualifiers supersede the laboratory qualifiers. Appendix C contains the PARCCs report prepared by the data validator. The validated data and qualifiers are presented in Appendix D. All positive detections (unqualified or qualified with a "J") are considered detected concentrations for the risk assessment. All nondetections qualified with a "U" or "UJ") will be retained in the risk assessment as samples without positive detections. If an analyte has all nondetected results for all samples, it will not be considered in the risk assessment. All sample results with an "R" validation qualifier will not be considered in the risk assessment because these values have been rejected and are unusable.

4.1.1.5 **Comparison of Concentrations Detected in Blanks with Concentrations Detected in Samples** The comparison of concentrations of chemicals detected in blanks with concentrations of chemicals in samples prevents the inclusion of non-site-related chemicals in the risk assessment. Concentrations of chemicals in blank samples provide a measure of contamination that has been introduced either in the field or in the laboratory. The comparisons are conducted as a part the data validation process, which is presented in Appendix C.

4.1.1.6 **Evaluation of Tentatively Identified Compounds** The identity and concentration of tentatively identified compounds (TICs) are uncertain. These TICs will be reviewed as a part of the risk assessment. If the number of TICs is small relative to the TAL and TCL chemicals and there is no historical information to suggest the TICs should be present, the TICs will not be quantitatively evaluated. If the number of TICs is large relative to the TAL and TCL chemicals, the TICs will be included in the quantitative evaluation and the uncertainty of the identity and concentration of these compounds will be addressed in the uncertainty analysis.

4.1.1.7 **Data Used in the Risk Assessment** A compilation of usable data for each medium is produced after data evaluation for use in the HHRA. The summarized

analytical data are then used to select HHCPCs for each medium (Subsection 4.1.2). Data collected from previous investigations are evaluated qualitatively (Appendix A).

4.1.2 **Approach for Identification of HHCPCs** HHCPCs are generally a subset of all compounds detected in the various media at a site and are selected based on concentration and frequency of detection; physical, chemical, and toxicological characteristics; and comparison of detected values to background, associated blanks, and risk-based values. In selecting CPCs for human health, USEPA criteria have been used (USEPA, 1989f). HHCPCs include chemicals that are positively identified in at least one sample or detected at levels significantly elevated above blank concentrations.

Chemicals that do not contribute significantly to human health risks are removed or "screened" from further consideration as HHCPCs, as recommended by USEPA (1991e). Analytes are excluded as HHCPCs if they meet any one of the following criteria.

1. If the maximum detected concentration is less than twice the arithmetic mean of the background concentration (inorganics only), the analyte is excluded (USEPA, 1991e).

2. If the maximum reported soil or water concentration is less than either the risk-based concentration (RBC) or State of Florida Soil Cleanup Goals (Florida, 1995), the analyte is excluded.

   The RBCs are taken from the USEPA Region III chemical of concern (COC) screening table (March 18, 1994) (USEPA, 1994g) as described in USEPA Region III guidance for selecting exposure routes and HHCPCs (USEPA, 1993d). The stated guidance and USEPA Region III COC screening table are provided in Appendix E. The target hazard quotient (HQ) for non-carcinogenic substances is 0.1, and the target cancer risk is 1×10^{-6} in the USEPA Region III COC screening table.

   For surface soil, subsurface soil, and sediment, the residential soil RBCs are used. No RBC is available for lead in soil due to lack of dose-response values. Based on USEPA recommendations, a target level of 400 milligrams per kilogram (mg/kg) for cleanup at Superfund sites is used as the RBC for lead in soil (USEPA, 1994h). The risk-based screening does not address potential leaching of analytes from soil to groundwater. However, Subsection 4.2.6 addresses the FDEP soil cleanup goals based on leachability to groundwater.

   For groundwater and surface water, tap water RBCs are used. No RBC is available for lead in groundwater; therefore, the treatment technology action level for lead in drinking water of 15 micrograms per liter ($\mu g/\ell$) is used (USEPA, 1994b).

   State of Florida cleanup criteria based on the residential and industrial exposure are used to screen surface and subsurface soil, respectively (FDEP, 1995a and 1995b). The target HQ for noncarcinogenic substances is 1.0 and the target cancer risk is 1×10^{-6} in the soil cleanup criteria. The soil cleanup criteria and the methodology used to develop these values are provided in Appendix F. For groundwater, three groups of Florida guidance

concentrations (primary MCLs, systemic, and carcinogenic) are used for screening (FDEP, 1994). These guidance concentrations are provided in Appendix G.

3. If the average concentration of an essential nutrient (sodium, potassium, magnesium, iron, and calcium) in a medium is below a toxic screening level and is consistent with or only slightly above the background concentration for that essential nutrient, the analyte is excluded. Appendix H describes the derivation of screening levels for the essential nutrients.

4. 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) of less than 5 percent (USEPA, 1989f) and is not an HHCPC in another medium, it is excluded.

After applying these criteria using professional judgment, medium-specific CPCs for human health are identified. Chemicals not identified as HHCPCs are clearly identified in tables, and the justification for their exclusion is noted.

4.1.3 **Exposure Assessment** The exposure assessment is conducted to estimate the pathways by which humans are potentially exposed, the magnitude of actual and/or potential human exposure, and the frequency and duration of exposure. This process is performed for both current and future site land uses. 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
- 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.

4.1.3.1 **Characterization of Exposure Setting** In the characterization of the exposure setting for an HHRA, the physical setting and demographics near the waste site are identified. The physical setting is characterized in terms of the following attributes: climate, meteorology, geology, vegetation, soil type, groundwater, and surface water (Chapter 2.0). This information is gathered from previous investigations, including the RI (ABB-ES, 1995). The information generated from the evaluation of the physical setting aids in defining the physical mechanisms that control or influence how people could be exposed at a waste site and provides information on the potential migration of chemicals.

Demographics are also characterized and identified for (1) the populations residing or working near the waste site, (2) the activity patterns of residents and/or workers, and (3) if any exist, the locations of potentially sensitive subgroups (Section 2.6). Sources of this information include (1) site visits, (2) previous investigations, (3) information generated during the RI, (4) maps, (5) aerial and standard photographs, and (6) Navy personnel interviews. Key to this activity is determining current and foreseeable future land use of the waste site and surrounding areas (e.g., residential, commercial and industrial, or recreational).

4.1.3.2 **Identification of Exposure Pathways and Receptors** The purpose of this step in the exposure assessment is the identification of all relevant exposure pathways through which specific populations may be exposed to chemicals, under current and future land use, at the site. An exposure pathway consists of four necessary elements: (1) source or mechanism of chemical release, (2) transport or retention medium, (3) a point of human contact, and (4) a route of exposure at the point of contact (USEPA, 1989f). Exposure pathways that have these elements are considered complete pathways. Only complete exposure pathways are evaluated in the HHRA.

A summary of exposure pathways for the HHRA is normally included in a site conceptual model. In most cases, the source of contamination is either in the soil, or soil is the initial receiving medium. There are several mechanisms for migration of chemicals from soil. Chemicals may accumulate in plants and animals that are in contact with soil or are in food chains that include biota in direct contact with soil. Mechanisms for migration into air include volatilization (primarily VOCs) and wind erosion of contaminated soil (all types of chemicals). Overland flow of water can result in migration of chemicals to surface water and sediment and in relocation to other surface soil (all types of chemicals). Infiltration can result in migration into subsurface soil and into groundwater (soluble chemicals). Chemicals can be transported in groundwater (primarily soluble VOCs, semivolatile organic compounds [SVOCs], and inorganics) and may potentially also discharge to surface water. Analytes can also be transferred to sediment (generally insoluble forms of inorganics and relatively insoluble SVOCs and pesticides) and to fish (primarily nonpolar organics and some inorganics that tend to accumulate in tissue) and other biota.

Based on the current and potential future land uses of a site being evaluated, human receptors are identified. Receptors commonly include future residents and excavation workers and current site workers and trespassers. Exposure scenarios are constructed to evaluate each receptor (Paragraph 4.1.3.3).

4.1.3.3 **Quantification of Exposures** Once complete exposure pathways are selected for evaluation (Paragraph 4.1.3.2), the final step of the exposure assessment is to quantify exposure (i.e., intake) for each pathway. This quantification process involves developing assumptions regarding exposure conditions for each receptor to estimate the total amount of chemicals that a hypothetical receptor may ingest, dermally absorb, or inhale from each exposure pathway. These exposure scenarios are based on several variables, which can be grouped into chemical-, population-, and assessment-related variables.

The ultimate goal of this step, as defined in USEPA guidance, is to identify the combination of 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, 1989f). This is performed for every complete exposure pathway selected for evaluation. The resulting exposure scenarios are referred to as the reasonable maximum exposure (RME) for each exposure pathway. More recent USEPA Guidance (USEPA, 1992f) recommends developing two exposure scenarios, an average exposure and a "high end," or RME. This guidance also suggests that other uncertainty analyses, including Monte Carlo analysis, can be useful in putting risk estimates into perspective.

<u>Chemical-Related Variable</u>. The chemical-related variable is the exposure point concentration (EPC) that is the representative concentration at the exposure

point. The EPCs are calculated in a manner consistent with USEPA guidance (USEPA, 1989f; 1991e; 1992g). The EPCs are, with the exceptions noted below, the 95 percent upper confidence limit (UCL) on the arithmetic mean of the concentrations in the data set used to evaluate exposure. The following equation for calculating the UCL on the arithmetic mean for a log normal distribution (USEPA, 1991e; 1992g) is used to calculate all UCLs:

$$UCL = e^{\left(\bar{x} + 0.5\, s^2 + \frac{s\,H}{\sqrt{n-1}}\right)} \qquad (1)$$

where

UCL	=	upper confidence limit,
e	=	constant (base of the natural log, equal to 2.718),
$\bar{x}$	=	mean of transformed data,
s	=	standard deviation of the transformed data,
H	=	H-statistic (from table published in Gilbert, 1987), and
n	=	number of samples.

In calculating the 95 percent UCLs, nondetections are assigned a value of one-half the associated reporting limits in the calculation of the arithmetic mean. In cases where there are fewer than 10 samples, fewer than four samples with detections, or where the UCL is greater than the maximum detected concentration, the maximum detected concentration is identified as the EPC.

Population-Related Variables. Population-related variables describe the characteristics of a hypothetical individual receptor within each potentially exposed population. These variables include contact rates, such as exposure frequencies and ingestion rates, and physical characteristics of human bodies, such as body weights and surface areas. When applicable, contact rates are selected from USEPA standard default exposure factor guidance (USEPA, 1991d) or USEPA dermal guidance (USEPA, 1992a). If site-specific factors indicate that such parameters are not appropriate, alternative parameters are used based on knowledge of human behavior and the relative accessibility of a site. Parameters describing the physical characteristics of the exposed populations are identified from appropriate USEPA guidance (USEPA, 1989f; 1989b; 1991d; 1991e).

Assessment-Related Variable. The assessment-related variable involved in exposure quantification is the averaging time. Averaging time reflects the duration of exposure and depends on the type of effect being evaluated. Exposure intake during a defined interval (e.g., a lifetime) is averaged over the entire period, resulting in an estimate of average daily intake.

There are essentially two types of effects typically evaluated in human health risk assessment: carcinogenic effects and noncarcinogenic effects. According to USEPA guidance, the averaging time for carcinogenic effects is assumed to be a 70-year lifetime (USEPA, 1989f). The averaging times for noncarcinogenic effects are equivalent to the duration of exposure and may vary depending on the nature of exposure. There is a wide range of possible estimates, from a day to a lifetime. However, based on USEPA guidance, exposure duration for noncarcinogenic effects can roughly be categorized into one of three periods: (1) chronic exposures of 7 years to a lifetime, (2) subchronic exposures of 2 weeks to 7 years, and (3) acute exposures of less than 2 weeks (USEPA, 1989f). The length

of the exposure period depends on the potentially exposed population and the characteristics of exposure. The averaging times applied to receptors are used in the risk calculations. All exposure scenarios evaluated for noncarcinogenic effects at NAS Cecil Field are considered chronic or subchronic exposures.

Calculation of Intakes. The equations used to calculate chemical intake are those presented in USEPA guidance (USEPA, 1989f). The general equation for calculating chemical intake is as follows:

$$Intake = \frac{C \times CR \times EF \times ED}{BW \times AT} \qquad (2)$$

where

Intake	=	daily chemical intake per unit body weight averaged over the exposure period,
C	=	concentration of the chemical in the exposure medium,
CR	=	contact rate for the medium of concern,
EF	=	exposure frequency,
ED	=	exposure duration,
BW	=	body weight of the hypothetically exposed individual, and
AT	=	averaging time (for carcinogens, AT = 70 years for 365 days per year; for noncarcinogens, AT = ED)

Some of the exposure pathways require additional calculations before intake values can be calculated. Brief explanations of the additional calculations required for the inhalation of particulates, inhalation of vapors while showering, and dermal absorption are provided below.

Inhalation of Particulates from Soil This evaluation is conducted to estimate levels of site chemicals that could occur in ambient air as a result of wind erosion. To estimate atmospheric concentrations of fugitive air chemicals, a three-step modeling process is conducted. In the first step, respirable particle-phase emission rates are calculated. In the second step, contaminant emission rates on a unit surface area basis are calculated. In the third step, downwind ambient concentrations are estimated using air dispersion modeling. The three-step process is further defined in Appendix I. For the purposes of this risk assessment, a conservative particulate emissions factor (PEF) is used as a default.

Inhalation of Vapors while Showering For this exposure scenario, the contaminant concentration in air is estimated based on release rates of volatiles from shower water. The model selected to predict indoor (bathroom) concentrations is that presented by Foster and Chrostowski (1987). The specific equations used to determine concentrations of chemicals in bathroom air are presented in Appendix J.

Dermal Absorption from Water The permeability constant approach is used to estimate dermal exposures to chemicals detected in water in accordance with the USEPA *Dermal Exposure Assessment: Principles and Applications*, Interim Report, (USEPA, 1992a). These models apply only to absorption from water. For inorganic chemicals, steady-state conditions and the permeability constant of water is assumed for all analytes. For organic compounds, a nonsteady-state model is

used. The model employs a dermal permeability constant estimated from the compound's octanol-water partition coefficient. A further description of the process used to estimate absorption of chemicals in water through the skin can be found in Appendix K.

Dermal Absorption from Soil Dermal absorption from soil is calculated in accordance with the USEPA *Dermal Exposure Assessment: Principles and Applications*, Interim Report, (USEPA, 1992a). Percutaneous absorption of chemicals detected in soil is chemical and matrix dependent. According to USEPA Region IV guidance (USEPA, 1992d), absorption factors for organics and inorganics are 1.0 percent and 0.1 percent, respectively. A soil adherence factor of 1 milligram of soil per square centimeter) of skin per event is used in the dermal intake equations (USEPA, 1992a). The equations used to describe dermal absorption from soil are located in Appendix K.

4.1.4 Toxicity Assessment The toxicity assessment evaluates the available evidence on the potential adverse effects associated with exposure to each HHCPC. 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.

4.1.4.1 **Hazard Identification** 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. Characterizing the nature and strength of causation is a part of the hazard identification step. For a number of the chemicals at hazardous waste sites, potential toxic effects have already been identified. Consequently, the objectives of the hazard identification in the HHRA are to (1) identify which of the chemicals detected at the site are potential hazards and (2) summarize their potential toxicity in brief narrative profiles.

4.1.4.2 **Dose-Response Assessment** A dose-response assessment is conducted to characterize and quantify the relationship between intake, or dose, of an HHCPC and the likelihood of a toxic effect or response. There are two major types of toxic effects evaluated in an HHRA: carcinogenic and noncarcinogenic. Following USEPA guidance for HHRAs (USEPA, 1989f), these two endpoints (cancer and noncancer) are evaluated separately. Identified dose-response values are used to estimate the incidence of adverse effects as a function of human exposure to a chemical.

There are two types of dose-response values: cancer slope factors (CSFs) for carcinogens and reference doses (RfDs) for noncarcinogens. For many compounds, both types of values have been developed by USEPA because many compounds cause both carcinogenic and noncarcinogenic effects. In addition, because the toxicity and/or carcinogenicity of a compound can depend on the route of exposure (i.e., oral, inhalation, or dermal), unique dose-response values are developed for the oral, dermal, and inhalation exposure routes. The sources of the dose-response values are described below in Paragraph 4.1.4.3.

Cancer Toxicity Values The CSF is a chemical-specific toxicity value developed by the USEPA Cancer Risk Assessment Verification Endeavor (CRAVE) based upon the dose of a chemical and the probability of a carcinogenic response. The unit risk, a toxicity value developed by the USEPA, is an estimate of the relationship

between the inhaled concentration of a chemical and the probability of a carcinogenic response from the exposure during the lifetime of the individual.

As required by USEPA Region IV guidance (USEPA, 1991e), risks associated with dermal exposures (most commonly for soil and water dermal contact) are evaluated using CSFs that are specific to dermally absorbed doses. Most oral CSFs are based on administered dose rather than the absorbed dose (trichloroethene's CSF is a notable exception). It is, therefore, necessary to adjust toxicity values that are based on administered doses so that they can be used for evaluation of absorbed doses. For dermal exposures, the toxicity values are adjusted as follows:

$$CSF_{adjusted} = \frac{CSF_{oral}}{ABSEFF_{oral}} \tag{3}$$

where $ABSEFF_{oral}$ is the absorption efficiency in the study that is the basis of the oral toxicity value.

If there is no information available on oral absorption efficiency, the conservative default values (USEPA, 1993b) of 80 percent for volatiles, 50 percent for SVOCs, and 20 percent for inorganics are used.

The oral CSF, inhalation CSF and unit risk, dermal CSF, weight of evidence classification, and cancer type observed for each carcinogenic HHCPC analyzed in an HHRA are normally provided in an appendix to the HHRA.

Noncancer Toxicity Values The RfD is an estimate (with uncertainty spanning an order of magnitude or more) of a daily intake for the human population, including sensitive subpopulations, that is likely to be without appreciable risk of deleterious effects during a lifetime. Noncarcinogenic risks due to inhalation are estimated by comparing the inhalation concentration to the inhalation correlate of the RfD, the reference concentration (RfC).

As required by USEPA Region IV guidance (USEPA, 1991e), risks associated with dermal exposures (most commonly for soil and water dermal contact) are evaluated using RfDs that are specific to absorbed doses. Most oral RfDs are based on an administered dose rather on the absorbed dose. It is, therefore, necessary to adjust toxicity values that are based on administered doses so that they can be used for evaluation of absorbed doses. For dermal exposures, we adjust the toxicity values as follows:

$$RfD_{adjusted} = RfD_{oral} \times ABSEFF_{oral} \tag{4}$$

where $ABSEFF_{oral}$ is the absorption efficiency in the study that is the basis of the oral toxicity value.

If there is no information available on oral absorption efficiency, the conservative default values (USEPA, 1993b) of 80 percent for volatiles, 50 percent for SVOCs, and 20 percent for inorganics are used.

Separate sets of RfDs have been developed for several chemicals for evaluating chronic and subchronic exposures. When available, subchronic RfDs are used for evaluating exposures with a duration less than 7 years but more than 2 weeks. Chronic RfDs are used when subchronic values are unavailable and when the exposure duration is greater than 7 years. There are no analogous published reference values for evaluating acute exposures, those lasting less than 2 weeks.

The oral RfD, inhalation RfC, dermal RfD, critical study on which the RfD is based, critical effect in the study, any uncertainty and modifying factors applied to the RfD or RfC, and the degree of confidence-assigned to the RfD or RfC for each HHCPC analyzed in an HHRA is normally provided in an appendix to the HHRA.

4.1.4.3 **Dose-Response Values** The primary source for identifying dose-response values is the USEPA Integrated Risk Information System (IRIS), which is an on-line computer database containing health risk and USEPA regulatory information about specific chemicals (USEPA, 1994d). Health risk information is included on IRIS only after a comprehensive review of chronic toxicity data by work groups composed of USEPA scientists. If no information is found in IRIS, the USEPA Health Effects Assessment Summary Tables (HEAST) (USEPA, 1994c) are used as a source of information. If appropriate dose-response values are not located from either of these two sources, other USEPA sources (including past versions of IRIS and HEAST and the documents produced by the USEPA's Environmental Criteria and Assessment Office) are consulted. If no USEPA dose-response value is identified, surrogate values from structurally similar compounds may be assigned.

Dose-response values for each of the chemicals selected as an HHCPC in an HHRA are normally provided as an appendix to the HHRA.

4.1.4.4 **Relative Potency Factors for Carcinogenic Polynuclear Aromatic Hydrocarbons (PAHs)** Carcinogenic PAHs are a class of compounds with very similar, complex heterocyclic structures. From this group of compounds, only one, benzo(a)pyrene, has a USEPA published cancer slope factor. For the other carcinogenic PAHs, the variable toxicity has been addressed by using Relative Potency Factors (RPFs) published by USEPA (USEPA, 1993c). The RPFs identify the potency of each compound relative to that of benzo(a)pyrene.

The RPFs are not CSFs themselves but are used to calculate CSFs for the other PAHs. The RPFs are applied to the cancer slope factor for benzo(a)pyrene to obtain an estimate of the cancer risk for these compounds. The RPFs are only used in estimating the cancer risk of these compounds and are not used to estimate the noncancer risks. The RPFs for the carcinogenic PAHs are provided in Table 4-1.

The RPFs are different from the Toxicity Equivalency Factors (TEFs) produced by USEPA Region IV guidance (USEPA, 1992d). TEFs are not used to calculate CSFs for the other PAHs. TEFs are applied to carcinogenic PAH EPCs to determine the equivalent benzo(a)pyrene concentration. The benzo(a)pyrene equivalent EPC for each carcinogenic PAH is then multiplied by the CSF for benzo(a)pyrene to obtain an estimate of the cancer risk for these compounds.

Table 4-1
Relative Potency Factors for
Carcinogenic Polynuclear Aromatic Hydrocarbons

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Polynuclear Aromatic Hydrocarbon	Relative Potency Factors
Benzo(a)pyrene	1
Benzo(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.01
Chrysene	0.001
Dibenzo(a,h)anthracene	1
Indeno(1,2,3-c,d)pyrene	0.1

Source: U.S. Environmental Protection Agency (1993f).

4.1.5 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 HHCPC and each complete exposure pathway identified in the exposure assessment.

Carcinogenic Risks Carcinogenic risks associated with exposure to individual chemicals are estimated by multiplying the chemical intake for each carcinogen by its CSF. This value is a chemical-specific excess lifetime cancer risk (ELCR) and represents an upper bound of the probability of an individual developing cancer over a lifetime as the result of exposure to a chemical. For each exposure pathway, the chemical-specific risks for all carcinogenic compounds are summed to determine the pathway-specific lifetime cancer risk. The following equations are used to estimate the chemical- and pathway-specific cancer risks:

Chemical-Specific Excess Lifetime Cancer Risk

$$Risk_i = CDI_i \times CSF_i \qquad (5)$$

where

$Risk_i$ = unitless probability of an individual developing cancer as the result of exposure to a chemical i,

CDI_i = chronic daily intake of chemical i averaged over 70 years and expressed as milligrams per kilogram body weight per day (mg/kg-day), and

CSF_i = USEPA cancer slope factor for chemical i (milligrams per kilogram per day [mg/kg-day])$^{-1}$.

Pathway-Specific Incremental Lifetime Cancer Risk

$$Risk_T = \Sigma\, Risk_i \qquad (6)$$

where

$Risk_T$ = unitless probability of an individual developing cancer as the result of multiple chemical exposures and

$Risk_i$ = unitless cancer risk estimate for the ith chemical associated with an exposure pathway.

The results from the carcinogenic risk assessment are compared with acceptable risks established by the USEPA. The USEPA guidelines (USEPA, 1990b), established in the National Oil and Hazardous Substances Contingency Plan (NCP), state that "for known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response."

Noncarcinogenic Risks Noncarcinogenic risk estimates are calculated by dividing chemical intake for each compound by the appropriate RfD. The result is called the HQ. The HQs for individual compounds within an exposure pathway were summed to obtain the hazard index (HI) for that particular pathway.
The following equations are used to determine the HQs and HIs:

Hazard Quotient

$$HQ_i = \frac{I_i}{RfD_i} \qquad (7)$$

where

HQ_i = hazard quotient of chemical i,

I_i = intake of chemical i averaged over the exposure period (mg/kg-day), and

RfD_i = reference dose for chemical i corresponding to the same exposure duration as the intake (mg/kg-day).

Hazard Index

$$HI = \Sigma\, HQ_i \qquad (8)$$

where

HI = potential for noncarcinogenic effects from multiple chemical exposures and

HQ_i = hazard quotient for i^{th} chemical associated with an exposure pathway.

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

values are calculated. Subchronic HIs are calculated for limited exposures (i.e., 30 days) at NAS Cecil Field.

Summary. Risk estimates are calculated for each waste site and are summarized in risk summary tables. The risks are presented by medium for both current and future land uses. The calculations of these estimates are documented in an appendix with all spreadsheets used to complete calculations. Within the risk summary text for each medium and site, the relative confidence in each risk estimate is discussed. The relative significance of risk estimates are evaluated in terms of a comparison with acceptable risk levels established by USEPA.

4.1.6 Uncertainty Analysis Risk estimates are generally conservative values that result from multiple layers of conservative assumptions inherent in the risk assessment process. Quantitative estimates of risk are based on numerous assumptions, most are intended to be protective of human health (i.e., conservative). As such, risk estimates are not truly probabilistic estimates of risk, but rather conditional estimates given a series of conservative assumptions about exposure and toxicity.

A thorough discussion of all potential sources of uncertainty in risk assessment is not feasible. In general, sources of uncertainty can be categorized into site-specific factors (e.g., variability in analytical data and exposure assessment) and toxicity and risk characterization assessment factors. Most toxicity- and risk characterization-specific uncertainties apply to all HHRAs equally in their impact on the calculated risk estimates. Common (not site-specific) sources of uncertainty and their potential effects on the magnitude of estimated risks are discussed here. Table 4-2 summarizes some of the sources of uncertainty that are common to all HHRAs. Site-specific uncertainties are normally discussed in the site-specific uncertainty section in an HHRA to provide perspective for the interpretation of the site-specific risk estimates.

4.1.6.1 Data Collection, Analysis, and Evaluation A certain amount of uncertainty is associated with the representative nature of the data collected to complete the risk evaluation at each site. Additional uncertainties associated with estimating exposure result from variances in sampling and analytical techniques.

Nature and Extent of Contamination. The nature and extent of contamination are normally discussed in detail as part of the RI. The extensive sampling and analytical program of an RI should adequately characterize the types of chemicals present, the physical location of those chemicals, and the concentrations that are present. There is inherent uncertainty in the assumption that the nature and extent of contamination has been adequately characterized. This could overestimate or underestimate risk.

Adequate Characterization of Exposure Areas. Contaminated areas, specifically soils, are sometimes small relative to the area in which a receptor would potentially be exposed. Because a receptor's exposure area may actually be larger than the area of contamination and a receptor's exposure would often be random, the nonrandom sampling may actually result in overestimation of exposures.

Table 4-2
Potential Sources of Uncertainty

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Potential Source	Direction of Effect	Justification
Exposure Assessment		
Likelihood of exposure pathways	Overestimate	Actual exposure may not occur.
Exposure point concentrations	Overestimate	Sampling data are assumed to be representative of likely exposures but are more likely to represent areas of contamination.
Exposure assumptions (e.g., frequency and duration)	Overestimate	Parameters selected are conservative estimates of exposure representing a reasonable maximum exposure.
Degradation of chemicals not considered	Overestimate	Risk estimates are based on recent chemical concentrations. Concentrations tend to decrease over time as a result of degradation for many organics.
Absorption of soil chemicals through the skin	Overestimate	Dermal absorption of chemicals is a function of the length of actual skin contact. Contact at this site may be insufficient to result in the absorption assumed.
Modeled exposure point concentrations	Unknown, probably overestimate.	Models are based on numerous assumptions resulting in conservative exposure point concentration.
Lack of dermal groundwater evaluation	Underestimate	Dermal absorption of chemicals in groundwater is not normally a driving exposure pathway.
Toxicity Assessment		
Extrapolation of animal toxicity data to humans	Unknown, probably overestimate.	Animals and humans differ with respect to adsorption, metabolism, distribution, and excretion of chemicals. The magnitude and direction of the difference varies with each chemical. Animal studies typically involve high-dose exposures, whereas humans are exposed to low doses.
Use of linearized, multistage model to derive cancer slope factors	Overestimate	Model assumes a nonthreshold, linear at low dose relationship for carcinogens. Many compounds induce cancer by nongenotoxic mechanisms. Model results in 95 percent upper confidence limits of cancer potency. Potency is unlikely to be higher and may be as low as zero.
Lack of oral toxicity values for lead	Underestimate	Dose-response values for lead are not available for exposures to lead in soil or groundwater. Risk from exposure to lead in soil and groundwater is not quantitatively evaluated.
Lack of inhalation toxicity values	Underestimate	Inhalation reference doses and cancer slope factors will not be available for all human health chemicals of potential concern being evaluated for inhalation exposures (fugitive dust and volatiles while showering); therefore, risks cannot be quantified and are underestimated.
Risk Characterization		
Summation of risk among chemicals within exposure pathways	Unknown	Little is known about the toxicity of chemical mixtures. In the absence of evidence to the contrary, additivity of risk is assumed.

4.1.6.2 **Selection of CPCs** Although USEPA criteria are used in selecting HHCPCs (USEPA, 1989f), there are uncertainties in the general selection process based on the use of risk-based screening and comparison to inorganic concentrations at reference locations.

Use of USEPA Region III RBC Values and Florida Guidance Concentrations for Screening of Chemicals. The selection of HHCPCs is designed to eliminate from further study those contaminants present in concentrations that would not be expected to represent significant human health risks. Because quantitative risks are not estimated for contaminants that are eliminated, overall risks at each site might be slightly underestimated. However, the screening process employs risk-based screening concentrations from USEPA Region III and guidance concentrations from FDEP (soil cleanup goals and groundwater guidance concentrations), which are based on conservative assumptions and should be protective of human health at most sites.

Background Screening for Inorganic Analytes. For a given inorganic analyte, the maximum reported soil or groundwater concentration at a waste site is compared to 2 times the average of the medium specific concentrations in the background (Subsection 4.1.2) locations. This approach is conservative and may result in an overestimation of risk.

Relative Potency Factors for Carcinogenic PAHs. In selecting HHCPCs (Subsection 4.1.2), the selection of a single PAH in a particular medium requires that the additional PAHs detected in that medium be retained as HHCPCs, even if the PAH concentration is less that the available risk based screening level. This is a protective approach that is unlikely to underestimate risks.

4.1.6.3 **Exposure Assessment** There are four major issues that contribute to uncertainties in the exposure assessment of most HHRAs:

- land use,
- use of the reasonable maximum exposure,
- determination of the EPC, and
- exposure parameters.

Land Use. Generally, exposure scenarios associated with future land use are difficult to predict. In an HHRA, residential land use is typically evaluated. The inclusion of a residential land use scenario in an HHRA is intended to represent a worst case scenario. Future residential land use at or near a historic waste site is normally possible, but not always probable. The inclusion of this scenario may overestimate the risk associated with the site.

EPC. The EPCs used in the HHRA are the 95 percent UCL on the arithmetic mean concentration or the maximum reported concentration in a contaminated area (whichever is lower). In many cases, there is a relatively small number of samples available, and the 95 percent UCL is actually higher than the maximum detected concentration of a contaminant. In such cases, the maximum detected concentration has been used to represent the exposure concentrations. Because the cancer risks and HI calculations theoretically evaluate risks for average concentrations (USEPA, 1992d), the use of the 95 percent UCL or the maximum detected concentration is a conservative estimate of exposure and, therefore, risk.

Furthermore, the assessment assumes that sampling was representative of exposures, but in fact, sampling was influenced by historical evidence and physical clues that may have focused sampling on likely areas of contamination rather than on representative exposure locations. Therefore, the EPCs could be biased high, resulting in an overestimate of risk.

Exposure Parameters. The selection and use of exposure parameters contributes to the uncertainty inherent in a risk estimate. There are several exposure parameters that impact most risk assessments as described below.

Residence Time Future residential exposure scenarios evaluated in the HHRA assume that an individual may be exposed to chemicals at one location for 30 years. This value represents a high end (90th percentile value) estimate of the time spent in a single residence (USEPA, 1991d). The median (50th percentile) time for an individual to reside in one location is 9 years. There is considerable variability in the time spent in a residence for the individuals within the population. The estimate used in this analysis is likely to overestimate exposure duration for roughly 90 percent of a population that might live in the area.

Sediment Ingestion For ingestion of sediment by a child, it was assumed that a child would consume 200 milligrams per day (mg/day) of sediment at any given surface water or sediment location. This estimate of the daily inadvertent sediment ingestion is an assumption that the sediment intake rate is equal to the daily soil ingestion rate published by USEPA (USEPA, 1991d). There are actually very little data available concerning actual sediment ingestion rates in children. Because the commonly used soil ingestion rate includes both outdoor soil exposures as well as indoor dust exposures, it is likely an overestimate of sediment exposure.

Dermal Exposure to Surface Water The approach for calculating dermal exposures to surface soil, surface water, and sediment at a specific site is described in Appendix K. In calculating dermal exposures to surface water, permeability constants (K_p) are used to estimate the movement of a chemical across the skin surface. Although some K_p values are empirically based, most are estimated based land use, on characteristics such as octanol water partition coefficients (K_{ow}) and molecular weights. There are uncertainties inherent in these calculations.

Particulate Emission Factor The derivation of the particulate emission factor that is used as an exposure parameter to evaluate exposure to particulates resulting form soil suspension by wind is described in Appendix I. The PEF that is used to calculate the concentration of soil particles that a receptor may inhale is the same for multiple receptors (for example, the resident and excavation worker). However, it is likely that more soil particles would be suspended in air during soil excavation activities and, therefore, that an excavation worker would be exposed to greater concentrations of HHCPCs associated with airborne soil particles than a resident. Risk associated with inhalation exposures for the excavation worker may be underestimated in the HHRA. It is likely, however, that use of a PEF representing greater particulate concentrations would only result in additional risks of less than an order of magnitude. If risk estimates for the excavation worker are orders of magnitude below USEPA threshold ranges, the use of an excavation worker-specific PEF will not normally be evaluated.

Dermal Exposures to Groundwater The ingestion of drinking water is normally the exposure pathway that produces the greatest risk associated with contaminated groundwater. The approach to the calculation of air concentrations of VOCs during showering is described in Appendix K. Dermal exposure to groundwater while showering is not evaluated in the HHRA (USEPA, 1994f). This may result in an underestimation of risk, particularly to SVOCs in groundwater. For VOCs, the analytes will tend to migrate to air prior to and during contact. This lessens the potential for dermal absorption.

Drinking Water Ingestion Rate The drinking water ingestion scenario assumes an ingestion rate of 2 liters of water per day, 350 days per year for 30 years. The 2-liter ingestion rate is a 90th percentile rate whereas the average consumption rate is 1.4 liters per day (USEPA, 1989f). The use of the 2-liter value may overestimate exposure and risk from drinking water for a large portion of a potentially exposed population.

4.1.6.4 Toxicity Assessment Toxicity information for many chemicals is very limited, leading to varying degrees of uncertainty associated with calculated toxicity values obtained in IRIS or HEAST. General sources of uncertainty for calculating toxicity factors include extrapolation for animal data to human data, low to high dose extrapolation, short-term to long-term exposures, interspecies sensitivity variation, extrapolation from subchronic to chronic no observed adverse effect level (NOAEL), extrapolation from lowest observed adverse effect level (LOAEL) to NOAEL, amount of data supporting the toxicity factors (i.e., inadequate studies), consistency of different studies for the same chemical, and responses of various species to equivalent doses.

The identification of human carcinogens and noncarcinogens, based on animal data, is a primary source of uncertainty in the use of toxicity values. It is not certain that the identification of carcinogenic activity in an animal species means that carcinogenic activity in humans will occur. In some cases, the metabolic processes involved in carcinogenic activity in a particular organ in animals may not exist in humans. Available evidence indicates that there are a limited number of substances that are classified as human carcinogens (USEPA Class A substances). The extrapolation of short-term to long-term exposures is also a component in some cases for the carcinogen dose-response values. The use of toxicity measures (e.g., RfDs and CSFs) introduces additional uncertainties. These parameters are generally based on animal studies, many of which are performed at high doses relative to the site-specific exposures that potentially could occur. These data require interpretation and/or extrapolation in the low dose area of the dose-response curve. The CSFs used in the risk assessment generally represent a "high end" estimate. The CSFs are the 95 percent UCL on the actual slope derived from the scientific data and, therefore, are likely overestimates of the potency.

4.1.6.5 Risk Characterization A mixture of analytes is present in each medium evaluated at NAS Cecil Field. The USEPA's *Guidelines for the Health Risk Assessment of Chemical Mixtures* (USEPA, 1986a) states that if sufficient data are not available on the effects of the chemical mixture of concern, or a reasonably similar mixture, additivity of effects for constituents of the mixture should be assumed. This assumption, according to USEPA, is expected to yield generally neutral risk estimates (i.e., neither conservative nor lenient). More recent guidance from USEPA (USEPA, 1989f) also references the *Guidelines for the Health Risk Assessment of Chemical Mixtures*, but further states that the assumption of

additivity assumes independence of action and that if this assumption is incorrect, overestimation or underestimation of the actual multiple substance risk may occur. In calculating HI values, additivity is assumed, but in some cases the analytes in a mixture have significantly different toxic mechanisms of action and impact different organs. In these cases, the overall HI likely overestimates noncancer risks.

4.1.7 Remedial Goal Options (RGOs) Those media with estimated incremental lifetime cancer risks above 1 in 10,000, or with a total HI greater than 1, are identified for each relevant site. These media are selected for development of media cleanup levels per Region IV guidance (USEPA, 1993a). RGOs and available criteria are intended to provide the basis for the development of remedial alternatives in the feasibility study (FS) that follows the remedial investigation (RI).

Each RGO table contains the potential media cleanup levels for media that have cancer risk estimates in excess of 10^{-4} or an HI greater than 1. Only analytes that individually contribute cancer risk greater than 10^{-6}, or an HQ greater than 0.1 for a given medium, are included in the RGO table. The table includes the concentrations associated with cancer risk levels of 10^{-4}, 10^{-5}, and 10^{-6}; with HQs of 0.1, 1, and 10; and any State or Federal regulatory guidance for an environmental medium.

To calculate risk-based RGOs, the equations and parameter values used to calculate cancer risks and noncancer hazards for site-specific conditions are employed. The total cancer risk or noncancer HI for a given media is determined by summing the risk or HQ resulting from each complete exposure pathway (dermal, ingestion, and inhalation). By rearranging the equation and setting the total risk for carcinogenic effects at 10^{-6}, 10^{-5}, or 10^{-4}, or the noncarcinogenic HI at 0.1, 1, or 10, it is possible to solve for the concentration (i.e., groundwater, surface water, soil, or sediment concentration) that yields the target risk or hazard. Appendix L contains more information on the calculation of RGOs.

RGOs are presented for informational purposes and are not considered actual cleanup goals.

4.1.7.1 **Comparison to Available Criteria** Site-specific data at NAS Cecil Field are compared to criteria for groundwater, surface soil, and subsurface soil. Available criteria are considered for each medium in an HHRA by presenting a comparison of those chemicals detected to the available criteria and providing the results of the comparison.

Groundwater. The available criteria for groundwater are based on the assumption that groundwater is used as a potable water supply. Federal drinking water criteria used in the comparison are the primary standards, which are based on health, economic, and engineering considerations (USEPA, 1994b). The standards, referred to as MCLs, are promulgated under the Safe Drinking Water Act (SDWA) and are intended to regulate the quality of "finished" water discharged to a community water supply distribution system. Secondary standards (also referred to as secondary MCLs) promulgated under the SDWA are based on aesthetic and economic considerations (e.g., taste, odor, or staining) and are not enforceable on the Federal level. Federal MCLs are normally regarded as the best criteria available for evaluating safe drinking water concentrations.

State criteria for groundwater include the Florida drinking water standards (Florida Legislature, 1994) and the Florida Groundwater Guidance Concentrations (FDEP, 1994a). The State of Florida recognizes the Florida primary standards to be the best criteria available for evaluating safe drinking water concentrations.

Soil. Florida has developed suggested cleanup goals for surface soil (FDEP, 1995a; 1995b) for sites in Florida. These values are based on the assumption that surface soil will be encountered in a residential or industrial setting. The residential setting criterion is selected for surface soil because it is protective of human health, given uncertainty in future land use. Industrial values will be used to screen subsurface soil.

When groundwater contamination is present at a site and soil may be contributing to the groundwater contamination, it is appropriate to evaluate the leaching potential of the soil. Florida has developed soil criteria based on leaching of soil to groundwater (FDEP, 1995b). The FDEP leaching-based soil concentrations have been developed so the leachate will meet drinking water quality standards.

Total Recoverable Petroleum Hydrocarbons (TRPH). When collected, TRPH data in soil (surface and subsurface soil as well as sediment) are compared to the available Florida guidance value of 50 mg/kg. The Florida guidance value is located in the Florida Administrative Code (FAC) under criteria for clean soil that has been thermally treated after contamination with petroleum (Florida Legislature, 1992). This criterion may not be directly applicable to soil and sediment at all sites, but may provide some regulatory perspective.

4.2 HHRA FOR SITE 3. The location, description, and history associated with Site 3 are discussed in detail in Chapter 2.0. At Site 3, surface soil, subsurface soil, surface water, sediment, and groundwater samples were collected and analyzed during the RI field investigation (Sections 3.1 through 3.3). After evaluation and management of the environmental data for Site 3 (Section 3.6), medium-specific (e.g., surface water and groundwater) HHCPCs were selected and the potential human health risks associated with each medium at the waste site were characterized as part of the HHRA.

A description of the methodology used to complete the HHRA for Site 3 is presented in Section 4.1.

4.2.1 Selection of CPCs HHCPCs are defined as chemicals for which data of sufficient quality are available for use in the risk assessment, that are potentially site related, and that are present at concentrations above risk-based screening levels (where available) as well as background screening levels (where available). In selecting HHCPCs, USEPA criteria have been used (Subsection 4.1.2). A summary of the HHCPCs selected for surface soil, subsurface soil, surface water, sediment, and groundwater (surficial and intermediate aquifers) is provided in Table 4-3.

4.2.1.1 Surface Soil Twenty-four surface soil samples (CF3SS1, CF3SS2, CF3SS3, CF3SS4, CF3SS5, CF3SS6, CF3SS7, CF3SS8, CF3SS9, CF3SS10, CF3SS11, CF3SS12, CF3SS13, CF3SS14, CF3SS15, CF3SS16, CF3SS17, CF3SS18, CF3SS19, CF3SS20, CF3SS21, CF3SS22, CF3SS23, and CF3SS24, with duplicates at CF3SS10, CF3SS20, and CF3SS24) were collected at Site 3 from depths of zero to 1 foot (Figure 3-1).

Table 4-3
Summary of Human Health Chemicals of Potential Concern (HHCPCs)

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Environmental Medium	HHCPCs[1]
Surface Soil	**Inorganic Analytes**: manganese **Organics**: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and total recoverable petroleum hydrocarbons (TRPH)
Subsurface Soil	**Inorganic Analytes**: beryllium and manganese **Organics**: TRPH
Surficial Aquifer	**Inorganic Analytes**: aluminum, arsenic, chromium, iron, manganese, and vanadium **Organics**: 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethene (total), benzene, trichloroethene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-methylnaphthalene, 4-methylphenol, benzo(b)fluoranthene, naphthalene, bis(2-ethylhexyl)phthalate, Aroclor-1248, and TRPH
Intermediate Aquifer	**Inorganic Analytes**: arsenic and manganese **Organics**: none
Surface Water	**Inorganic Analytes**: antimony **Organics**: dibromochloromethane, bromodichloromethane, and chloroform
Sediment	**Inorganic Analytes**: none **Organics**: Aroclor-1254 and endrin ketone

[1] HHCPCs were selected for each medium in Tables 4-4 through 4-9.

A summary of the analytes detected in the surface soil samples at Site 3 and the HHCPC screening results are presented in Table 4-4. Seven SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene), one inorganic contaminant (manganese) and TRPH were retained as HHCPCs.

4.2.1.2 **Subsurface Soil** Subsurface soil samples were collected at 21 locations in 1994 (CF3SB1, CF3SB2, CF3SB3, CF3SB4, CF3SB5, CF3SB6, CF3SB7, CF3SB8, CF3SB9, CF3SB10, CF3SB11, CF3SB12, CF3SB13, CFSB25, CF3SB26, CFSB27, CF3SB28, CF3SB29, CF3SB30, CF3SB31, and CF3SB32, with duplicates at CF3SB10, CF3SB27, and CF3SB32), as indicated on Figure 3-1. Sixteen subsurface soil samples (BOR3-1-1, BOR3-1-2, BOR3-2-1, BOR3-2-2, BOR3-3-1, BOR3-3-2, BOR3-4-1, BOR3-4-2, BOR3-5-1, BOR3-5-2, BOR3-6-1, BOR3-6-2, BOR3-7-1, BOR3-7-2, BOR3-8-1, and BOR3-8-2, with a duplicate at BOR3-6-1) from the 1991 RI/FS report were also included in the data set (Figure 3-2).

Subsurface soil data were grouped together for HHCPC selection at Site 3, regardless of the depth interval in which they were collected. A summary of the analytes detected in the subsurface soil samples at Site 3 and the HHCPC screening results are presented in Table 4-5. Two inorganic chemicals (beryllium and manganese) and TRPH were retained as HHCPCs.

4.2.1.3 **Groundwater** As previously discussed in Section 3.3 and in the RI report (ABB-ES, 1995), unfiltered and filtered samples were submitted for chemical analyses during the groundwater sampling program investigating the surficial and intermediate aquifers. The 30 sample locations for the surficial aquifer (surficial, intermediate, and deep) (CF3MW1, CF3MW3S, CF3MW4S, CF3MW5S, CF3MW6S, CF3MW7D, CF3MW7S, CF3MW11I, CF3MW12D, CF3MW13S, CF314I, CF3MW15D, CF3MW16S, CF3MW17D, CF3MW18S, CF3MW19D, CF3MW20S, CF3MW21I, CF3MW22D, CF3MW23S, CF3MW24D, CF3MW25S, CF3MW26I, CF3MW27D, CF3MW28S, CF3MW29D, CF3MW31S, CF3MW32D, CF3MW34S, and CF3MW35D, including duplicates at CF3MW17D and CF3MW24D) and the three samples for the intermediate aquifer (UZH) (CF3MW7DP, CF3MW30DD, and CF3MW33DD) are indicated on Figure 3-3.

The separate evaluations of the surficial and intermediate aquifers at NAS Cecil Field in the risk characterization part of the HHRA (Paragraph 4.2.4.3) include results from unfiltered samples only.

<u>Surficial Aquifer</u> HHCPCs were selected according to the procedures outlined in Subsection 4.1.2 for those monitoring wells that are set within the contamination plume (CF3MW3S, CF3MW4S, CF3MW6S, CF3MW7D, CF3MW7S, CF3MW13S, CF314I, CF3MW15D, CF3MW18S, CF3MW19D, CF3MW28S, CF3MW29D, CF3MW31S, and CF3MW32D) as described in the RI report (ABB-ES, 1995). Additional information concerning the plume at Site 3 is located in the RI report (ABB-ES, 1995).

Table 4-6 summarizes the analytes detected in surficial aquifer samples at Site 3. Six VOCs (1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethene (total), benzene, and trichloroethene), eight SVOCs (1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-methylnaphthalene, 4-methylphenol, benzo(b)fluoranthene, naphthalene, andbis(2-ethylhexyl)phthalate), one polychlorinated biphenyl (PCB) (Aroclor-1248), six inorganics (aluminum, arsenic, chromium, iron, manganese, and vanadium), and TRPH were retained as HHCPCs.

Table 4-4
Selection of Human Health Chemicals of Potential Concern (HHCPCs), Site 3 Surface Soil

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations	Mean of Detected Concentrations[3]	Screening Background Concentration[4]	Screening Concentration[5]	Florida Soil Cleanup Goals[6]	Analyte CPC? (Yes/No)	Reason[7]
Volatile Organic Compounds (µg/kg)									
1,1-Dichloroethene	1/24	6 to 43.5	3	3	ND	1,100	100	No	S, G
1,2-Dichloroethene (total)	1/24	6 to 43.5	4	4	ND	70,000	26,000	No	S, G
2-Butanone	2/24	7 to 86	2 to 3	2.5	ND	4,700,000	2,200,000	No	S, G
Acetone	1/24	12 to 86	4	4	ND	780,000	260,000	No	S, G
Methylene chloride	2/24	6 to 43.5	3 to 4	3.5	ND	85,000	16,000	No	S, G
Toluene	1/24	6 to 43.5	3	3	ND	1,600,000	520,000	No	S, G
Xylenes (total)	12/24	6 to 43.5	3 to [2]7	4	ND	16,000,000	13,000,000	No	S, G
Semivolatile Organic Compounds (µg/kg)									
2-Methylphenol	1/24	350 to 565	24	24	ND	390,000	2,600,000	No	S, G
Acenaphthylene	1/24	350 to 565	170	170	ND	NSC	670,000	No	G
Anthracene	1/24	350 to 565	59	59	ND	2,300,000	20,000,000	No	S, G
Benzo(a)anthracene	2/24	350 to 565	44 to 620	332	ND	880	1,400	Yes	C
Benzo(a)pyrene	4/24	350 to 565	23 to 440	174	ND	88	100	Yes	
Benzo(b)fluoranthene	4/24	350 to 565	30 to 870	294	ND	880	1,400	Yes	C
Benzo(g,h,i)perylene	4/24	350 to 565	28 to 270	116	ND	NSC	14,000	No	G
Benzo(k)fluoranthene	2/24	350 to 565	85 to 280	183	ND	8,800	14,000	Yes	C
Butylbenzylphthalate	1/24	350 to 565	48	48	ND	1,600,000	15,000,000	No	S, G
Carbazole	1/24	350 to 565	24	24	ND	32,000	42,000	No	S, G
Chrysene	4/24	350 to 565	22 to 700	225	ND	88,000	140,000	Yes	C
Di-n-butylphthalate	1/24	350 to 565	1,400	1,400	ND	780,000	7,300,000	No	S, G
Dibenz(a,h)anthracene	2/24	350 to 565	32 to 100	66	ND	88	100	Yes	
Fluoranthene	4/24	350 to 565	29 to 720	228	ND	310,000	2,900,000	No	S, G

See notes at end of table.

Table 4-4 (Continued)
Selection of Human Health Chemicals of Potential Concern (HHCPCs), Site 3 Surface Soil

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations	Mean of Detected Concentrations[3]	Screening Background Concentration[4]	Screening Concentration[5]	Florida Soil Cleanup Goals[6]	Analyte CPC? (Yes/No)	Reason[7]
Semivolatile Organic Compounds (µg/kg) (Continued)									
Indeno(1,2,3-cd)pyrene	3/24	350 to 565	22 to 330	157	ND	880	1,400	Yes	C
Phenanthrene	1/24	350 to 565	44	44	ND	NA	1,700,000	No	G
Phenol	1/24	350 to 565	[2]33	33	ND	4,700,000	34,000,000	No	S,G
Pyrene	3/24	350 to 565	23 to 890	323	ND	230,000	2,200,000	No	S, G
bis(2-Ethylhexyl)phthalate	2/24	350 to 565	180 to 290	235	ND	46,000	48,000	No	S, G
Pesticides and PCBs (µg/kg)									
4,4-DDT	8/24	3.9 to 20	1.3 to 10	5	ND	1,900	3,100	No	S, G
Dieldrin	1/24	2.1 to 20	1.6	1.6	ND	40	70	No	S, G
Endosulfan II	4/24	0.2 to 20	0.17 to [2]1.55	0.65	ND	47,000	390,000	No	S, G
Endrin ketone	1/24	3.85 to 20	4	4	ND	NA	NA	No	F
alpha-HCH	1/24	1.95 to 10	[2]0.89	0.89	ND	100	200	No	S, G
alpha-Chlordane	7/24	1.95 to 10	0.099 to [2]0.805	0.45	ND	[8]470	[8]800	No	S, G
gamma-Chlordane	4/24	1.95 to 10	[2]0.119 to 0.8	0.36	ND	[8]470	[8]800	No	S, G
Aroclor-1254	1/24	38.5 to 200	[2]14.75	14.75*	ND	[11]83	[11]900	No	S, G
Inorganic Analytes (mg/kg)									
Aluminum	24/24	40 to 40	527 to 2,010	1,313	10,100	23,000	75,000	No	B, S, G
Antimony	1/24	12 to 12	2.1	2.1	ND	3.1	26	No	S, G
Barium	23/24	40 to 40	1.8 to 27.6	6	12	550	5,200	No	S, G
Cadmium	5/24	1 to 1	0.24 to 2.6	1.1	ND	3.9	37	No	S, G
Calcium	23/24	1,000 to 1,000	513 to 66,100	10,770	458	1,000,000	NA	No	S
Chromium	12/24	2 to 2	0.4 to 6.2	1.8	25.8	[9]39	[9]290	No	B, S, G

See notes at end of table.

Table 4-4 (Continued)
Selection of Human Health Chemicals of Potential Concern (HHCPCs),
Site 3 Surface Soil

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations	Mean of Detected Concentrations[3]	Screening Background Concentration[4]	Screening Concentration[5]	Florida Soil Cleanup Goals[6]	Analyte CPC? (Yes/No)	Reason[7]
Inorganic Analytes (mg/kg) (Continued)									
Copper	22/24	5 to 5	0.48 to 42.4	5.6	ND	290	[12]2,900	No	S, G
Iron	24/24	20 to 20	85 to 2,100	587	2,792	47,824	NA	No	B, S
Lead	24/24	0.6 to 0.6	2.2 to 258	16	9.4	[10]400	500	No	S, G
Magnesium	23/24	1,000 to 1,000	58 to [2]1,622	232	230	460,468	NA	No	S
Manganese	23/24	3 to 3	2.6 to 41.5	10.7	11	39	370	Yes	
Mercury	3/24	0.1 to 0.1	0.16 to 0.32	0.26	ND	2.3	23	No	S, G
Nickel	9/24	8 to 8	0.57 to 2.4	1.1	7.2	160	1,500	No	B, S, G
Potassium	20/24	1,000 to 1,000	24.1 to [2]298.9	53.8	310	1,000,000	NA	No	B, S
Selenium	1/24	1 to 1	[2]0.75	0.75	ND	39	390	No	S, G
Silver	5/24	2 to 2	0.33 to 4.4	1.7	ND	39	390	No	S, G
Sodium	9/24	1,000 to 1,000	122 to 241	171	ND	1,000,000	NA	No	S
Vanadium	24/24	10 to 10	0.79 to 4.6	1.9	13.2	55	490	No	B, S, G
Zinc	6/24	4 to 4	13.5 to 93.9	35.4	ND	2,300	23,000	No	S, G
Total Recoverable Petroleum Hydrocarbons (TRPH) (mg/kg)									
TRPH	7/24	12 to 29	29 to 370	145	ND	NSC	NSC	Yes	

See notes on following page.

Table 4-4 (Continued)
Selection of Human Health Chemicals of Potential Concern (HHCPCs), Site 3 Surface Soil

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

[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).
[2] Value is the average of a sample and its duplicate. For nondetect values, 1/2 the contract-required quantitation limit/contract-required detection limit is used as a surrogate.
[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 a "U" or "UJ" validation qualifier for that analyte.
[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, iron, magnesium, potassium, and sodium), U.S. Environmental Protection Agency (USEPA) Region III risk-based concentration for residential surface soil exposure per January 1993 guidance ("Selecting Exposure Routes and Chemicals of Concern by Risk-Based Screening," EPA/903/R-93-001) was used for screening. Actual values are taken from the chemical of concern screening table dated March 18, 1994, and are based on a cancer risk of 10^{-6} or a hazard quotient of 0.1. For the essential nutrients, screening values were derived based on recommended daily allowances (See Appendix H).
[6] Values are taken from the Florida Department of Environmental Protection (FDEP) memorandum, "Soil Cleanup Goals for Florida," dated September 29, 1995 (FDEP, 1995b). The residential values are based on a cancer risk of 10^{-6} and the child resident based on a hazard quotient of 1.
[7] Analytes were included or excluded from the risk assessment for the following reasons:

S = the maximum detected concentration did not exceed the screening concentration,
G = the maximum detected concentration did not exceed the Florida cleanup goals,
B = the maximum detected concentration did not exceed twice the arithmetic mean of detected concentrations at background locations,
F = the frequency of detection was less than 5 percent, and
C = the analyte is a member of a chemical class that contains other HHCPCs (i.e., carcinogenic polynuclear aromatic hydrocarbons).

[8] All forms of Chlordane.
[9] The value is based on chromium hexavalent form.
[10] USEPA Office of Solid Waste and Emergency Response Directive No. 9355.4-12 revised interim recommended soil cleanup for Comprehensive Environmental Response, Compensation, and Liability Act and Resource Conservation and Recovery Act sites.
[11] Value is for all PCBs.
[12] Value is from FDEP memorandum, "Soil Cleanup Goals for the Military Sites," dated April 5, 1995 (FDEP, 1995a).

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

Sample locations include CF3SS1, CF3SS2, CF2SS3, CF3SS4, CF3SS5, CF3SS6. CF3SS7, CF3SS8, CF3SS9, CF3SS10, CF3SS11, CF3SS12, CF3SS13, CF3SS14, CF3SS15, CF3SS16, CF3SS17, CF3SS18, CF3SS19, CF3SS20, CF3SS21, CF3SS22, CF3SS23, and CF3SS24. Duplicate samples CF3SS10D, CF3SS20D, and CF3SS24D. Background sample locations include CEFBSS01, CEFBSS02, CEFBSS03, CEFBSS04, CEFBSS05, CEFBSS06, CEFBSS07, CEFBSS08, CEFBSS10, CEFBSS11, CEFBSS12, CEFBSS13, CEFBSS14, and CEFBSS15.

CPC = chemical of potential concern.
μg/kg = micrograms per kilogram.
ND = not detected in any background samples.
NSC = no screening concentration available.
NA = not available.
PCB = polychlorinated biphenyl.
DDT = dichlorodiphenyltrichloroethane.
HCH = hexachlorocyclohexane.
mg/kg = milligrams per kilogram.

Table 4-5
Selection of Human Health Chemicals of Potential Concern (HHCPCs)
Site 3 Subsurface Soil

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations	Mean of Detected Concentrations[3]	Screening Background Concentration[4]	Screening Concentration[5]	Florida Soil Cleanup Goals[6]	Analyte CPC? (Yes/No)	Reason[7]
Volatile Organic Compounds (µg/kg)									
1,1-Dichloroethane	1/37	5 to 760	3	3	ND	780,000	2,1000,000	No	S
1,1-Dichloroethene	3/37	5 to 760	18 to 23	20.3	ND	1,100	100	No	S
1,2-Dichloroethene (total)	3/37	5 to 760	12 to 18	15	ND	70,000	180,000	No	S, G
2-Butanone	4/37	5 to 1,500	3 to 16	8.1	ND	4,700,000	15,000,000	No	S, G
Carbon disulfide	4/37	5 to 760	1 to 2	1.8	ND	780,000	34,000	No	S, G
Chloroform	2/37	5 to 760	550 to 560	555	ND	78,000	800	No	S, G
Ethylbenzene	2/37	5 to 760	3 to [2]3.5	3.3	ND	780,000	10,000,000	No	S, G
Methylene chloride	3/37	5 to 760	4 to 5	4.7	ND	85,000	23,000	No	S, G
Toluene	8/37	5 to 760	1 to 190	30.3	ND	1,600,000	3,500,000	No	S, G
Trichloroethene	5/37	5 to 760	5 to 270	80	ND	47,000	9,300	No	S, G
Xylenes (total)	9/37	5 to 760	2 to 21	5.8	ND	16,000,000	92,000,000	No	S, G
Semivolatile Organic Compounds (µg/kg)									
1,4-Dichlorobenzene	3/37	330 to 3,300	26 to 30	27.3	ND	27,000	11,000	No	S
2-Nitroaniline	1/37	970 to 16,000	26	26	ND	470	73,000	No	S
3-Nitroaniline	1/37	970 to 16,000	82	82	ND	23,000	4,700,000	No	S
4-Nitroaniline	1/37	970 to 16,000	40	40	ND	23,000	NSC	No	S
4-Nitrophenol	1/37	970 to 16,000	58	58	ND	480,000	NSC	No	S
Benzo(a)anthracene	1/37	330 to 3,300	23	23	ND	880	4,900	No	S, G
Benzo(a)pyrene	1/37	330 to 3,300	55	55	ND	88	500	No	S, G
Benzo(b)fluoranthene	2/37	330 to 3,300	32 to 88	60	ND	880	5,000	No	S, G
Benzo(g,h,i)perylene	1/37	330 to 3,300	87	87	ND	NSC	50,000	No	G
Benzo(k)fluoranthene	1/37	330 to 3,300	79	79	ND	8,800	48,000	No	S, G
Chrysene	1/37	330 to 3,300	31	31	ND	88,000	500,000	No	S, G

See notes at end of table.

Table 4-5 (Continued)
Selection of Human Health Chemicals of Potential Concern (HHCPCs)
Site 3 Subsurface Soil

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting	Range of Detected Concentrations	Mean of Detected Concentrations[3]	Screening Background Concentration[4]	Screening Concentration[5]	Florida Soil Cleanup Goals[6]	Analyte CPC? (Yes/No)	Reason[7]
Semivolatile Organic Compounds (µg/kg) (Continued)									
Di-n-butylphthalate	2/37	330 to 3,300	760 to 800	780	ND	780,000	140,000,000	No	S, G
Fluoranthene	2/37	330 to 3,300	30 to 480	255	ND	310,000	48,000,000	No	S, G
Indeno(1,2,3-cd)pyrene	1/37	330 to 3,300	59	59	ND	880	5,000	No	S, G
Pyrene	1/37	330 to 3,300	42	42	ND	230,000	41,000,000	No	S, G
bis(2-Ethylhexyl)phthalate	15/37	330 to 3,900	38 to 6,800	1,105	ND	46,000	110,000	No	S, G
Pesticides and PCBs (µg/kg)									
4,4-DDE	2/37	4 to 38	0.78 to 1.4	1.1	ND	1,900	11,000	No	S, G
Endosulfan II	2/37	0.2 to 38	0.13 to 0.41	0.27	ND	47,000	5,900,000	No	S, G
Endrin	1/37	4 to 38	[2]1.575	1.575	ND	2,300	470,000	No	S, G
alpha-HCH	1/37	2.1 to 19	39	39	ND	100	600	No	S, G
alpha-Chlordane	[8]1/21	2 to 2.85	0.41	0.41	ND	[9]470	[9]3,000	No	S, G
delta-HCH	1/37	2.1 to 19	1.2	1.2	ND	NA	470,000	No	G
gamma-HCH (Lindane)	1/37	2.1 to 19	24	24	ND	490	3,000	No	S, G
gamma-Chlordane	1/37	2 to 190	0.47	0.47	ND	[9]470	[9]3,000	No	S, G
Inorganic Analytes (mg/kg)									
Aluminum	37/37	40 to 40	465 to 3,100	1,185	11,230	23,000	>1,000,000	No	B, S, G
Antimony	2/37	12 to 12	0.99 to 2.5	1.7	ND	3.1	220	No	S, G
Arsenic	13/37	2 to 20	0.094 to 1.1	0.22	1.6	[10]2.3	3.1	No	B, S, G
Barium	30/37	40 to 40	0.47 to 32.5	3.7	15.4	550	84,000	No	S, G
Beryllium	3/37	1 to 1	0.11 to 0.32	0.19	ND	0.15	1.0	Yes	
Cadmium	4/37	1 to 1	0.33 to 2.6	1.1	ND	3.9	600	No	S, G
Calcium	32/37	1,000 to 1,000	74 to 235,000	8,546	320	1,000,000	NSC	No	S
Chromium	20/37	2 to 2	[2]0.81 to 28.1	3.6	15	[11]39	[11]430	No	S, G

See notes at end of table.

Table 4-5 (Continued)
Selection of Human Health Chemicals of Potential Concern (HHCPCs)
Site 3 Subsurface Soil

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations	Mean of Detected Concentrations[3]	Screening Background Concentration[4]	Screening Concentration[5]	Florida Soil Cleanup Goals[6]	Analyte CPC? (Yes/No)	Reason[7]
Inorganic Analytes (mg/kg) (Continued)									
Copper	20/37	5 to 5	0.5 to 19.4	2.7	1.2	290	[13]72,000	No	S, G
Cyanide	1/37	0.5 to 2	1.3	1.3	ND	160	40,000	No	S, G
Iron	37/37	20 to 20	75.6 to 1,050	313	2,838	47,824	NA	No	B, S
Lead	29/37	0.6 to 1	0.8 to 7.4	2.5	13.2	[12]400	1,000	No	B, S, G
Magnesium	33/37	1,000 to 1,000	16.9 to 1,620	144	268	460,468	NA	No	S
Manganese	32/37	3 to 3	1 to 66.3	7.2	7.8	39	5,500	Yes	
Mercury	9/37	0.1 to 0.1	0.036 to 0.21	0.07	1.1	2.3	480	No	B, S, G
Nickel	8/37	8 to 8	0.63 to 19.1	3.8	5.4	160	26,000	No	S, G
Potassium	16/37	1,000 to 1,000	18.8 to 143	59.1	152.8	1,000,000	NA	No	B, S
Selenium	1/37	1 to 1	1.1	1.1	ND	39	9,900	No	S, G
Silver	3/37	2 to 2	0.55 to 1.4	0.89	ND	39	9,000	No	S, G
Sodium	24/37	1,000 to 1,000	87 to 160	123	312	1,000,000	NA	No	B, S
Vanadium	22/37	10 to 10	0.57 to 4.5	1.6	15.4	55	4,800	No	B, S, G
Zinc	9/37	4 to 4	2.33 to 36.9	11.7	ND	2300	560,000	No	S, G
Total Recoverable Petroleum Hydrocarbons (TRPH) (mg/kg)									
TRPH	[8]7/21	12 - 130	20 - 1,600	344	ND	NSC	NSC	Yes	

See notes on following page.

Table 4-5 (Continued)
Selection of Human Health Chemicals of Potential Concern (HHCPCs)
Site 3 Subsurface Soil

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, 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] Value is the average of a sample and its duplicate. For nondetect values, 1/2 the contract-required quantitation limit (CRQL)/contract-required detection limit (CRDL) is used as a surrogate.
[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 a "U" or "UJ" validation qualifier for that analyte.
[4] The background screening value is twice the average of detected concentrations for inorganic analytes in background samples. For nondetect values, 1/2 the CRQL/CRDL is used as a surrogate for the nondetect value.
[5] For all chemicals except the essential nutrients (calcium, iron, magnesium, potassium, and sodium), U.S. Environmental Protection Agency (USEPA) Region III risk-based concentration for residential surface soil exposure per January 1993 guidance ("Selecting Exposure Routes and Chemicals of Concern by Risk-Based Screening," EPA/903/R-93-001) was used for screening. Actual values are taken from the chemicals of concern screening table dated March 18, 1994, and are based on a cancer risk of 10^{-6} or a hazard quotient of 0.1. For the essential nutrients, screening values were derived based on recommended daily allowances (See Appendix H).
[6] Values are taken from the Florida Department of Environmental Protection (FDEP) memorandum, "Soil Cleanup Goals for in Florida," dated September 29, 1995. The industrial values are based on a cancer risk of 10^{-6} and a hazard quotient of 1.
[7] Analytes were included or excluded from the risk assessment for the following reasons:
S = the maximum detected concentration did not exceed the screening concentration,
G = the maximum detected concentration did not exceed the Florida Soil Cleanup Goal,
B = the maximum detected concentration did not exceed twice the arithmetic mean of detected concentrations at background locations, and
[8] Number of samples analyzed varies because the compound was not included on the 1990 Contract Laboratory Program statement of work.
[9] Value is for all forms of Chlordane.
[10] The value is based on arsenic as a carcinogen.
[11] The value is based on chromium hexavalent form.
[12] USEPA Office of Solid Waste and Emergency Response Directive No. 9355.4-12 revised interim recommended soil cleanup value for Comprehensive Environmental Response, Compensation, and Liability Act and Resource Conservation and Recovery Act sites.
[13] Value is from FDEP memorandum, "Soil Cleanup Goals for the Military Sites," dated April 5, 1995.
Notes: The average of a sample and its duplicate is used for all table calculations.

Sample locations include BOR3-1-1, BOR3-1-2, BOR3-2-1, BOR3-2-2, BOR3-3-1, BOR3-3-2, BOR3-4-1, BOR3-4-2, BOR3-5-1, BOR3-5-2, BOR3-6-1, BOR3-6-2, BOR3-7-1, BOR3-7-2, BOR3-8-1, BOR3-8-2, CF3SB1, CF3SB2, CF3SB3, CF3SB4, CF3SB5, CF3SB6, CF3SB7, CF3SB8, CF3SB9, CF3SB10, CF3SB11, CF3SB12, CF3SB13, CF3SB25, CF3SB26, CF3SB27, CF3SB28, CF3SB29, CF3SB30, CF3SB31, and CF3SB32.
Duplicate samples include BOR3-6-1D, CF3SB10D, CF3SB27D, and CF3SB32D.
Background sample locations include CFBBMS1S0, CFBBMS1S6, CFBBMS2S2, CFBBMS2S6, CFBBMS3I2, CFBBMS3I6, CFBBMS4S2, CFBBMS4S4, CFBBMS5S2, CFBBMS5S6, CFBBMS6I0, CFBBMS6I6, CFBBMS7S0, CFBBMS7S4, CFBBMS8S2, CFBBMS8S6, CFBBMS9I0, and CFBBMS9I6.

CPC = chemical of potential concern.
μg/kg = micrograms per kilogram.
ND = not detected in any background samples.
NSC = no screening concentration.
PCB = polychlorinated biphenyl.
DDE = dichlorodiphenyldichloroethene.
HCH = hexachlorocyclohexane.
NA = not available.
mg/kg = milligrams per kilogram.

Table 4-6
Selection of Human Health Chemicals of Potential Concern
Site 3 Unfiltered Groundwater from Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations	Mean of Detected Concentrations[2]	Screening Background Concentration[3]	Screening Concentration[4]	Florida Guidance Concentration[5]	Analyte CPC? (Yes/No)	Reason[6]
Volatile Organic Compounds (µg/ℓ)									
1,1,1-Trichloroethane	4/14	1 to 170	96 to 860	342	ND	130	200	Yes	
1,1-Dichloroethane	8/14	1 to 170	1 to 590	167	ND	81	700	Yes	
1,1-Dichloroethene	8/14	1 to 170	2 to 350	115	ND	0.044	7	Yes	
1,2-Dichloroethene (total)	4/14	1 to 83	9 to 1,900	517	ND	5.5	[7]70	Yes	
2-Butanone	3/14	2 to 170	1 to 25	9	ND	2,200	4,200	No	S, G
Acetone	1/14	2 to 550	180	180	ND	370	700	No	S, G
Benzene	1/14	1 to 83	26	26	ND	0.087	1	Yes	
Trichloroethene	6/14	1 to 83	9 to 1,700	476	ND	1.6	3	Yes	
Xylenes (total)	5/14	1 to 170	9 to 150	51	ND	1,200	10,000	No	S, G
Semivolatile Organic Compounds (µg/ℓ)									
1,2-Dichlorobenzene	4/14	10 to 2,000	350 to 9,800	2,963	ND	37	600	Yes	
1,3-Dichlorobenzene	4/14	10 to 2,000	9 to 240	75.5	ND	54	NSC	Yes	
1,4-Dichlorobenzene	4/14	10 to 2,000	49 to 1,300	401	ND	0.44	75	Yes	
2,4-Dimethylphenol	3/14	10 to 2,000	0.5 to 10	4.2	ND	73	NSC	No	S
2-Methylnaphthalene	7/14	10 to 2,000	0.8 to 200	86.3	ND	[8]150	NSC	Yes	
2-Methylphenol	2/14	10 to 2,000	8 to 19	13.5	ND	180	350	No	S, G
4-Methylphenol	4/14	10 to 2,000	3 to 61	20	ND	18	35	Yes	

See notes at end of table.

Table 4-6 (Continued)
Selection of Human Health Chemicals of Potential Concern
Site 3 Unfiltered Groundwater from Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations	Mean of Detected Concentrations[3]	Screening Background Concentration[4]	Screening Concentration[5]	Florida Guidance Concentration[6]	Analyte CPC? (Yes/No)	Reason[7]
Semivolatile Organic Compounds (μg/ℓ) (Continued)									
Benzo(b)fluoranthene	1/14	10 to 2,000	3	3	ND	0.092	4	Yes	
Di-n-butylphthalate	1/14	10 to 2,000	0.8	0.8	ND	370	700	No	S, G
Diethylphthalate	2/14	10 to 2,000	1 to 3	2	ND	2,900	5,600	No	S, G
Naphthalene	8/14	10 to 2,000	0.6 to 450	148	ND	150	NSC	Yes	
Phenol	3/14	10 to 2,000	0.5 to 2	1	ND	2,200	NSC	No	S
bis(2-Ethylhexyl)phthalate	3/14	10 to 2,000	0.6 to 5	2.2	ND	4.8	6	Yes	
Pesticides and PCBs (μg/ℓ)									
Aroclor-1248	2/14	0.8 to 1	0.6 to 0.79	0.7	ND	0.0087	0.5	Yes	
Endosulfan II	1/14	0.1 to 0.1	0.042	0.042	ND	22	0.35	No	S, G
Inorganic Analytes (μg/ℓ)									
Aluminum	9/14	200 to 200	37.4 to 47,400	6,087	17,200	3,700	NSC	Yes	
Arsenic	6/14	10 to 10	1.5 to 24.7	8.8	7.6	[9]0.038	50	Yes	
Barium	14/14	200 to 200	6 to 48.1	25	42	260	2,000	No	S, G
Calcium	14/14	5,000 to 5,000	1,440 to 69,900	32,840	47,100	1,055,398	NSC	No	S
Chromium	1/14	10 to 10	36.6	36.6	ND	[10]18	100	Yes	
Cobalt	1/14	50 to 50	10.7	10.7	20	NSC	NSC	No	B
Copper	4/14	25 to 25	6.1 to 73.5	29.9	ND	140	NSC	No	S
Iron	12/14	100 to 100	44.6 to 36,500	5,717	2,500	13,267	NSC	Yes	

See notes at end of table.

Table 4-6 (Continued)
Selection of Human Health Chemicals of Potential Concern
Site 3 Unfiltered Groundwater from Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations	Mean of Detected Concentrations[3]	Screening Background Concentration[4]	Screening Concentration[5]	Florida Guidance Concentration[6]	Analyte CPC? (Yes/No)	Reason[7]
Inorganic Analytes (μg/ℓ) (Continued)									
Lead	3/14	3 to 3	1.8 to 7.6	4	13	[11]15	15	No	B, S, G
Magnesium	14/14	5,000 to 5,000	247 to 12,400	4,615	6,820	118,807	NA	No	S
Manganese	14/14	15 to 15	4.2 to 170	40.5	99	18	NSC	Yes	
Nickel	1/14	40 to 40	12.8	12.8	38	73	100	No	B, S, G
Potassium	14/14	5,000 to 5,000	159 to 4,600	1,627	3,920	297,016	NSC	No	S
Sodium	14/14	5,000 to 5,000	1,920 to 13,100	7,200	12,400	396,022	160,000	No	S, G
Vanadium	1/14	50 to 50	26.5	26.5	ND	26	49	Yes	
Zinc	5/14	20 to 20	2.1 to 10.1	5.9	ND	1,100	NSC	No	S
Total Recoverable Petroleum Hydrocarbons (TRPH) (μg/ℓ)									
TRPH	5/14	0.5 to 0.5	1,000 to 2,100	1,600	ND	NSC	NSC	Yes	

See notes on following page.

Table 4-6 (Continued)
Selection of Human Health Chemicals of Potential Concern
Site 3 Unfiltered Groundwater from Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, 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 a "U" or "UJ" validation qualifier for that analyte.
[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, iron, magnesium, potassium, and sodium), U.S. Environmental Protection Agency (USEPA) Region III risk-based concentration (RBC) for tap water per January 1993 guidance ("Selecting Exposure Routes and Chemicals of Concern by Risk-Based Screening," EPA/903/R-93-001) was used for screening. Actual values are taken from the chemical of concern screening table dated March 18, 1994, and are based on a cancer risk of 10^{-6} or a hazard quotient of 0.1. For the essential nutrients, screening values were derived based on recommended daily allowances (see Appendix H).
[5] Florida Department of Environmental Protection *Groundwater Guidance Concentrations* (June 1994). Primary standards and guidance concentrations (carcinogen and systemic toxicants) were taken from Chapter 6.0 of the document.
[6] Analytes were included or excluded from the risk assessment for the following reasons:

S = the maximum detected concentration did not exceed the screening concentration,
G = the maximum detected concentration did not exceed the Florida Guidance Concentration, and
B = the maximum detected concentration did not exceed twice the arithmetic mean of detected concentrations at background locations.

[7] Value reported is for cis-1,2-dichloroethene.
[8] RBC value for this polynuclear aromatic hydrocarbon is not available; RBC for naphthalene is used as a conservative screening surrogate.
[9] The value is based on arsenic as a carcinogen.
[10] The value is based on chromium hexavalent form.
[11] Treatment technology action limit for drinking water distribution systems per "National Primary Drinking Water Regulations" 40 Code of Federal Regulations 141 as amended in 57 Federal Register 41345, August 3, 1993.

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

Sample locations include CF3MW3S, CF3MW4S, CF3MW6S, CF3MW7D, CF3MW7S, CF3MW13S, CF3MW14I, CF3MW15D, CF3MW18S, CF3MW19D, CF3MW28S, CF3MW29D, CF3MW31S, and CF3MW32D.
Duplicate samples include none.
Background sample locations include CF3MW8S, CF3MW9I, and CF3MW10D.

CPC = chemical of potential concern.
$\mu g/\ell$ = micrograms per liter.
ND = not detected in any background samples.
NSC = no screening concentration.
PCB = polychlorinated biphenyl.
NA = not available.

Table 4-7 presents the monitoring wells within the contamination plume and the concentrations of HHCPCs found in each well.

Intermediate Aquifer. HHCPCs were selected according to the procedures outlined in Subsection 4.1.2 for all monitoring wells set in the intermediate aquifer at Site 3 (CF3MW7DP, CF3MW30DD, and CF3MW33DD) because no organic plume was identified (ABB-ES, 1995).

Table 4-8 summarizes the analytes detected in the intermediate aquifer samples at Site 3. Two inorganics (arsenic and manganese) were retained as HHCPCs.

4.2.1.4 **Surface Water** Surface water was sampled concurrently with sediment in Rowell Creek at two locations (CF3SW1 and CF3SW2, including a duplicate at CF3SW1) in the 1994 sampling period (Figure 3-1). CF3SW2 will be used as a background reference point for the risk assessment. One sample (RCSW3), located at the area where groundwater discharges to surface water, from the 1993 sampling period was included in the data set (Figure 3-1).

A summary of the analytes detected in the surface water samples at Site 3 and the HHCPC screening results are presented in Table 4-9. Three VOCs (dibromochloromethane, bromodichloromethane, and chloroform) and one inorganic analyte (antimony) were retained as HHCPCs.

4.2.1.5 **Sediment** samples (CF3SD1, CF3SD2, and RCSD3, including a duplicate at CF3SD1) were collected in Rowell Creek associated with Site 3 concurrently with surface water samples (Figure 3-1). CF3SD2 will be used as a background reference point for the risk assessment.

A summary of the analytes detected in the sediment samples at Site 3 and the HHCPC screening results are presented in Table 4-10. One pesticide (endrin ketone) and one PCB (Aroclor-1254) were retained as HHCPCs.

4.2.2 **Exposure Assessment** Although permission is required to obtain access to NAS Cecil Field, Site 3 and the surrounding area can be accessed by Navy personnel, including adult and child dependents. There are five media that represent potential sources of exposure associated with Site 3: (1) surface soils, (2) subsurface soil, (3) surface water, (4) sediment, and (5) groundwater. Based on current land use, surface soil, surface water, and sediment are the media that are appropriate for evaluation in the HHRA for Site 3. Under future conditions, residential land use is possible. Therefore, surface soil, subsurface soil, surface water, sediment, and groundwater are evaluated in the HHRA.

Current Land Use. A site worker or maintenance worker would be an adult Navy or civilian personnel that completes monthly (1 day per month) land maintenance on Site 3 (e.g., mowing).

Adult trespassers could include individuals who engage in recreational activities (i.e., hunting or swimming) on the property. These individuals could be Navy personnel, guests, or civilians. Child trespassers are adolescents that currently live on the facility, visit the facility, or trespass onto the facility.

Table 4-7
Concentrations of Human Health Chemicals of Potential Concern (HHCPCs) in Monitoring Wells in the Contaminant Plume Surficial Aquifer Associated with Site 3

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Monitoring Well	HHCPCs Detected in Well	Concentration (μg/ℓ)
CF3MW3S	1,2-dichloroethene (total)	47
	trichloroethene	70
	4-methylphenol	12
	naphthalene	59
	2-methylnaphthalene	41
	bis(2-ethylhexyl)phthalate	1
	aluminum	47,400
	arsenic	2.2
	barium	48.1
	chromium	36.6
	iron	10,200
	manganese	150
	vanadium	26.5
	TRPH	1,800
CF3MW4S	1,1-dichloroethene	44
	1,1-dichloroethane	350
	1,1,1-trichloroethane	96
	4-methylphenol	3
	naphthalene	160
	2-methylnaphthalene	96
	Aroclor-1248	0.6
	iron	6,130
	manganese	25.7
	vanadium	26.5
	TRPH	1,700
CF3MW6S	1,1-dichloroethene	48
	1,1-dichloroethane	590
	1,1,1-trichloroethane	150
	benzene	26
	4-methylphenol	61
	naphthalene	270
	2-methylnaphthalene	120
	Aroclor-1248	0.79
	arsenic	7.2
	iron	36,500
	manganese	50.1
	TRPH	2,100

See notes at end of table.

Table 4-7 (Continued)
Concentrations of Human Health Chemicals of Potential Concern (HHCPCs) in Monitoring Wells in the Contaminant Plume Surficial Aquifer Associated with Site 3

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Monitoring Well	HHCPCs Detected in Well	Concentration ($\mu g/\ell$)
CF3MW7D (and duplicate)	aluminum	3,211*
	iron	885*
	manganese	10*
CF3MW7S	1,1-dichloroethene	280
	1,1-dichloroethane	160
	1,1,1-trichloroethane	860
	trichloroethene	550
	1,3-dichlorobenzene	9
	1,4-dichlorobenzene	49
	1,2-dichlorobenzene	350
	4-methylphenol	4
	naphthalene	150
	2-methylnaphthalene	94
	benzo(b)fluoranthene	3
	arsenic	1.5
	iron	5,040
	manganese	170
	TRPH	1,000
CF3MW13S	1,1-dichloroethene	350
	1,1-dichloroethane	120
	1,2-dichloroethene (total)	1,900
	1,1,1-trichloroethane	260
	trichloroethene	1,700
	1,3-dichlorobenzene	240
	1,4-dichlorobenzene	1,300
	1,2-dichlorobenzene	9,800
	naphthalene	450
	2-methylnaphthalene	200
	aluminum	495
	iron	6,160
	manganese	19.5
	TRPH	1,300
CF3MW14I	1,1-dichloroethene	2
	1,1-dichloroethane	1
	trichloroethene	9
	1,3-dichlorobenzene	36

See notes at end of table.

Table 4-7 (Continued)
Concentrations of Human Health Chemicals of Potential Concern (HHCPCs) in Monitoring Wells in the Contaminant Plume Surficial Aquifer Associated with Site 3

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Monitoring Well	HHCPCs Detected in Well	Concentration (μg/ℓ)
CF3MW14I (Continued)		
	1,4-dichlorobenzene	170
	1,2-dichlorobenzene	1,100
	naphthalene	14
	arsenic	11.5
	iron	427
	manganese	6.7
CF3MW15D	aluminum	48.1
	arsenic	24.7
	iron	429
	manganese	49.1
CF3MW18S	1,1-dichloroethene	4
	1,1-dichloroethane	8
	naphthalene	0.6
	2-methylnaphthalene	0.8
	bis(2-ethylhexyl)phthalate	0.6
	aluminum	442
	iron	255
	manganese	21.6
CF3MW19D	manganese	35.3
CF3MW28S	1,1-dichloroethene	160
	1,1-dichloroethane	94
	1,2-dichloroethane (total)	110
	trichloroethene	480
	1,3-dichlorobenzene	17
	1,4-dichlorobenzene	83
	1,2-dichlorobenzene	600
	naphthalene	77
	2-methylnaphthalene	52
	aluminum	510
	arsenic	5.5
	iron	1,640
	manganese	15.9
CF3MW29D	bis(2-ethylhexyl)phthalate	5
	manganese	5

See notes at end of table.

Table 4-7 (Continued)
Concentrations of Human Health Chemicals of Potential Concern (HHCPCs) in Monitoring Wells in the Contaminant Plume Surficial Aquifer Associated with Site 3

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Monitoring Well	HHCPCs Detected in Well	Concentration ($\mu g/\ell$)
CF3MW31S	1,1-dichloroethene	28
	1,1-dichloroethane	9
	1,2-dichloroethane (total)	9
	trichloroethene	48
	aluminum	44.3
	iron	54.2
	manganese	4.5
CF3MW32D	aluminum	54.4
	iron	44.6
	manganese	4.2

Notes: $\mu g/\ell$ = micrograms per liter.
TRPH = total recoverable petroleum hydrocarbons.
* = average of detected concentrations in a sample and its duplicate. For nondetects, one-half the detection limit is used as a surrogate.

Table 4-8
Selection of Human Health Chemicals of Potential Concern
Site 3 Unfiltered Groundwater from Intermediate Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations	Mean of Detected Concentrations[2]	Screening Background Concentration[3]	Screening Concentration[4]	Florida Guidance Concentration[5]	Analyte CPC? (Yes/No)	Reason[6]
Volatile Organic Compounds (μg/ℓ)									
No analytes detected									
Semivolatile Organic Compounds (μg/ℓ)									
Phenol	1/3	10 to 10	1	1	NA	2,200	NSC	No	S
bis(2-Ethylhexyl)phthalate	1/3	10 to 10	2	2	NA	4.8	6	No	S, G
Pesticides and PCBs (μg/ℓ)									
No analytes detected									
Inorganic Analytes (μg/ℓ)									
Aluminum	2/3	200 to 200	22.7 to 672	347	NA	3,700	NSC	No	S
Arsenic	1/3	10 to 10	1.2	1.2	NA	[7]0.038	50	Yes	
Barium	3/3	200 to 200	33.4 to 75.5	49.4	NA	260	2,000	No	S, G
Calcium	3/3	5,000 to 5,000	53,500 to 67,400	60,333	NA	1,055,398	NSC	No	S
Magnesium	3/3	5,000 to 5,000	8,870 to 10,500	9,613	NA	118,807	NSC	No	S
Manganese	3/3	15 to 15	10.8 to 37.9	25.2	NA	18	NSC	Yes	
Potassium	3/3	5,000 to 5,000	1,820 to 4,020	2,563	NA	297,016	NSC	No	S
Sodium	3/3	5,000 to 5,000	7,860 to 12,000	9,623	NA	396,022	160,000	No	S, G

See notes on following page.

Table 4-8 (Continued)
Selection of Human Health Chemicals of Potential Concern (HHCPCs)
Site 3 Unfiltered Groundwater from Intermediate Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, 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 a "U" or "UJ" validation qualifier for that analyte.
[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, iron, magnesium, potassium, and sodium),U.S. Environmental Protection Agency (USEPA) Region III risk-based concentration for tap water per January 1993 guidance ("Selecting Exposure Routes and Chemicals of Concern by Risk-Based Screening," EPA/903/R-93-001) was used for screening. Actual values are taken from the chemical of concern screening table dated March 18, 1994, and are based on a cancer risk of 10^{-6} or a hazard quotient of 0.1. For the essential nutrients, screening values were derived based on recommended daily allowances (see Appendix H).
[5] Florida Department of Environmental Protection *Groundwater Guidance Concentrations* (June 1994). Primary standards and guidance concentrations (carcinogens and systemic toxicants) were taken from Chapter 6.0 of the document.
[6] Analytes were included or excluded from the risk assessment for the following reasons:
S = the maximum detected concentration did not exceed the screening concentration, and
G = the maximum detected concentration did not exceed the Florida Guidance Concentration.
[7] The value is based on arsenic as a carcinogen.

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

Sample locations include CF3MW7DDP, CF3MW30DD, and CF3MW33DD
Duplicate samples include none.
Background sample locations include none.

CPC = chemical of potential concern.
$\mu g/\ell$ = micrograms per liter.
NA = not applicable because no background samples were collected.
NSC = no screening criteria available.
PCB = polychlorinated biphenyl.

Table 4-9
Selection of Human Health Chemicals of Potential Concern
Site 3 Surface Water

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations ~~(x)~~[2]	Mean of Detected Concentrations[3]	Screening Background Concentration[4]	Screening Concentration[5]	Analyte CPC? (Yes/No)	Reason[6]
Volatile Organic Compounds (µg/ℓ)								
Dibromochloromethane	1/2	1.5 to 10	[2]1.3	1.3	ND	0.13	Yes	
Bromodichloromethane	2/2	1 to 1	[2]2 to 3.5	2.8	ND	0.17	Yes	
Chloroform	2/2	2 to 10	[2]5 to 5	5	ND	0.15	Yes	
Methylene chloride	1/2	2 to 10	[2]3.5	3.5	ND	4.1	No	S
Semivolatile Organic Compounds (µg/ℓ)								
No analytes detected								
Pesticides and PCBs (µg/ℓ)								
No analytes detected								
Inorganic Analytes (µg/ℓ)								
Aluminum	2/2	200 to 200	141 to [2]558.5	350	ND	11,000	No	S
Antimony	1/2	60 to 60	[2]16.2	16.2	ND	1.5	Yes	
Barium	1/2	200 to 200	[2]26.1	26.1	55.6	260	No	B, S
Calcium	2/2	5,000 to 5,000	[2]16,700 to 26,500	21,600	46,400	1,055,398	No	B, S
Copper	1/2	25 to 25	[2]4.55	4.55	4.6	140	No	B, S
Iron	2/2	100 to 100	702 to [2]976	839	910	13,267	No	S
Lead	1/2	5 to 5	[2]2.4	2.4	ND	[7]15	No	S
Magnesium	2/2	5,000 to 5,000	[2]3,490 to 9,670	6,580	12,100	118,807	No	B, S
Manganese	2/2	15 to 15	10.7 to [2]19.7	15.2	35.6	18	No	B
Potassium	2/2	5,000 to 5,000	[2]1,255.5 to 4,500	2,878	5,380	297,016	No	B, S
Silver	1/2	10 to 10	0.24	0.24	ND	18	No	S
Sodium	2/2	5,000 to 5,000	[2]10,810 to 27,200	19,005	38,000	396,022	No	B, S
Vanadium	1/2	50 to 50	[2]1.8	1.8	2.8	26	No	B, S

See notes on following page.

Table 4-9 (Continued)
Selection of Human Health Chemicals of Potential Concern
Site 3 Surface Water

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, 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] Value is the average of a sample and its duplicate. For nondetected values, 1/2 the contract-required quantitation limit or contract-required detection limit is used as a surrogate.
[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 a "U" or "UJ" validation qualifier for that analyte.
[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, iron, magnesium, potassium, and sodium), U.S. Environmental Protection Agency (USEPA) Region III risk-based concentrations for tap water per January 1993 guidance ("Selecting Exposure Routes and Chemicals of Concern by Risk-Based Screening," EPA/903/R-93-001) were used for screening. Actual values are taken from the chemical of concern screening table dated March 18, 1994, and are based on a cancer risk of 10^{-6} or a hazard quotient of 0.1. For the essential nutrients, screening values were derived based on recommended daily allowances (see Appendix H).
[6] Analytes were included or excluded from the risk assessment for the following reasons:
S = the maximum detected concentration did not exceed the screening concentration, and
B = the maximum detected concentration did not exceed twice the arithmetic mean of detected concentrations at background locations.
[7] Treatment technology action limit for drinking water distribution systems per "National Primary Drinking Water Regulations" 40 Code of Federal Regulations 141 as amended in 57 Federal Register 41345, August 3, 1993.

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

Sample locations include CF3SW1 and RCSW3.
Duplicate sample includes CF3SW1D.
Background sample location includes CF3SW2.

CPC = chemical of potential concern.
$\mu g/\ell$ = micrograms per liter.
ND = not detected in any background samples.
PCB = polychlorinated biphenyl.

Table 4-10
Selection of Human Health Chemicals of Potential Concern
Site 3 Sediment

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations	Mean of Detected Concentrations[3]	Screening Background Concentration[4]	Screening Concentration[5]	Analyte CPC? (Yes/No)	Reason[6]
Volatile Organic Compounds (µg/kg)								
2-Butanone	2/2	14 to 14	[2]5.5 to 6	5.8	ND	4,700,000	No	S
Semivolatile Organic Compounds (µg/kg)								
Di-n-butylphthalate	1/2	460 to 460	310	310	ND	780,000	No	S
bis(2-Ethylhexyl)phthalate	1/2	460 to 460	260	260	ND	46,000	No	S
Pesticides and PCBs (µg/kg)								
4,4-DDE	1/2	4 to 4.65	1.8	1.8	ND	1,900	No	S
4,4-DDT	1/2	4.5 to 4.6	[2]3.4	3.4	ND	1,900	No	S
Aroclor-1254	1/2	45 to 46.5	180	180	ND	83	Yes	
Dieldrin	1/2	4.4 to 4.5	[2]3.45	3.45	ND	40	No	S
Endrin ketone	1/2	4.4 to 4.5	[2]1.5	1.5	ND	NSC	Yes	
Inorganic Analytes (mg/kg)								
Aluminum	2/2	40 to 40	[2]394 to 1,010	702	1,136	23,000	No	B, S
Barium	1/2	40 to 40	6.9	6.9	ND	550	No	S
Calcium	2/2	1,000 to 1,000	[2]350.5 to 912	631	1,040	1,000,000	No	B, S
Copper	1/2	5 to 5	3.4	3.4	ND	290	No	S
Iron	2/2	20 to 20	[2]270.5 to 599	435	526	47,824	No	S
Lead	2/2	0.6 to 1	[2]3.5 to 6.2	4.9	5.8	[7]400	No	S
Magnesium	2/2	1,000 to 1,000	[2]49.9 to 85.8	67.9	99.6	460,468	No	B, S
Manganese	2/2	3 to 3	[2]2.1 to 3	2.6	8.6	39	No	B, S
Vanadium	2/2	10 to 10	[2]0.835 to 1.2	1	2.2	55	No	B, S
Zinc	1/2	4 to 4	14.6	14.6	ND	2,300	No	S

See notes on following page.

Table 4-10 (Continued)
Selection of Human Health Chemicals of Potential Concern
Site 3 Sediment

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, 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] Value is the average of a sample and its duplicate. For nondetect values, 1/2 the contract-required quantitation limit or contract-required detection limit is used as a surrogate.
[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 a "U" or "UJ" validation qualifier for that analyte.
[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, iron, magnesium, potassium, and sodium), U.S. Environmental Protection Agency (USEPA) Region III risk-based concentration for residential surface soil exposure per January 1993 guidance ("Selecting Exposure Routes and Chemicals of Concern by Risk-Based Screening," EPA/903/R-93-001) was used for screening. Actual values are taken from the chemical of concern screening table dated March 18, 1994, and are based on a cancer risk of 10^{-6} or a hazard quotient of 0.1. For the essential nutrients, screening values were derived based on recommended daily allowances (See Appendix H).
[6] Analytes were included or excluded from the risk assessment for the following reasons:
S = the maximum detected concentration did not exceed the screening concentration, and
B = the maximum detected concentration did not exceed twice the arithmetic mean of detected concentrations at background locations.
[7] USEPA Office of Solid Waste and Emergency Response Directive No. 9355.4-12 revised interim recommended soil cleanup for Comprehensive Environmental Response, Compensation, and Liability Act and Resource Conservation and Recovery Act sites.

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

Sample locations include CF3SD1 and RCSD3.
Duplicate sample includes CF3SD1D.
Background sample location includes CF3SD2.

CPC = chemical of potential concern.
μg/kg = micrograms per kilograms.
ND = not detected in any background samples.
PCB = polychlorinated biphenyl.
DDE = Dichlorodiphenyldichloroethane.
DDT = dichlorodiphenyltrichloroethane.
NSC = no screening criteria available.
mg/kg = milligrams per kilograms.

Future Land Use. A resident would include individuals who live either directly on the site or on adjacent property. These individuals would also be using the surficial aquifer as a source of drinking water.

An excavation worker would include individuals involved in the excavation of the site. An example of excavation workers would be construction workers preparing the site for future building opportunities.

Occupational workers are individuals that work in close (less than 200 feet) proximity to the site for a minimum of 250 days per year. Currently there are no individuals working this close to OU 8; however, there is a possibility of individuals working in close proximity of the site in future years.

Media-specific receptors and exposure scenarios are identified in Paragraphs 4.2.2.1 through 4.2.2.4 for current and future land use. The information is also summarized in Tables 4-11 and 4-12 and on Figure 4-1. Receptor-specific exposure parameters for each exposure scenario are presented in Appendix M. The risk calculation spreadsheets in Appendix N also contain the exposure parameters for each exposure scenario. EPCs for each medium were determined according to procedures outlined in Paragraph 4.1.3.3. The EPCs for analytes selected as HHCPCs are presented in Tables 4-13 through 4-18. The contaminant exposure intakes for the receptors evaluated are presented in the risk calculation spreadsheets in Appendix N.

4.2.2.1 Surface Soil

Current Land Use. At Site 3, current land use (i.e., idle military/industrial) indicates that an adult/child transient and an adult site worker are appropriate for evaluation of surface soil ingestion, dermal contact, and inhalation of fugitive dust (Table 4-11). The trespasser and worker evaluations are only presented under current land use in the risk characterization (Paragraph 4.2.4.1).

Future Land Use. Under future land use at Site 3, the evaluation of an adult/child resident would be considered appropriate if the current land use is shifted to housing. Surface soil ingestion, dermal contact, and inhalation of fugitive (airborne) dust for the future resident are evaluated. An occupational and excavation worker are also considered under future land use. An occupational worker is appropriate because the land could potentially be developed into an industrial area. The excavation worker is also appropriate because land development in the future is a possibility.

EPCs. The EPCs for HHCPCs identified for surface soil at Site 3 are presented in Table 4-13.

4.2.2.2 Subsurface Soil

Current Land Use. Currently, there is no exposure to subsurface soil at Site 3.

Future Land Use. Under future land use at Site 3, an adult excavation worker scenario would be considered appropriate. The adult excavation worker scenario is appropriate for evaluation because future development of land at or near Site 3 could include excavation and/or earthwork.

EPCs. The EPCs for HHCPCs for Site 3 subsurface soil are presented in Table 4-14.

Table 4-11
Human Health Exposure Routes Evaluated, Site 3

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Exposure Medium Exposure Route	Child Trespasser	Adult Trespasser	Site Worker	Child Resident	Adult Resident	Occupational Worker	Excavation Worker
Surface Soil							
Incidental ingestion	X	X	X	X	X	X	X
Dermal contact	X	X	X	X	X	X	X
Inhalation of particulates	X	X	X	X	X	X	X
Subsurface Soil							
Incidental ingestion							X
Dermal contact							X
Inhalation of particulates							X
Groundwater							
Ingestion					X		
Inhalation of shower vapors					X		
Surface Water							
Incidental ingestion	X	X		X	X		
Dermal contact	X	X		X	X		
Sediment							
Ingestion	X	X		X	X		
Dermal contact	X	X		X	X		

Note: X = exposure evaluated in human health baseline risk assessment.

Table 4-12
Summary of Potential Exposure Pathways

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Medium of Exposure	Route of Exposure	Potentially Exposed Population	Selected for Evaluation?	Reason for Selection or Exclusion
Current Land Use				
Surface Soil	Dermal contact and ingestion of soil; inhalation of fugitive dust.	Resident (child and adult) Occupational worker (adult) Trespasser (child and adult) Site worker (adult)	No No Yes Yes	No humans currently reside at the site. There are no individuals working in close proximity to the site on a daily basis. Children and adults may contact surface soil while trespassing. Under current land use, site worker exposure to surface soils is possible because of contact with the area under current land use.
Subsurface Soil	Dermal contact and ingestion of soil; inhalation of fugitive dust.	Excavation worker (adult)	No	No earthwork is currently being conducted at the site.
Rowell Creek: Sediment and Surface Water	Dermal contact and ingestion of sediment and surface water while wading.	Resident (child and adult) Trespasser (child and adult)	No Yes	No humans currently reside at the site associated with Rowell Creek. Although it is unlikely, adults or children may wade in sediment and surface water while trespassing in water associated with the site. The resident is evaluated under future land use for wading in surface water and sediment.
Groundwater: Surficial and Intermediate Aquifers	Ingestion of groundwater as drinking water; inhalation of volatiles while showering.	Resident (adult)	No	There are no current exposures to groundwater.

Table 4-12 (Continued)
Summary of Potential Exposure Pathways

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Medium of Exposure	Route of Exposure	Potentially Exposed Population	Selected for Evaluation?	Reason for Selection or Exclusion
Future Land Use				
Surface Soil	Dermal contact and ingestion of soil; inhalation of fugitive dust.	Resident (child and adult) Trespasser (child and adult) Occupational worker (adult) Site worker (adult) Excavation worker	Yes Yes Yes Yes Yes	If the site is developed for residential use, residents could potentially contact chemicals in surface soil. The land could potentially be developed for industrial purposes and an occupational worker could be exposed to chemicals in the surface soil. Excavation workers could be exposed if the site was developed for industrial or residential use. Because there is no reason to believe that the exposure would be significantly altered between current and future land use for the transient and site worker exposures, these scenarios are only reported under current land use.
Subsurface Soil	Dermal contact and ingestion of soil; inhalation of fugitive dust.	Excavation worker (adult)	Yes	Excavation workers could be exposed if the site was developed for industrial or residential use.
Rowell Creek: Sediment and Surface Water	Dermal contact and ingestion of sediment and surface water while wading.	Resident (child and adult) Trespasser (child and adult)	Yes Yes	Transients or residents may wade in Rowell Creek while trespassing or living on or near the site. The transient exposure scenario is only reported under current land use.
Groundwater	Ingestion of groundwater as drinking water; inhalation of volatiles while showering.	Resident (adult)	Yes	If the site is developed for residential use, residents could potentially contact chemicals in groundwater.

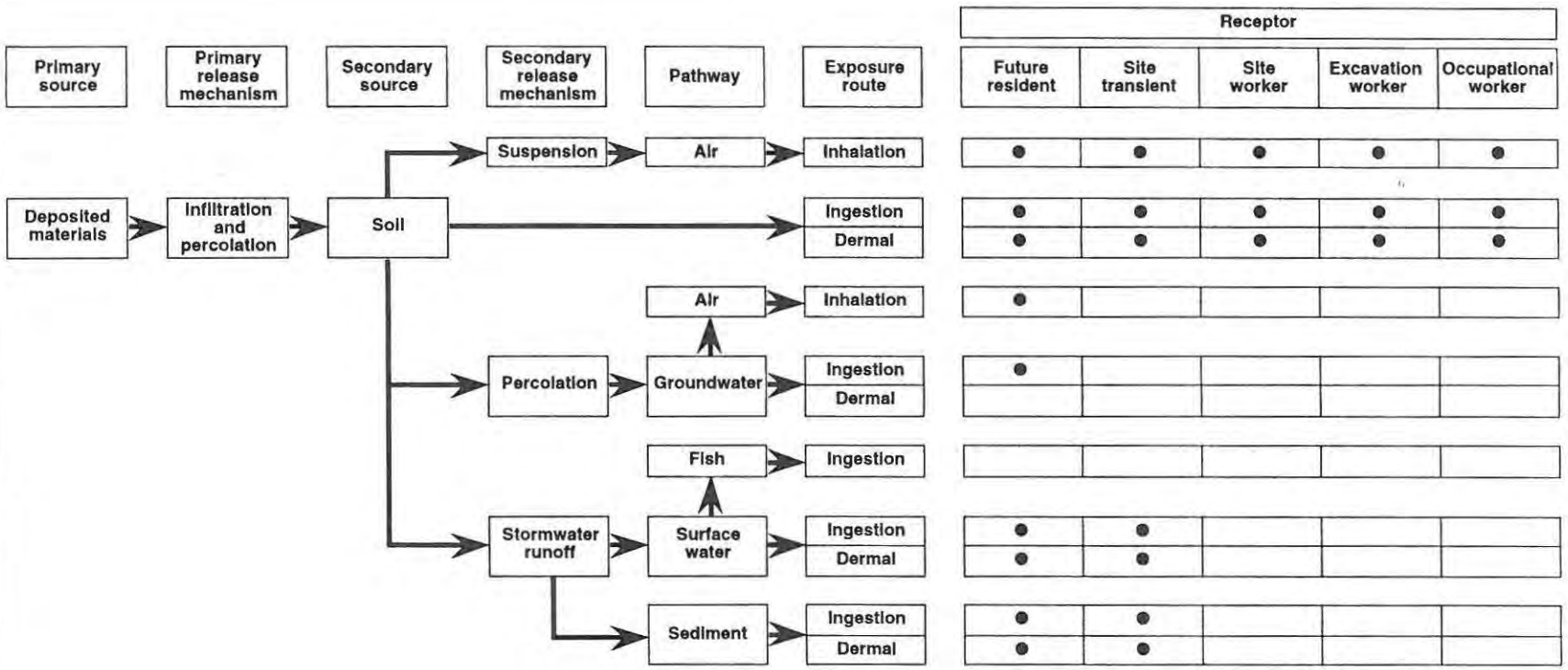


FIGURE 4-1

COMPLETE EXPOSURE PATHWAYS FOR HUMAN RECEPTORS

BASELINE RISK ASSESSMENT, OPERABLE UNIT 8

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

8500-12 CF OU8 BRA 950419WEM

Table 4-13
Exposure Point Concentrations for Human Health Chemicals of Potential Concern (HHCPCs), Site 3 Surface Soil

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Maximum Detected Concentra	95% UCL[2]	Exposure Point Concentration[3]
Volatile Organic Compounds (μg/kg)				
No analytes selected as HHCPCs				
Semivolatile Organic Compounds (μg/kg)				
Benzo(a)anthracene	2/24	620	NC	620
Benzo(a)pyrene	4/24	440	273	273
Benzo(b)fluoranthene	4/24	870	287	287
Benzo(k)fluoranthene	2/24	280	NC	280
Chrysene	4/24	700	290	290
Dibenz(a,h)anthracene	2/24	100	247	100
Indeno(1,2,3-cd)pyrene	3/24	330	NC	330
Pesticides and PCBs (μg/kg)				
No analytes selected as HHCPCs				
Inorganic Analytes (mg/kg)				
Manganese	23/24	41.5	14.6	14.6
Total Recoverable Petroleum Hydrocarbons (TRPH) (mg/kg)				
TRPH	7/24	370	91.8	91.8

[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] Ninety-five percent UCL calculated on the arithmetic mean of all samples using 1/2 the contract-required quantitation limit/contract-required detection limit for samples in which the analyte was not detected.
[3] The exposure point concentration is the lesser of the maximum concentration detected onsite or the 95% UCL. In cases where the analyte was detected in less than four samples, the maximum detected concentration is used as the exposure point concentration.

Notes: % = percent.
UCL = upper confidence limit.
μg/kg = micrograms per kilogram.
NC = not calculated.
PCB = polychlorinated biphenyl.
mg/kg = milligrams per kilogram.

Table 4-14
Exposure Point Concentrations for Human Health Chemicals of Potential Concern (HHCPCs), Site 3 Subsurface Soil

Human Health Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Maximum Detected Concentration	95% UCL[2]	Exposure Point Concentration[3]
Volatile Organic Compounds (μg/kg)				
No analytes selected as HHCPCs				
Semivolatile Organic Compounds (μg/kg)				
No analytes selected as HHCPCs				
Pesticides and PCBs (μg/kg)				
No analytes selected as HHCPCs				
Inorganic Analytes (mg/kg)				
Beryllium	3/37	0.32	NC	0.32
Manganese	32/37	66.3	7.3	7.3
Total Recoverable Petroleum Hydrocarbons (TRPH) (mg/kg)				
TRPH	7/21	1,600	215	215

[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] Ninety-five percent UCL calculated on the arithmetic mean of all samples using 1/2 the contract-required quantitation limit/contract-required detection limit for samples in which the analyte was not detected.
[3] The exposure point concentration is the lesser of the maximum concentration detected onsite or the 95% UCL. In cases where the analyte was detected in less than four samples, the maximum detected concentration is used as the exposure point concentration.

Notes: % = percent.
UCL = upper confidence limit.
μg/kg = micrograms per kilogram.
PCB = polychlorinated biphenyl.
mg/kg = milligrams per kilogram.
NC = not calculated.

Table 4-15
Exposure Point Concentrations for Human Health Chemicals of Potential Concern, Site 3 Unfiltered Groundwater from Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Maximum Detected Concentration	95% UCL[2]	Exposure Point Concentration[3]
Volatile Organic Compounds (μg/ℓ)				
1,1,1-Trichloroethane	4/14	860	36,316	860
1,1-Dichloroethane	8/14	590	48,533	590
1,1-Dichloroethene	8/14	350	14,186	350
1,2-Dichloroethene (total)	4/14	1,900	10,301	1,900
Benzene	1/14	26	NC	26
Trichloroethene	6/14	1,700	228,662	1,700
Semivolatile Organic Compounds (μg/ℓ)				
1,2-Dichlorobenzene	4/14	9,800	62,318	9,800
1,3-Dichlorobenzene	4/14	240	48.4	48.4
1,4-Dichlorobenzene	4/14	1,300	567	567
2-Methylnaphthalene	7/14	200	633	200
4-Methylphenol	4/14	61	365	61
Benzo(b)fluoranthene	1/14	3	NC	3
Naphthalene	8/14	450	1,882	450
bis(2-Ethylhexyl)phthalate	3/14	5	NC	5
Pesticides and PCBs (μg/ℓ)				
Aroclor-1248	2/14	0.79	NC	0.79
Inorganic Analytes (μg/ℓ)				
Aluminum	9/14	47,400	28,854	28,854
Arsenic	6/14	24.7	9.9	9.9
Chromium	1/14	36.6	NC	36.6
Iron	12/14	36,500	293,608	36,500
Manganese	14/14	170	122	122
Vanadium	1/14	26.5	NC	26.5
Total Recoverable Petroleum Hydrocarbons (TRPH) (μg/ℓ)				
TRPH	5/14	2,100	1,500	1,500

See notes on following page.

Table 4-15 (Continued)
Exposure Point Concentrations for Human Health Chemicals of Potential Concern, Site 3 Unfiltered Groundwater from Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, 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] Ninety-five percent UCL calculated on the arithmetic mean of all samples using 1/2 the contract-required quantitation limit/contract-required detection limit) for samples in which the analyte was not detected.
[3] The exposure point concentration is the lesser of the maximum concentration detected onsite or the 95% UCL. In cases where the analyte was detected in four or less samples, the maximum detected concentration is used as the exposure point concentration.

Notes: % = percent.
UCL = upper confidence limit.
$\mu g/\ell$ = micrograms per liter.
NC = not calculated.
PCB = polychlorinated biphenyl.

Table 4-16
Exposure Point Concentrations for Human Health Chemicals of Potential Concern (HHCPCs), Site 3 Unfiltered Groundwater from Intermediate Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Maximum Detected Concentration	95% UCL[2]	Exposure Point Concentration[3]
Volatile Organic Compounds (μg/ℓ)				
No analytes detected				
Semivolatile Organic Compounds (μg/ℓ)				
No analytes selected as HHCPCs				
Pesticides and PCBs (μg/ℓ)				
No analytes detected				
Inorganic Analytes (μg/ℓ)				
Arsenic	1/3	1.2	NC	1.2
Manganese	3/3	37.9	NC	37.9

[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] Ninety-five percent UCL calculated on the arithmetic mean of all samples using 1/2 the (contract-required quantitation limit/contract-required detection limit) for samples in which the analyte was not detected.
[3] The exposure point concentration is the lesser of the maximum concentration detected onsite or the 95% UCL. In cases where the analyte was detected in four or less samples, the maximum detected concentration is used as the exposure point concentration.

Notes: % = percent.
UCL = upper confidence limit.
μg/ℓ = micrograms per liter.
PCB = polychlorinated biphenyl.
NC = not calculated.

Table 4-17
Exposure Point Concentrations for Human Health Chemicals of Potential Concern, Site 3 Surface Water

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Maximum Detected Concentration	95% UCL[2]	Exposure Point Concentration[3]
Volatile Organic Compounds (μg/ℓ)				
Dibromochloromethane	1/2	[2]1.3	NC	1.3
Bromodichloromethane	2/2	[2]3.5	NC	3.5
Chloroform	2/2	[2]5	NC	5
Semivolatile Organic Compounds (μg/ℓ)				
No analytes detected				
Pesticides and PCBs (μg/ℓ)				
No analytes detected				
Inorganic Analytes (μg/ℓ)				
Antimony	1/2	[2]16.2	NC	16.2

[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] Value is the average of a sample and its duplicate. For nondetected values, 1/2 the contract-required quantitation limit or contract-required detection limit (CRQL/CRDL) is used as a surrogate.
[3] Ninety-five percent UCL calculated on the arithmetic mean of all samples using 1/2 the CRQL/CRDL for samples in which the analyte was not detected.
[4] The exposure point concentration is the lesser of the maximum concentration detected onsite or the 95% UCL. In cases where the analyte was detected in four or less samples, the maximum detected concentration is used as the exposure point concentration.

Notes: % = percent.
UCL = upper confidence limit.
μg/ℓ = micrograms per liter.
NC = not calculated.
PCB = polychlorinated biphenyl.

Table 4-18
Exposure Point Concentrations for Human Health Chemicals of Potential Concern (HHCPCs), Site 3 Sediment

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Maximum Detected Concentration	95% UCL[3]	Exposure Point Concentration[4]
Volatile Organic Compounds (μg/kg)				
No analytes selected as HHCPCs				
Semivolatile Organic Compounds (μg/kg)				
No analytes selected as HHCPCs				
Pesticides and PCBs (μg/kg)				
Aroclor-1254	1/2	180	NC	180
Endrin ketone	1/2	[2]1.5	NC	1.5
Inorganic Analytes (mg/kg)				
No analytes selected as HHCPCs				

[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] Value is the average of a sample and its duplicate. For nondetected values, 1/2 the contract-required quantitation limit or contract-required detection limit (CRQL/CRDL) is used as a surrogate.
[3] Ninety-five percent UCL calculated on the arithmetic mean of all samples using 1/2 the CRQL/CRDL for samples in which the analyte was not detected.
[4] The exposure point concentration is the lesser of the maximum concentration detected onsite or the 95% UCL. In cases where the analyte was detected in three or less samples, the maximum detected concentration is used as the exposure point concentration.

Notes: % = percent.
UCL = upper confidence limit.
μg/kg = micrograms per kilogram.
PCB = polychlorinated biphenyl.
NC = not calculated.
mg/kg = milligrams per kilogram.

4.2.2.3 **Groundwater** As discussed in Paragraph 2.6.2.1, potable water for NAS Cecil Field is obtained from the Floridan aquifer system. Households in the Jacksonville area obtain water from the surficial and intermediate aquifers as well as the Floridan aquifer system (Subsection 2.6.2). It is possible that some households would use the water as a potable water supply.

Current Land Use. Currently, neither the surficial nor the intermediate aquifer is used as a potable or non-potable water source at Site 3 or within 4,500 feet of Site 3.

Future Land Use. The domestic use of the surficial or intermediate aquifer (adult ingestion and inhalation of volatiles while showering) as part of a residential exposure scenario would be considered appropriate at Site 3 if the current land use was changed to residential use in the future. The surficial and intermediate aquifers are evaluated separately in the risk characterization because they are geologically distinct and exhibit different organic and inorganic contamination (Paragraph 4.2.4.3).

EPC. The EPCs for HHCPCs for the surficial aquifer at Site 3 are presented in Table 4-15. The EPCs for HHCPCs for the intermediate aquifer at Site 3 are presented in Table 4-16.

4.2.2.4 **Surface Water and Sediment** Rowell Creek is classified by the FDEP as a Class III water and, as such, is designated for recreation, propagation, and management of fish and wildlife (Florida Legislature, 1995).

Current Land Use. Rowell Creek near Site 3 is not currently being used for recreation by Navy personnel or civilians. Transients are not known to come into contact with Rowell Creek adjacent to Site 3; however, it is possible transients could wade in the creek if they were trespassing in the area. A transient wading scenario using exposure parameters commonly employed in swimming exposures (except surface area) has been used for the surface water and sediment at Site 3. The trespasser evaluation is only presented under current land use in the risk characterization (Paragraphs 4.2.4.4 and 4.2.4.5).

Future Land Use. Because Rowell Creek is a Class III recreational body of water, exposures to surface water and sediment via ingestion and dermal contact are evaluated using exposure parameters for a child and adult resident in a future wading scenario. A resident wading scenario using exposure parameters commonly employed in swimming exposures (except surface area) has been used for the surface water and sediment in Rowell Creek.

EPCs. The EPCs for HHCPCs for Site 3 surface water and sediment at Site 16 are presented in Tables 4-17 and 4-18.

4.2.3 Toxicity Assessment The purpose of the toxicity assessment is to identify the adverse effects that are associated with exposure to each analyte and to identify the relationship between level of exposure and severity or likelihood of adverse effects. The toxicity assessment methods are described in Subsection 4.1.4. Brief toxicity summaries for the HHCPCs appear in Appendix O. Dose-response information for HHCPCs is identified in Appendix P. This information was used to estimate the ELCR for carcinogens and the HI for all HHCPCs in the risk characterization (Subsection 4.2.4). Dose-response values current as of November 1994 for IRIS and March 1994 for HEAST have been used in this HHRA.

Uncertainties associated with chemical-specific toxicity values are discussed in Paragraph 4.2.5.3.

4.2.4 **Risk Characterization** Quantitative estimates of both carcinogenic and noncarcinogenic risks were calculated for each HHCPC and each complete exposure pathway selected for evaluation in the exposure assessment, as described in Subsection 4.1.5. Risk estimates for potential exposures to surface soil, subsurface soil, surface water, sediment, and groundwater are discussed in Paragraphs 4.2.4.1. through 4.2.4.5. A summary of risk estimates for current and future scenarios is provided in Tables 4-19 and 4-20, respectively. Risk calculation spreadsheets are presented in Appendix N.

4.2.4.1 **Surface Soil** The risk characterization results are shown in spreadsheets N-1 through N-14.

For both current and future land use, the cancer risk is either below or within the USEPA acceptable risk range (10^{-4} to 10^{-6}) for all scenarios and is above Florida's risk assessment criterion of 10^{-6}. For current land use, the cancer risk associated with surface soil ingestion, dermal contact, and fugitive dust inhalation is $4x10^{-7}$ for the trespasser (child and adult). The cancer risk for the site worker is $1x10^{-7}$. For potential future land use, the resident (adult and child) cancer risk is $7x10^{-6}$. This risk is well within the USEPA acceptable risk range but above Florida's risk assessment criterion of 10^{-6}. The cancer risk for the occupational worker is $9x10^{-7}$, for the excavation worker, it is $2x10^{-8}$.

The HIs associated with surface soil ingestion, dermal contact, and inhalation of fugitive dust for current land use are all below 1 (child and adult trespasser and adult site worker). For potential future land use, HIs for the adult and child resident, the occupational worker, and the excavation worker are also below 1.

4.2.4.2 **Subsurface Soil** The risk characterization results for subsurface soil are shown in spreadsheets N-15 and N-16.

Exposure to subsurface soil is not occurring under current land use. For potential future land use, the cancer risk associated with subsurface soil ingestion, dermal contact, and fugitive dust inhalation is $2x10^{-8}$ for the excavation worker, which is below the USEPA acceptable risk range of 10^{-6} to 10^{-4}. The HI associated with the ingestion, dermal contact, and fugitive dust inhalation of Site 3 subsurface soil by an excavation worker is 0.0003, which is also below a level of concern.

4.2.4.3 **Groundwater** The risk characterization results for unfiltered groundwater are shown in spreadsheets N-17 through N-20. The surficial aquifer results are shown in spreadsheets N-17 through N-19. The intermediate aquifer results are shown in spreadsheet N-20.

Surficial Aquifer There is no exposure to the surficial aquifer under current land use. The cancer risk associated with potential future domestic use of groundwater (ingestion and inhalation exposure to VOCs during showering) is $3x10^{-3}$ for the future adult resident. This cancer risk is higher than the USEPA

Table 4-19
Risk Summary for Current Scenarios at Site 3

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Medium and Receptor		Exposure Route	HI	ELCR
Current Land Use				
Surface soil				
	Adult trespasser	Incidental ingestion	0.00001	9×10^{-8}
		Dermal contact	0.00001	6×10^{-8}
		Inhalation of particulates	0.00006	ND
		Total adult trespasser:	**0.00008**	**2×10^{-7}**
	Child trespasser	Incidental ingestion	0.00002	1×10^{-7}
		Dermal contact	0.00002	5×10^{-8}
		Inhalation of particulates	0.0001	ND
		Total child trespasser:	**0.0001**	**2×10^{-7}**
		Total trespasser:	**NC**	**4×10^{-7}**
	Adult site worker	Incidental ingestion	0.000005	6×10^{-8}
		Dermal contact	0.000007	4×10^{-8}
		Inhalation of particulates	0.00006	ND
		Total adult site worker:	**0.00007**	**1×10^{-7}**
Surface water				
	Adult trespasser (wader)	Incidental ingestion	0.009	2×10^{-8}
		Dermal contact	0.1	4×10^{-8}
		Total adult trespasser:	**0.1**	**6×10^{-8}**
	Child trespasser (wader)	Incidental ingestion	0.01	2×10^{-8}
		Dermal contact	0.2	3×10^{-8}
		Total child trespasser:	**0.2**	**5×10^{-8}**
		Total trespasser:	**NC**	**1×10^{-7}**
Sediment				
	Adult trespasser (wader)	Incidental ingestion	0.002	7×10^{-8}
		Dermal contact	0.006	3×10^{-7}
		Total adult trespasser:	**0.008**	**3×10^{-8}**
	Child trespasser (wader)	Incidental ingestion	0.002	5×10^{-8}
		Dermal contact	0.008	2×10^{-9}
		Total child trespasser:	**0.01**	**2×10^{-7}**
		Total trespasser:	**NC**	**5×10^{-7}**

Notes: HI = hazard index.
ELCR = excess lifetime cancer risk.
ND = no toxicity values available for calculation.
NC = not calculated because child and adult hazard indices are not additive.

Table 4-20
Risk Summary for Future Scenarios at Site 3

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Medium and Receptor	Exposure Route	HI	ELCR
Future Land Use			
Surface soil			
Adult resident	Incidental ingestion	0.0001	2×10^{-6}
	Dermal contact	0.0002	1×10^{-6}
	Inhalation of particulates	0.004	ND
	Total adult resident:	**0.004**	**3×10^{-6}**
Child resident	Incidental ingestion	0.001	4×10^{-6}
	Dermal contact	0.0003	4×10^{-7}
	Inhalation of particulates	0.02	ND
	Total child resident:	**0.02**	**4×10^{-6}**
	Total resident:	**NC**	**7×10^{-6}**
Adult occupational worker	Incidental ingestion	0.00005	6×10^{-7}
	Dermal contact	0.00006	3×10^{-7}
	Inhalation of particulates	0.001	ND
	Total adult occupational worker:	**0.001**	**9×10^{-7}**
Adult excavation worker	Incidental ingestion	0.00006	2×10^{-8}
	Dermal contact	0.00002	3×10^{-9}
	Inhalation of particles	0.0005	ND
	Total adult excavation worker:	**0.00056**	**2×10^{-8}**
Subsurface soil			
Adult excavation worker	Incidental ingestion	0.00007	1×10^{-8}
	Dermal contact	0.00005	1×10^{-8}
	Inhalation of particulates	0.0002	2×10^{-11}
	Total adult excavation worker:	**0.0003**	**2×10^{-8}**
Surficial aquifer			
Adult resident	Ingestion of groundwater as drinking water	20	3×10^{-3}
	Inhalation of volatiles while showering	0.08	4×10^{-4}
	Total adult resident:	**20**	**3×10^{-3}**

See notes at end of table.

Table 4-20 (Continued)
Risk Summary for Future Scenarios at Site 3

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Medium and Receptor		Exposure Route	HI	ELCR
Intermediate aquifer				
	Adult resident	Ingestion of groundwater as drinking water	0.3	2×10^{-5}
		Inhalation of volatiles while showering	NV	NV
		Total adult resident:	**0.3**	**2×10^{-5}**
Surface water				
	Adult resident (wader)	Incidental ingestion	0.02	6×10^{-8}
		Dermal contact	0.2	1×10^{-7}
		Total adult resident:	**0.2**	**2×10^{-7}**
	Child resident (wader)	Incidental ingestion	0.1	7×10^{-8}
		Dermal contact	0.4	4×10^{-8}
		Total child resident:	**0.5**	**1×10^{-7}**
		Total resident:	**NC**	**3×10^{-7}**
Sediment				
	Adult resident (wader)	Incidental ingestion	0.004	2×10^{-7}
		Dermal contact	0.01	7×10^{-7}
		Total adult resident:	**0.01**	**9×10^{-7}**
	Child resident (wader)	Incidental ingestion	0.03	4×10^{-7}
		Dermal contact	0.02	3×10^{-7}
		Total child resident:	**0.05**	**7×10^{-7}**
		Total resident:	**NC**	**2×10^{-6}**

Notes: HI = hazard index.
ELCR = excess lifetime cancer risk.
ND = no toxicity values available for calculation.
NC = not calculated because child and adult hazard indices are not additive.
NV = no volatiles were selected as human health chemicals of potential concern.

acceptable cancer risk range. The major chemicals contributing to the ELCR for the resident are 1,1-dichloroethene (ELCR = $3x10^{-3}$), trichloroethene (ELCR = $2x10^{-4}$), 1,4-dichlorobenzene (ELCR = $2x10^{-4}$), and arsenic (ELCR = $2x10^{-4}$).

The HI associated with domestic use of groundwater under potential future land use is 20. This HI is greater than 1, indicating a potential for adverse health effects if such exposures were to occur. Major contributors to this HI are trichloroethene (HQ = 7.8), 1,2-dichloroethene (HQ = 5.8), 1,2-dichlorobenzene (HQ = 3), and 1,1-dichloroethene (HQ = 1.1) (via ingestion).

RGOs for the ELCR and HI associated with residential exposures to surface soil and groundwater are presented in Subsection 4.2.7.

Intermediate Aquifer. There is no exposure to the intermediate aquifer under current land use. The cancer risks associated with potential future domestic use of groundwater (ingestion and inhalation exposure to VOCs during showering) is $2x10^{-5}$ for the future adult resident. This risk is within the USEPA acceptable cancer risk range. The only contaminant contributing cancer risk to the ELCR for the resident is arsenic (adult resident ingestion). Because no VOCs were selected as HHCPCs, risks from the potential inhalation of VOCs while showering were not calculated (Table 4-20).

The HI associated with domestic use of groundwater under potential future land use is 0.3, which is below the level of concern (HI = 1).

4.2.4.4 **Surface Water** The risk characterization results for surface water are shown in spreadsheets N-21 through N-25.

Both cancer and noncancer risks are below levels of concern for both current and future land use. For current land use, the cancer risk associated with surface water ingestion and dermal contact in the part of Rowell Creek associated with Site 3 is $1x10^{-7}$ for the trespasser wader (child and adult). Under future land use, the cancer risk associated with surface water ingestion and dermal contact in Rowell is $3x10^{-7}$ for the resident (child and adult). The HIs associated with surface water ingestion and dermal contact for current and future land use are below 1 (adult and child trespasser and child and adult resident).

4.2.4.5 **Sediment** The risk characterization results for sediment are shown in spreadsheets N-26 through N-29.

Both cancer and noncancer risks are below the levels of concern for both current and future land use. For current land use, the cancer risk associated with sediment ingestion and dermal contact in the part of Rowell Creek associated with Site 3 is $5x10^{-7}$ for the trespasser wader (child and adult). Under future land use, the cancer risk associated with surface water ingestion and dermal contact in Rowell Creek is $2x10^{-6}$ for the resident. This risk is well within the USEPA's acceptable risk range but above Florida's action level. The HIs associated with sediment ingestion and dermal contact for current and future land use are below 1 (adult and child trespasser and child and adult resident).

4.2.5 Uncertainty Analysis General uncertainties associated with the collection, analysis, and evaluation of data, exposure assessment, toxicity assessment, and the risk estimation process were discussed in Subsection 4.1.6.

Site-specific uncertainties that are important for the interpretation of the calculated risk estimates at Site 3 are presented below for surface soil, subsurface soil, surface water, sediment, and groundwater.

4.2.5.1 **Data Evaluation** Some uncertainty is associated with the representative nature of the data collected to complete the risk evaluation at Site 3. As noted in the RI (ABB-ES, 1995), data were collected to best represent the current conditions at Site 3 in surface soil, subsurface soil, surface water, sediment, and groundwater. The data were not collected randomly, but were biased to characterize the contamination in media associated with historic waste disposal activities at Site 3. The data collected at Site 3 are believed to be representative of the current media conditions (ABB-ES, 1995).

Uncertainty is associated with the representative nature of the data collected to complete the risk evaluation for groundwater. However, high turbidity was associated with the unfiltered samples at the following locations: (CF3MW3S, CF3MW4S, CF3MW6S, CF3MW7D, CF3MW7S, CF3MW13S, CF314I, CF3MW15D, CF3MW18S, CF3MW19D, CF3MW28S, CF3MW29D, CF3MW31S, and CF3MW32D). Some of the unfiltered data used in the HHRA are, therefore, expected to contain some high inorganic concentrations as a result are of suspended solids from the specific sample locations. Thus, the results may be biased high and cause overestimation of risk to inorganics, but not enough to change the overall conclusions, which are driven by organic chemicals.

Surficial Aquifer In the HHRA, the monitoring wells in the surficial aquifer were selected for evaluation on the basis of the presence or absence of an organic plume (USEPA, 1991e). A plume was associated with Site 3 in the surficial aquifer system (ABB-ES, 1995). Because a plume was identified, only those monitoring wells in the organic plume were used to evaluate groundwater in the HHRA. This method of selecting monitoring wells for evaluation at a site may underestimate the risk associated with inorganic chemicals but did not in the case of Site 3. The inorganic concentrations in samples from wells located outside the plume were compared to the concentrations of inorganics in samples from in the wells located in the plume. Samples from wells located in the plume had higher concentrations of inorganic contaminant than samples from wells located outside the plume.

Tentatively Identified Compounds. As their designation implies, the presence of TICs has not been established with a degree of certainty great enough to warrant their inclusion in the HHRA for any medium at Site 3. The relative number of TICs is low in comparison to the chemicals detected using the TCL and TAL methods. Further, there is little toxicity data available to evaluate the potential health effects of these analytes even if they were considered for quantitative evaluation. The inability to evaluate TICs in the HHRA may result in a potential underestimation of the health risks associated with the use of media at Site 3 under current and future land uses.

Laboratory Dichlorodiphenyltrichloroethane (DDT) Contamination. The surface soil, subsurface soil, surface water, and sediment samples from OU 8 were analyzed after the laboratory ran a highly contaminated sample from another client. All samples had to be reanalyzed. The sample contaminated the laboratory's gel-permeation cleanup (GPC) unit and some of their glassware. The GPC unit was replaced; however, residue on the glassware continued to be a random problem. These problems involved sporadic detections of DDT, aldrin, dieldrin,

and methoxychlor in the reanalyzed samples. The following steps were taken during the data evaluation step of the risk assessment to determine whether to use the original analyses or the reanalyses.

For DDT, dieldrin, aldrin, and methoxychlor positive detections, the selection of the official sample concentration was based on the lower of the original analysis or the reanalysis. This step could potentially underestimate the risk associated with these analytes. It is possible that one of these analytes was actually detected at a high concentration but is rejected because of the laboratory's contamination.

For other pesticides and PCBs that randomly appeared in either the original analysis or the reanalyses, the higher of the two values was used. This procedure probably overestimates the risk because these analytes are probably artifacts of the laboratory's contamination problem.

4.2.5.2 Selection of CPCs Although USEPA criteria have been used in selecting HHCPCs at Site 3, there are uncertainties in the general selection process based on the use of a risk-based screening and comparison to inorganic concentrations at reference locations (Paragraph 4.1.6.2).

One concern of using low frequency of detection as a screening tool is that "hot spots" (localized high concentrations) may not be evaluated. However, in only one instance was a frequency of detection less than 5 percent the basis for elimination of an analyte from the list of HHCPCs. Endrin ketone, detected in only one out of 24 samples, was eliminated as an HHCPC in surface soil. The only detected concentration of endrin ketone was 4 $\mu g/kg$. Although there are no Region III RBCs for endrin ketone, the residential soil RBC for endrin is 2,300 $\mu g/kg$ (adjusted for an HQ of 0.1). The residential soil Florida soil cleanup goal is 23,000 $\mu g/kg$. Therefore, this concentration is not representative of a "hot spot" in a risk context.

Under normal circumstances, some analytes would be excluded from the intermediate aquifer assessment by a comparison to upgradient inorganic concentrations. Background (upgradient) was not considered during the selection of HHCPCs for the intermediate aquifer. The HHCPC selection for the intermediate aquifer was, therefore, conservative and may have resulted in overestimating site-related risks.

4.2.5.3 Exposure Assessment Residential land use was the assumed potential future land use scenario according to USEPA Region IV guidance (USEPA, 1991e). It is likely, however, that the area near Site 3 will remain idle or become industrial after base closure. The likelihood of a future residential use is highly uncertain.

Surface Soil. The exposure scenarios and exposure parameters selected for the evaluation of Site 3 surface soil (Appendix M, Tables M-1 and M-5) are considered conservative because they address realistic current exposures and a reasonable maximal exposure for future land use (future resident). Based on the selection of these exposure scenarios and the associated exposure parameters, the calculated exposures are sufficiently conservative to state that the exposure estimates associated with surface soil at Site 3 are likely overestimates for current or future land use at Site 3.

Surface Water. The exposure scenarios and exposure parameters selected for the evaluation of Site 3 surface water are presented in Appendix M, Tables M-8 and M-9.

Wading Scenario. There is high confidence that swimming is not a realistic recurring pathway based on the depth of Rowell Creek (1 to 2 feet). The evaluation of a wading scenario (for exposure to both surface water and sediment) has been completed to provide a realistic pathway for current and future land use. However, the wading scenario was completed in a manner that probably overestimates risk by selecting exposure parameters from guidance for swimming exposures (with the exception of the skin surface area exposed).

The exposure frequency used in the current land use wading scenario was 45 days per year as recommended by USEPA Region IV for swimming exposure (USEPA, 1991e). This frequency reflects the number of days that a transient might use the recreational waters and is likely an overestimate for a trespasser exposure. The exposure frequency used in the future land use wading scenario is 100 days per year, and exceeds the USEPA suggested frequency for swimming.

The ingestion rate (0.13 liter per day) reflects conservative assumptions used in swimming scenarios. The ingestion rate is the product of an exposure time of 2.6 hours per day and 50 milliliter per hour (USEPA, 1989b) surface water consumption value. The dermal surface area exposed to surface water while wading is age-adjusted in accordance with USEPA guidance (1992a), and is limited to skin surfaces that are commonly exposed during wading (e.g., hands, feet, and legs) for children and adults. This is the greatest deviation from normal swimming scenario exposure parameters.

Sediment. The exposure scenarios and exposure parameters selected for the evaluation of Site 3 sediment are presented in Appendix M, Tables M-6 and M-7.

Wading Scenario. The evaluation of a wading scenario (for both exposure to surface water and sediment) has been completed to provide a realistic pathway, but it has been completed in a conservative manner as discussed under surface water.

The exposure parameters used in the wading scenario were primarily selected from guidance on swimming exposures as discussed under surface water. For consumption of sediment by a child, it was assumed that a child would consume either 100 or 200 mg/day (depending on the age) of sediment during each exposure (USEPA, 1991d). This estimate of the daily inadvertent sediment ingestion is an assumption that the sediment intake rate is equal to the daily soil ingestion rate. There is actually very little data available concerning actual sediment ingestion rates in children and this assumption is probably an overestimate for a wading exposure.

4.2.5.4 Toxicity Assessment This section addresses chemical-specific uncertainties associated with the evaluation of risk in this assessment. Site- and media-specific applications of these uncertainties are addressed below for arsenic, lead, manganese, and TRPH under each media as appropriate. The lack of inhalation toxicity values is also discussed.

Surface and Subsurface Soil.

Lead Currently, there are no suitable dose-response values for assessing the risks associated with exposure to lead in soil. The USEPA Superfund program has issued a directive that sets soil lead screening levels at 400 to 1,000 mg/kg (USEPA, 1994h). Risk from exposure to lead was not quantitatively evaluated because concentrations in surface and subsurface soil at Site 3 are below 400 mg/kg.

TRPH Currently, there are no suitable dose-response values for assessing the risks associated with exposure to TRPH in soil. Risk from exposure to TRPH is not quantitatively evaluated in the risk assessment. This leads to an underestimation of risk from exposure to soil.

Surficial and Intermediate Aquifer.

Lead Currently, there are no suitable dose-response values for assessing the risks associated with exposure to lead in groundwater. The USEPA Office of Water has issued an action level of 0.015 milligrams per liter (mg/ℓ) for groundwater in the May 1994 Drinking Water Regulations and Health Advisories (USEPA, 1994b). Risk from exposure to lead is not quantitatively evaluated because concentrations in the surficial and intermediate aquifer are both below 0.015 mg/ℓ. This action level is not solely health based, but is regarded as an appropriate measure of comparison.

TRPH Currently, there are no suitable dose-response values for assessing the risks associated with exposure to TRPH in groundwater. Risk from exposure to TRPH is not quantitatively evaluated in the risk assessment. This leads to an underestimation of risk from exposure to groundwater.

Surficial Aquifer.

Arsenic The arsenic CSF is a source of uncertainty in the HHRA for the surficial aquifer because concentrations of arsenic that tend to be present in the regional area surrounding NAS Cecil Field are high enough to consistently cause arsenic to be a significant contributor to cancer risks. There are two CSFs associated with ingested inorganic arsenic, an unmodified CSF ($[1.5\ mg/kg/day]^{-1}$) and a modified CSF ($[0.15\ mg/kg/day]^{-1}$). Either CSF may be used to evaluate cancer risk associated with arsenic. The more conservative approach has been used in this document, but it may provide an overestimate of the risk associated with ingested arsenic. The use of the modified CSF ($[0.15\ mg/kg/day]^{-1}$) would have resulted in lower calculated risks.

Lack of Inhalation Toxicity Values. In some cases, inhalation RfDs and CSFs are not available for HHCPCs being evaluated for inhalation exposures (fugitive dust and volatiles while showering). For example, inhalation CSFs are not currently available for many PAHs, some of which have been implicated in causing cancer and other toxic effects via the inhalation route. Risks associated with inhalation exposures for those compounds cannot be quantified and are, therefore, underestimated. However, exposures associated with inhalation are often lower than the corresponding ingestion and dermal exposures. The magnitude of underestimation of risk because of the lack of inhalation toxicity values is, therefore, minor.

4.2.5.5 **Risk Characterization** A mixture of analytes is present in each medium evaluated. The USEPA's *Guidelines for the Health Risk Assessment of Chemical Mixtures* (USEPA, 1986a) states that if sufficient data are not available on the effects of the chemical mixture of concern, or a reasonably similar mixture, additivity of effects for constituents of the mixture should be assumed (Paragraph 4.1.6.6). In calculating HI values in this HHRA, additivity was assumed, but in some cases the analytes in a mixture have significantly different toxic mechanisms of action and affect different organs. In these cases, the overall HI likely overestimates noncancer risks.

4.2.6 Comparison to Available Criteria Available criteria and guidance for groundwater (USEPA, 1994b; FDEP, 1994), surface soil (FDEP, 1995a; 1995b), and subsurface soil (FDEP, 1995a; 1995b) were considered in the HHRA for Site 3. The maximum detected concentrations for each chemical detected in the Site 3 surficial aquifer, intermediate aquifer, surface soil, and subsurface soil were compared to the available criteria (Paragraph 4.1.7.1).

Groundwater. In the surficial aquifer, the maximum detected concentration of 1,1,1-trichloroethane, 1,1-dichloroethene, 1,2-dichloroethene (total), benzene, trichloroethene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 4-methylphenol, benzo(b)fluoranthene, Aroclor-1248, exceeded their respective Federal MCL, or Florida guidance concentrations. Each of these chemicals was retained as an HHCPC for the surficial aquifer because it was detected at a concentration that exceeded background (upgradient) or risk-based screening concentrations.

In the intermediate aquifer, aluminum exceeded the Federal secondary MCL and the Florida secondary standard. However, this chemical was not retained as an HHCPC because it was lower than the associated risk-based screening concentration.

Soil. The concentration of benzo(a)pyrene detected in Site 3 surface soil exceeded the available FDEP guidance concentrations for direct contact and inhalation exposures.

In subsurface soil, the concentrations of chemicals detected in Site 3 subsurface soil did not exceed the FDEP guidance concentration for the general worker. The maximum concentration of trichloroethene exceeds its available FDEP guidance concentration for leaching to groundwater. This comparison was conducted because subsurface soil may be contributing to the contamination in the surficial aquifer.

TRPH. TRPH data were collected in surface and subsurface soil, groundwater, surface water, and sediment at Site 3. TRPH was not detected in surface and sediment samples. The maximum TRPH value for surface soil and subsurface soil exceeded the available Florida guidance value of 50 mg/kg developed for thermally treated soil contaminated with TRPH (Florida Legislation, 1992).

4.2.7 Remedial Goal Options As previously discussed in Subsection 4.1.7, RGOs are calculated for HHCPCs in media with incremental lifetime cancer risks above 1×10^{-4} and/or with a total HI greater than 1. RGOs were calculated for the only residential exposure to the groundwater in the surficial aquifer (ELCR = 3×10^{-3} and HI = 20).

RGOs have been developed for those HHCPCs that contribute a cancer risk of greater than 10^{-6} to the ELCR of 3×10^{-3} for the unfiltered surficial aquifer groundwater. RGOs have also been developed for those HHCPCs that contribute an HQ greater than 0.1 to the HI of 20 for the surficial aquifer. These RGOs are presented in Table 4-21.

4.2.8 Summary The purpose of the HHRA at Site 3 was to characterize the risks associated with the potential exposures to site-related chemicals. Potential health risks were evaluated under current and assumed future land use conditions for a subset of chemicals detected in surface soil, subsurface soil, surface water, sediment, and groundwater (surficial and intermediate aquifers) associated with Site 3. The chemicals were selected because they are the most likely chemicals to pose risks of concern to human receptors.

Current Land Use. All cancer (Figure 4-2) and noncancer risks (Figure 4-3) for current land use are consistent with USEPA Superfund guidelines, established in the NCP, that indicate that acceptable exposure levels are associated with an excess lifetime cancer risk due to exposure to the HHCPCs at a site in the a range of $1\times10^{-6}$to 1×10^{-4} (USEPA, 1990b) or an HI of 1 or less.

Future Land Use. Cancer and noncancer risks in surface soil, subsurface soil, surface water, sediment, and the intermediate aquifer under future residential land use assumptions are consistent with acceptable risks as described by USEPA (USEPA, 1990b). However, residential exposure to surface soil for both the child and adult receptors generated risks above Florida's target cleanup level of 1×10^{-6}

Future use of the surficial aquifer generates risks greater than those The cancer risk estimate for the surficial aquifer under future land use conditions (adult resident) is 3×10^{-3} (Figure 4-4). The major contaminant contributing cancer risk to the ELCR for the resident is 1,1-dichloroethene (ELCR = 3×10^{-3}). The noncancer risk estimate (HI) for the surficial aquifer (adult resident) is 20 (Figure 4-5). Major contributors to this HI are trichloroethene (HQ = 7.8), 1,2-dichloroethene (HQ = 5.8), 1,2-dichlorobenzene (HQ = 3), and 1,1-dichloroethene (HQ = 1.1).

Table 4-21
Remedial Goal Options, Site 3 Unfiltered Groundwater from Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Chemical	Exposure Point Concentration[1] (μg/ℓ)	Range of Detected Concentrations (μg/ℓ)	Total Lifetime Cancer Risk			Total Hazard Index			Florida Primary Standard[2] (μg/ℓ)	Federal MCL[3] (μg/ℓ)
			10^{-4}	10^{-5}	10^{-6}	10	1	0.1		
Volatile Organic Compounds										
1,1,1-Trichloroethane	860	96 to 860	NA	NA	NA	NC	NC	NC	200	200
1,1-Dichloroethane	590	1 to 590	NA	NA	NA	28,500	2,850	285	--	--
1,1-Dichloroethene	350	2 to 350	12.6	1.26	0.126	3,290	329	32.9	7	7
1,2-Dichloroethene (total)	1,900	9 to 1,900	NA	NA	NA	3,290	329	32.9	[4]70	[4]70
Benzene	26	26	203	20.3	2.03	NC	NC	NC	1	5
Trichloroethene	1,700	9 to 1,700	647	64.7	6.47	2,180	218	21.8	3	5
Semivolatile Organic Compounds										
1,2-Dichlorobenzene	9,800	350 to 9,800	NA	NA	NA	32,850	3,285	328.5	600	600
1,3-Dichlorobenzene	48.4	9 to 240	NA	NA	NA	32,270	3,227	322.7	--	[5]600
1,4-Dichlorobenzene	567	49 to 1,300	354	35.4	3.54	33,350	3,335	3,335	75	75
4-Methylphenol	61	3 to 61	NA	NA	NA	1,825	182.5	18.25	--	--
Benzo(b)fluoranthene	3	3	1.17	0.117	0.0117	NC	NC	NC	--	0.2
Naphthalene	450	0.6 to 450	NA	NA	NA	14,600	1,460	146	--	--
bis(2-Ethylhexyl)phthalate	5	0.6 to 5	608	60.8	6.08	7300	730	73	6	6
Pesticides and PCBs										
Aroclor-1248	0.79	0.6 to 0.79	1.11	0.111	0.0111	NC	NC	NC	0.5	0.5

See notes at end of table.

Table 4-21 (Continued)
Remedial Goal Options, Site 3 Unfiltered Groundwater from Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Chemical	Exposure Point Concentration[1] (μg/ℓ)	Range of Detected Concentrations (μg/ℓ)	Total Lifetime Cancer Risk			Total Hazard Index			Florida Primary Standard[2] (μg/ℓ)	Federal MCL[3] (μg/ℓ)
			10^{-4}	10^{-5}	10^{-6}	10	1	0.1		
Inorganic Analytes										
Aluminum	28,284	37.4 to 47,400	NA	NA	NA	365,240	36,534	3,642.4	--	--
Arsenic	9.9	1.5 to 24.7	4.87	0.487	0.0487	110	11.0	1.1	50	50
Chromium	36.6	36.6	NA	NA	NA	1825	182.5	18.25	100	100
Iron	36,500	44.6 to 36,500	NA	NA	NA	--	--	--	--	--
Manganese	122	4.2 to 170	NA	NA	NA	1,825	182.5	18.25	--	--
Vanadium	26.5	26.5	NA	NA	NA	2,555	255.5	25.55	--	2

[1] Exposure point concentrations are presented in Tables 4-12 through 4-17.
[2] Chapter 62-550, Florida Administrative Code. Safe Drinking Water Act, September 1994.
[3] USEPA, 1994g.
[4] Value is for cis-1,2-dichloroethene.
[5] Value is based on data for 1,2-dichlorobenzene.

Notes: Potential future land use: residential.
Medium: groundwater.
Exposure routes: ingestion of groundwater as drinking water and inhalation of volatiles while showering.

μg/ℓ = micrograms per liter.
MCL = maximum contaminant level.
NA = not applicable.
-- = not available.
NC = not calculated.
PCB = polychlorinated biphenyl.

Cancer Risk Summary, Current Land Use

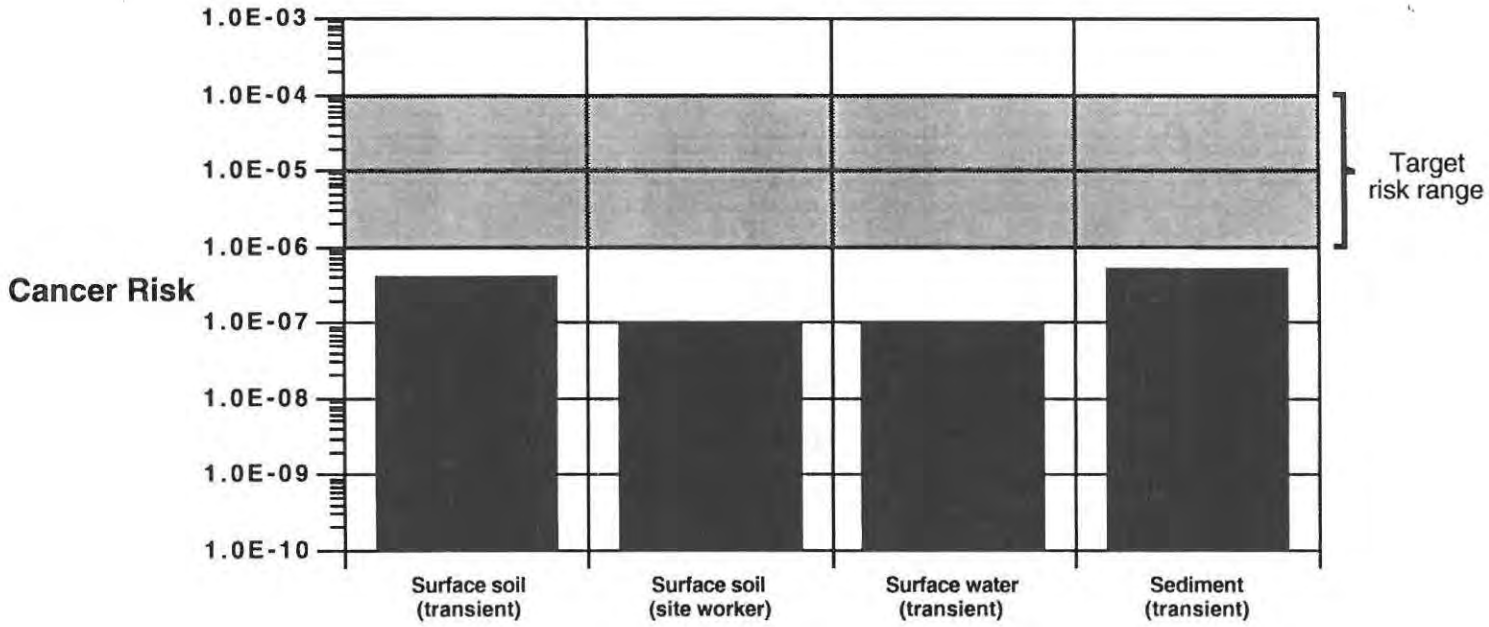


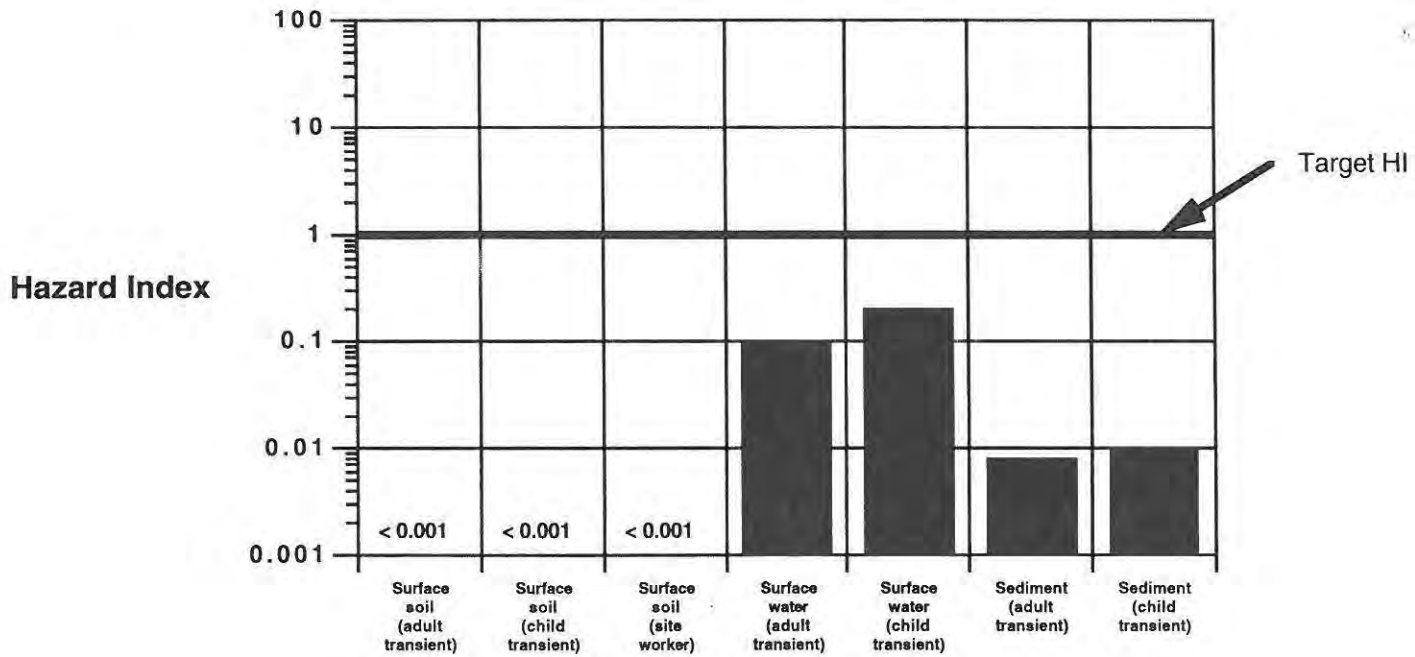
FIGURE 4-2
CANCER RISK SUMMARY,
CURRENT LAND USE

BASELINE RISK ASSESSMENT,
OPERABLE UNIT 8

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

8544-74-TKH FIG 4-2 080497MAW

Hazard Index Summary, Current Land Use



NOTE:
HI = hazard index

FIGURE 4-3
HAZARD INDEX SUMMARY,
CURRENT LAND USE

BASELINE RISK ASSESSMENT,
OPERABLE UNIT 8

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

8544-74-TKH FIG 4-3 080497MAW

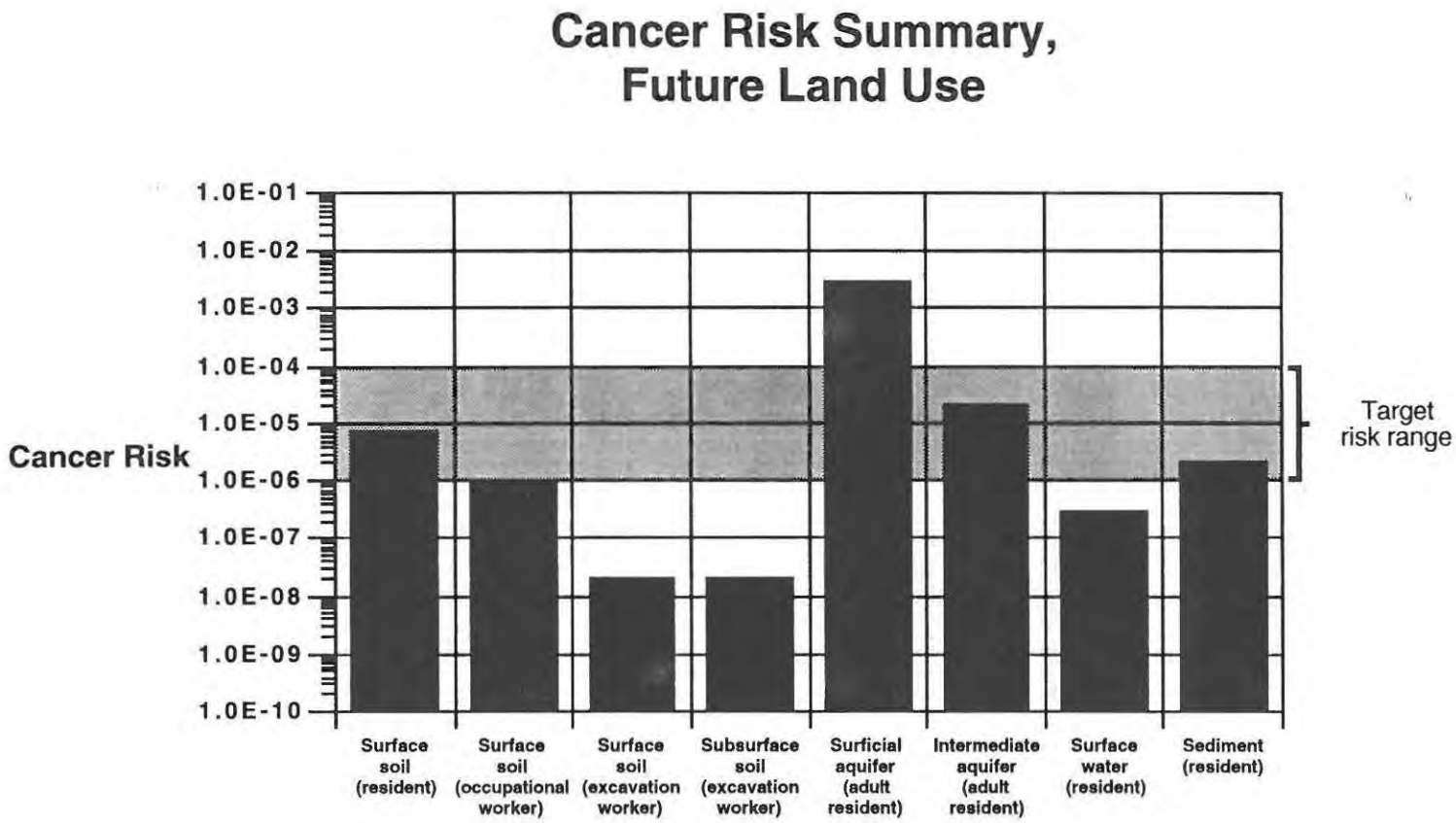


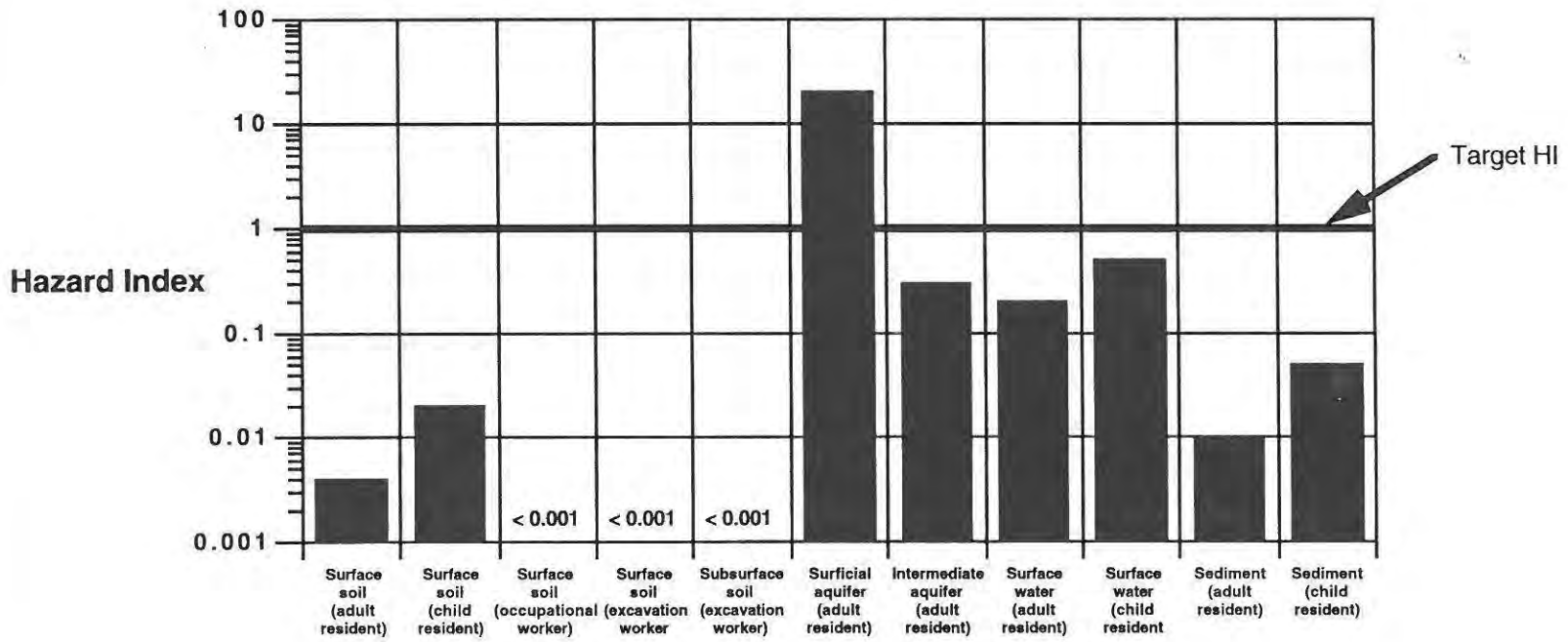
FIGURE 4-4
CANCER RISK SUMMARY,
FUTURE LAND USE

BASELINE RISK ASSESSMENT,
OPERABLE UNIT 8

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

8544-74-TKH FIG 4-4 080497MAW

Hazard Index Summary, Future Land Use



NOTE:
HI = hazard index

FIGURE 4-5
HAZARD INDEX SUMMARY,
FUTURE LAND USE

BASELINE RISK ASSESSMENT,
OPERABLE UNIT 8

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

5.0 ECOLOGICAL RESOURCES

Ecological resources at Site 3 (OU 8) were characterized based on the results of several field investigations and a limited literature review. Wetland and upland terrestrial wildlife habitats and receptors are described in Section 5.1 based on the results of a habitat evaluation field program completed in 1994. The limited aquatic habitats at the OU 8 site are described in Section 5.2. Rare, endangered, and threatened species that may be present at NAS Cecil Field and OU 8 are described in Section 5.3.

Surface soil and groundwater toxicity testing was also completed at the OU 8 sites. Toxicity testing activities are described in Chapter 6.0.

5.1 HABITAT CHARACTERIZATION. The Site 3 study area is located to the southwest of Lake Fretwell, and west of Rowell Creek as it flows south from Lake Fretwell. The study area is characterized by disturbed uplands in the northwesterly and westerly parts, and palustrine wetlands in the eastern portion, adjacent to Rowell Creek.

A wetlands assessment and mapping of upland vegetative communities was completed for Site 3 (Camp, Dresser and McKee [CDM], 1994). Upland communities were classified according to the Florida Natural Areas Inventory (FNAI) system (FNAI, 1990). The wetlands identified to the east and southeast of Site 3 were delineated according to current State of Florida (Florida Legislature, 1990) and Federal guidelines (Environmental Laboratory, 1987). Based on a review of regulations and discussions with the FDEP representatives, it was determined that the U.S. Army Corps of Engineers wetland delineation technique would satisfy the State of Florida guidelines. Wetland communities are described according to U.S. Fish and Wildlife Service (USFWS) (Cowardin and others, 1979) and FNAI classification systems (FNAI, 1990).

Table 5-1 presents the USFWS and corresponding FNAI wetland classifications for NAS Cecil Field, a brief description of the wetland characteristics, and a summary list of representative vegetation in each wetland cover type. A description of typical upland plant communities at NAS Cecil Field is presented in Table 5-2.

The FNAI wetland classification system describes undisturbed vegetative communities. Wetland and upland habitats at Site 3 have been significantly altered in the past due to a variety of anthropogenic disturbances; therefore, the FNAI classification system may not provide comprehensive descriptions of all study area cover types.

Appendix Q includes a list of characteristic plant species observed or expected to occur at Site 3.

5.1.1 Site 3 Vegetative Cover Types Terrestrial areas of Site 3 consist of scrubby flatwoods and disturbed, grassy uplands (Figure 5-1). A palustrine freshwater wetland system associated with the Rowell Creek floodplain is mapped under the USFWS system by Cowardin and others (1979) as a mixture of Palustrine Forested and Scrub-Shrub Broad-Leaved Deciduous classes, with some Palustrine

Table 5-1
Wetland Classification System Characteristics

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

USFWS Classification[1]	Corresponding FNAI Classification[2]	Description	Representative Vegetation (common name)
Palustrine Forested Broad-Leaved Deciduous	Bottomland forest	Closed canopy forest occurring on lowlying flatlands that border streams with distinct banks.	Red maple, sweetgum, slash pine, loblolly pine, sweetbay, cinnamon fern, and wax myrtle.
Palustrine Scrub-Shrub Broad-Leaved Deciduous	Wet prairie	Dense ground cover on low, relatively flat, poorly drained, sandy soil.	Hatpins, wax myrtle, panicums, meadow beauty, sunflower, pitcher plants, St. Johnswort, and sundews.
Palustrine Scrub-Shrub Broad-Leaved Deciduous	Baygall	Densely forested, peat-filled seepage depression, usually saturated (high water table).	Sweet bay, swamp bay, red bay, loblolly bay, dahoon holly, gallberry, wax myrtle, possumhaw, chokeberry, poison ivy, cinnamon fern, chain fern, and grape.
Palustrine Emergent Persistent	Floodplain marsh	Usually flooded with standing water.	Arrowheads, bog buttons, rushes, sedges, dotted smartweed, black willow, sweetbay, royal fern, hat pins, and cattails.

[1] Cowardin and others, 1979.
[2] FNAI, 1990.

Source: Camp, Dresser, and McKee, 1994.

Notes: USFWS = U.S. Fish and Wildlife Service.
FNAI = Florida Natural Areas Inventory.

Table 5-2
Description of Upland Habitats

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Classification	Description	Representative Vegetation (common name)
Scrubby Flatwood	Open canopy of widely scattered pine trees, with a sparse shrub understory; relatively flat, areas of open sand, with some characteristics of Mesic Flatwood.	Slash pine, longleaf pine, loblolly pine, muscadine grape, saw palmetto, wax myrtle, blackberry, and goldenrod.
Disturbed Upland	Nearly treeless plain with a dense ground cover on relatively flat, moderately to poorly drained terrain.	Ragweed, goldenrod, dog fennel, bracken fern, wax myrtle, sand blackberry, golden ragweed, and muscadine grape.

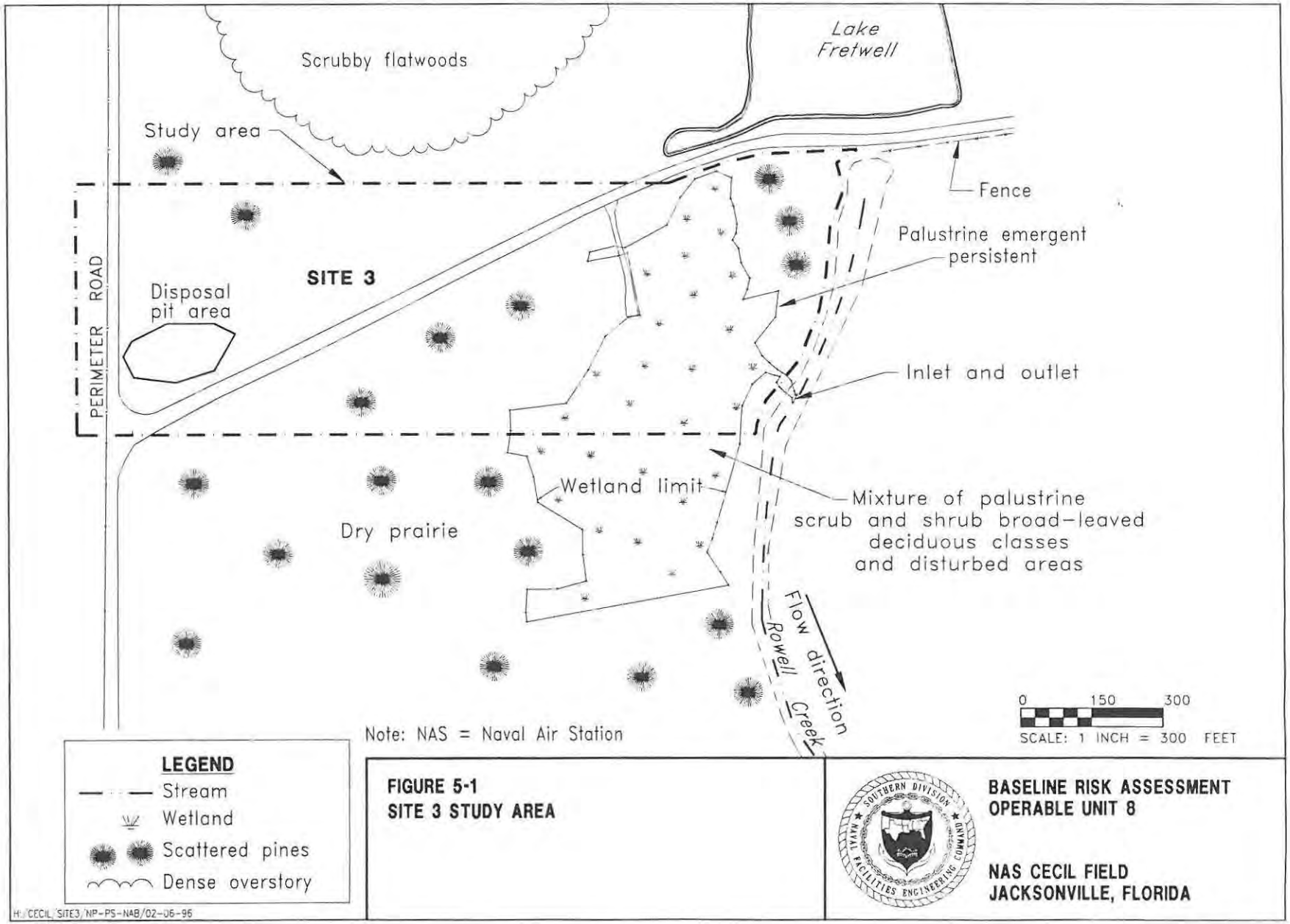


FIGURE 5-1
SITE 3 STUDY AREA

BASELINE RISK ASSESSMENT
OPERABLE UNIT 8

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

Emergent Persistent mixed in the northeastern part. Rowell Creek, which bounds Site 3 to the east, flows from Lake Fretwell and the Site 3 wetlands in a southerly direction to Sal Taylor Creek.

An upland community consisting primarily of disturbed uplands with some characteristics of a dry prairie occurs in the western part of Site 3, both to the north and south of the Lake Fretwell service road. The Site 3 disposal areas are located in this part of the site. This area consists of flat, sandy soil with dense ground cover, and little to no trees. Typical vegetation identified here includes ragweed (*Ambrosia sp.*), goldenrod (*Solidago fistulosa*), dog fennel (*Eupatorium capillifolium*), bracken fern (*Pteridium aquilinum*), sand blackberry (*Rubus cuneifolius*), golden ragweed (*Senecio aureus*), and muscadine grape (*Vitis rotundifolia*). Scattered wax myrtle (*Myrica cerifera*) and slash pine (*Pinus elliotii*) are also present.

A small part of the northern end of the study area most closely resembles the FNAI (1990) Scrubby Flatwoods cover type. The area is flat and sandy with scattered pine trees, a sparse shrubby understory, and barren sand. Typical vegetation identified in this area includes longleaf pine (*Pinus palustris*), loblolly pine (*Pinus taeda*), saw palmetto (*Serenoa repens*), myrtle oak (*Quercus myrtifolia*), goldenrod (*Solidago fistulosa*), and sand blackberry (*Rubus cuneifoluis*).

The wetland identified at Site 3 is best described as a mixture of Palustrine Forested and Scrub-Shrub Broad-Leaved Deciduous classes, with some Palustrine Emergent Persistent mixed in the northerly part of the wetland. A summary of the Site 3 wetland classes and indicator species is presented in Table 5-3.

Table 5-3
Wetland Classifications of the Site 3 Study Area

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Wetland Class[1]	Indicator Species (common name)
Palustrine Forested Broad-Leaved Deciduous	Red maple, sweet gum, swamp bay, sweet bay, wax myrtle, loblolly bay, and cinnamon fern.
Palustrine Scrub-Shrub Broad-Leaved Deciduous	Sweet bay, swamp bay, red bay, loblolly bay, wax myrtle, muscadine grape, gallberry, meadow beauty, and netted chain fern.
Palustrine Emergent Persistent	Black willow, myrtle oak, climbing hempweed, scarlet pimpernel, rushes, and dotted smartweed.

[1] Wetland classes indicated on Figure 5-1.

The mixed forested and scrub-shrub communities most clearly resemble the FNAI classifications of Bottomland Forest, Wet Prairie, and Baygall. The Bottomland Forest is characterized by a low-lying, closed canopy hardwood forest. Dominant trees are red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), and various pines. The shrubby understory includes wax myrtle (*Myrica cerifera*) and loblolly bay (*Gordonia lasianthus*). Herbaceous vegetation in this habitat includes cinnamon ferns (*Osmunda cinnamomea*) and netted chain fern (*Woodwardia*

areolata). Communities in the Wet Prairie part of Site 3 consist of sparse, dense ground cover of grasses and herbs. Dominant species include hatpins (*Eriocaulon decangulare*), panic grass (*Panicum* sp.), St.-Johnswort (*Hypericum fasciculatum*), and meadow beauty (*Rhexia virginica*), with some scattered wax myrtle (*Myrica cerifera*). The Baygall community, also a part of this area, is typically found in flat areas or on slopes where high lowland water tables help maintain soil moisture. Typical plants in this community include sweetbay (*Magnolia virginiana*), swamp bay (*Persea palustris*), red bay (*Persea borbonia*), loblolly bay (*Gordonia lasianthus*), gallberry (*Ilex glabra*), muscadine grape (*Vitis rotundifolia*), netted chain fern (*Woodwardia areolata*), and cinnamon fern (*Osmunda cinnamomea*).

The Palustrine Emergent Persistent area, which is mixed into the northeastern part of the wetlands at Site 3, most closely approximates the FNAI Floodplain Marsh classification. It is dominated by emergent grasses, herbs, and shrubs. Typical species include sedges (*Carex* sp.), bulrush (*Scirpus* sp.), climbing hempweed (*Mikania scandens*), scarlet pimpernel (*Anagallis arvensis*), and dotted smartweed (*Polygonum punctatum*), along with scattered black willow (*Salix nigra*) and myrtle oak (*Quercus myrtifolia*).

5.1.2 Wildlife Habitat Characterization The presence of both upland and wetland areas in the Site 3 study area collectively provide suitable habitat for certain wildlife receptors.

Uplands. It is likely that the invertebrate biomass at the uplands at Site 3 serves as a forage base for a limited number of wildlife species, including amphibians, reptiles, birds, and mammals. Upland habitats likely support several reptilian and amphibian species, including 20 to 30 species of reptiles and amphibians (Ashton and Ashton, 1988; 1989; 1991). Species of mole salamander (*Ambystoma* spp.) spend at least part of the year in pine woodlands (such as the scrubby flatwoods at Site 3), and a number of other salamanders, frogs (including members of the genera *Hyla*, *Rana*, and *Pseudacris*), and toads (*Bufo* spp.) may also occur in this habitat. Several lizard species and colubrid snakes may also be found in disturbed pine forest communities (Ashton and Ashton, 1988).

Depending upon the vegetative association, southeastern pine forests provide habitat for a diverse array of avifauna, including insectivorous gleaners of pine needles and bark, flycatchers, a seed-eating assemblage, and nocturnal and diurnal aerial predators (Wolfe and others, 1988). The scrubby flatwoods along the northern boundary of Site 3 are expected to host such an assemblage, and the edge of this wooded area allows for additional diversity of species. Birds of prey such as the black vulture (*Coragyps atratus*), turkey vulture (*Cathartes aura*), red-tailed hawk (*Buteo jamaicensis*), and red-shouldered hawk (*B. lineatus*) search for prey items in the more open regions, and granivorous birds such as the mourning dove (*Zenaida macroura*) and northern bobwhite (*Colinus virginianus*) are likely to occur in this upland community.

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

Disturbed grassy uplands typically host reptiles such as the box turtle (*Terrapene carolina*), six-lined racerunner (*Cnemidophorus sexlineatus*), black racer (*Coluber constrictor*), and coachwhip (*Masticophus flagellum*). Birds likely to forage here include the turkey vulture (*Cathartes aura*), bobwhite (*Colinus virginianus*), and meadowlark (*Sturnella magna*). The least shrew (*Cryptotis parva*), cotton rat ((*Sigmodon hispidus*), harvest mouse (*Reithrodontomys humulis*), spotted skunk (*Spilogale putorius*), and bobcat (*Lynx rufus*) are among mammals typically found in this habitat (FNAI, 1990).

Wetlands. The Rowell Creek floodplain and its associated wetlands are expected to provide suitable habitat for a diverse assemblage of wildlife species. A rich diversity of invertebrates inhabits the floor and arboreal canopy of floodplain forests in the region. These invertebrates are consumed by a number of amphibian, reptile, bird, and mammal species, which in turn provide food for many secondary and tertiary consumers.

The floodplain swamp likely provides habitat for a number of insectivorous, herbivorous, and carnivorous mammals, as well as a diverse assemblage of reptiles and amphibians. Reptiles typically occurring in such floodplains include the water moccasin (*Agkistrodon piscivorous*), as well as several snake and turtle species. Amphibian species likely to occur in such areas include oak toads (*Bufo quercicus*) and southern leopard frog (*Rana sphenocephala*). Various species of mole salamander (*Ambystoma* spp.), treefrog (*Hyla* spp.), and grass frog (*Pseudacris* spp.) may also occur in wetland habitats at Site 3.

Birds commonly observed in palustrine forests include swamp sparrow (*Melospiza georgiana*), Carolina wren (*Thryothorus ludovicianus*), northern cardinal, and common yellowthroat (*Geothlypis trichas*). Beaver (*Castor canadensis*), raccoon (*Procyon lotor*), otter (*Lutra canadensis*), and opossum (*Didelphis virginiana*) are also known to occur in forested wetlands at NAS Cecil Field. The short-tailed shrew (*Blarina brevicauda*), an insectivorous small mammal, is known to occur in wetland forests in Florida (O'Neil and Mettee, 1982).

Lists of characteristic amphibian, reptile, bird, and mammal species that may occur at Site 3 are included in Appendix Q.

5.2 AQUATIC HABITATS AND RECEPTORS. A semiquantitative macroinvertebrate survey was conducted at NAS Cecil Field in June and July 1993 (EA Engineering, Science, and Technology [EA], 1994). The 1993 sampling event included sampling of aquatic macroinvertebrate communities at locations throughout Rowell Creek and Lake Fretwell. One sampling location from this sampling event was located in Rowell Creek, downgradient from Site 3. This Rowell Creek station (station RC-BIO-3) is located approximately 1,200 feet east of the disposal area within the area of groundwater plume discharge from Site 3. The plume enters Rowell Creek downstream from the Lake Fretwell dam. Between RC-BIO-3 and Lake Fretwell is a sewage outfall associated with the NAS Cecil Field Navy wastewater treatment plant. The presence of this sewage outfall adds some uncertainty to the evaluation of the macroinvertebrate community at Site 3. Any observed impacts on the macroinvertebrate community at RC-BIO-3 may be attributable to either the sewage treatment plant outfall or the Site 3 groundwater plume.

5.2.1 Sampling and Data Analysis Methods Macroinvertebrate sampling at NAS Cecil Field was completed during a low-flow period, which is considered to be a

period of high stress (FDEP, 1992). Detailed discussions of the field and laboratory methodology for collection and analyses of the macroinvertebrate data and the acute aquatic toxicity data are provided in Appendix R.

Sampling completed at Site 3 included

- collection of parameters describing aquatic habitat,
- collection of macroinvertebrates by use of dip net sweeps,
- collection of macroinvertebrates by use of Hester-Dendy artificial substrates, and
- collection of macroinvertebrates by use of three replicate petite ponar dredge samples.

The sampling and analyses of the Site 3 (RC BIO-3) benthic communities and aquatic habitat assessment generally follows USEPA rapid bioassessment protocols, a cumulative metric technique developed by USEPA (1989d), modified by Barbour and others (1992) and further adapted by FDEP (EA, 1992). This process involves the use of a series of metrics or community attributes, each of which is designed to evaluate a component of benthic community structure or function. Because no upgradient reference station was available to evaluate the impact of the Site 3 groundwater plume, the State of Florida regional reference station (Five Mile Creek) was used as a standard of comparison.

5.2.2 **Physical Substrate and Chemical Parameters** A summary of the physical and chemical characterization scores for each station sampled is included in Appendix R. Most stations had fairly similar characteristics. All stations were located in forested areas with relatively poor aquatic habitat quality.

The surface water quality measurements for total hardness, nitrate plus nitrite, total nitrogen, and total phosphorus at RC-BIO-3 are summarized in Table 5-4. Water depth at RC-BIO-3 was 0.2 meter from the riparian zone to instream, and low stream velocity (0.2 cubic feet per second) was observed. Water temperature taken at or near the bottom was 27.1 degrees Celsius (°C) and pH was 6.7. The dissolved oxygen (DO) value of 5.2 mg/ℓ was slightly above the Florida water quality standard of ≥5 mg/ℓ (Florida Legislature, 1995). Conductivity was 437 micromhos per centimeter [μmhos/cm]), which is within the normal range according to State of Florida surface water quality standards (Florida Legislature, 1995).

Water clarity was clear; however, an odor of chlorine was prominent in the RC-BIO-3 surface water and sediment. Five percent aquatic vegetation and 10 percent woody debris were observed at RC-BIO-3. Sand was a major (80 percent) component of the substrate. No leaf pack, mud, muck, or silt were apparent in the substrate. No periphyton, fish, or aquatic macrophytes were found at this station.

5.2.3 **Aquatic Habitat Assessment Results** Aquatic habitat quality scores were calculated for the sampling station based on data collected during the field survey. The results of the habitat quality scoring, including the State of Florida regional reference, Five Mile Creek, are summarized in Table 5-5.

Table 5-4
Summary of Site 3 Surface Water Quality Measurements

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Station	Depth[1] (m)	Temperature1 (°C)	pH[1]	DO[1] (mg/ℓ)	Conductivity[1] (μmhos/cm)	Secchi[1] (m)	Total Hardness[2] (mg/ℓ as $CaCO_3$)	Total Kjeldahl Nitrogen[2] (mg/ℓ)	Nitrate plus Nitrite[2] (mg/ℓ)	Total Nitrogen[2] (mg/ℓ)	Total Phosphorus[2] (mg/ℓ)
CF3SW1[3,4]	NA	21	6.3	2.7	121	NA	97	NA	NA	NA	0.4
RCSW3	0.2	27.1	6.7	5.2	437	0.20	[5]106	NA	[6]65.55	NA	1.30[7]
CF3SW2[3]	0.2	24.5	6.8	1.0	120	0.20	110	NA	NA	2	NA
Five Mile Creek[7]	1	23	4.4	5.8	62	0.3	NA	NA	NA	NA	0.5

[1] From Appendix R. Measured in the field by EA Engineering, Science, and Technology, Inc.
[2] From Appendix D. Measured in the laboratory.
[3] Although no macroinvertebrate data were collected at these wetland stations, water quality parameters are included in this table for regional perspective.
[4] Values for this station represent an average of duplicate samples collected simultaneously.
[5] Value is for sample collected June 26, 1993.
[6] Value represents an average of samples collected June 26, 1993, and August 18, 1993.
[7] Five Mile Creek is the Florida regional reference station considered in this study.

Notes: m = meter.
°C = degrees Celsius.
DO = dissolved oxygen.
mg/ℓ = milligrams per liter.
μmhos/cm = micromhos per centimeter (a measure of electrical conductivity).
$CaCO_3$ = calcium carbonate.
NA = not available.

Table 5-5
Habitat Assessment Scores

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Station	Bottom Substrate	Water Velocity	Artificial Channel	Bank Stability	Riparian Zone Vegetation	Flow Adjustment	Total Score	Percent Comparison to Five Mile Creek
RC-BIO-3	12	20	12	7	3	--	54	80.6
Five Mile Creek[1]	24	8	15	10	10	5	72	100

[1] Five Mile Creek is the Florida regional reference station considered in this study.

Notes: Methods for sampling and habitat scoring procedures are reported in Appendix R.
-- = not available.

Habitat quality at the station is generally poor, due at least in part to poor bottom substrate, and lack of aquatic macrophytic vegetation. The score (54) represented 80.6 percent that of the regional reference station (Five Mile Creek, total score = 72).

5.2.4 Benthic Macroinvertebrate Community A taxonomic list of the benthic macroinvertebrates at NAS Cecil Field is presented in Appendix R. Identified taxa were collected using dip nets, a petite ponar dredge, and Hester-Dendy artificial substrates.

Metrics are measurements of various components of the structure and function of the benthic macroinvertebrate community. Independently, they provide information on the status of the part of the community they represent. Together, the metrics contribute to an integrated assessment of the biological condition of the community. Thirteen metrics were used as measurements of the benthic macroinvertebrate community structure and function for Site 3 (Table 5-6). Selected metrics for Site 3 are presented in Table 5-7 . The calculated metric values for the three separate sample types (i.e., dip net, ponar, and Hester-Dendy samples) for each of the stations are presented in Appendix R. A discussion of the metric values calculated for Site 3 is included in the following subsections.

5.2.4.1 **Dip Net Samples** The metric values selected for analyses of the dip net data include taxa richness, the Florida index, the Hilsenhoff biotic index, ephemeroptera-plecoptera-trichoptera (EPT) index, chironomid taxa, percent dominant taxon, percent shredders, and percent filter-collectors (Table 5-7). The values calculated for each of these metrics are listed in Appendix R.

Examination and interpretation of the metric scores show considerable differences between RC-BIO-3 and the Five Mile Creek reference station. Taxa richness, Florida index and EPT index are markedly decreased at RC-BIO-3, but percent dominant taxon and percent shredders are greatly increased at RC-BIO-3.

The metric values were assigned bioassessment ranking scores and total metric scores were calculated for each station. Station RC-BIO-3 scored approximately 50 percent of the regional reference station (Five Mile Creek). The low DO levels and generally poorer habitat quality at RC-BIO-3 may help explain the low

Table 5-6
Benthic Macroinvertebrate Community Metrics

Baseline Risk Assessment
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Metric	Description
Total taxa (number of invertebrate taxa)	Defines species richness. Richness generally increases with increasing water quality, habitat diversity, and/or habitat suitability (U.S. Environmental Protection Agency [USEPA], 1990a).
Number of individuals per square meter	Classifies invertebrate density (USEPA, 1990a). Lower benthic abundance per unit area (density) is presumed to correlate with impairment, whereas higher abundance is presumed to relate to a healthier community.
Dominant taxon	Measures redundancy. A high level of redundancy (i.e., dominance of the fauna by a single taxon) is equated with the dominance of a pollutant-tolerant organism and a lowered diversity (Plafkin and others, 1989).
Percent dominant taxon	Calculated as the ratio of the taxonomic group with the most individuals (dominant) to the total number of organisms. Percent dominance should remain low to reflect a healthy biotic condition (Plafkin and others, 1989).
Florida index	Commonly used index for Florida streams that focuses on the tolerance of specific populations indigenous to the State. This index does not use the entire macroinvertebrate assemblage, and is heavily weighted to the arthropods (e.g., invertebrates with horny segmented external covering and jointed limbs). The Florida index increases in value as the condition of the water quality increases (Florida Legislature, 1990a).
Shannon-Weaver index	Measures indices of community structure and function. The Shannon-Weaver value may range from 0 to 3.3 log N, where N = the total number of individuals. This index is often insensitive to subtle changes in community structure unless the environment has been grossly modified; however, it is often used to calculate other indices (USEPA, 1990a).
Percent diptera	Measures increases in the presence of stress (USEPA, 1990a).
Percent chironomid	Represents pollutant-tolerant benthic taxa (USEPA, 1990a).
Percent ephemeroptera-plecoptera-trichoptera (EPT)	Consists of the most pollutant-sensitive benthic taxa. Communities with good biotic condition are characterized by a fairly even distribution among EPT and chironomids (USEPA, 1990a).
Percent filter collectors	Reflects the riffle and run community food base and provides insight into the nature of potential disturbance factors. Predominance of a feeding type may indicate an unbalanced community responding to an overabundance of a particular food source. Filtering collectors are sensitive to toxicants bound to fine particulate organic material and may decrease in abundance when exposed to sources of such bound toxicants (USEPA, 1990a).
Percent shredders	Shredders are sensitive to riparian (bank to bank) zone impacts and are particularly good indicators of toxic effects when the toxicants are readily adsorbed to course particulate organic matter (USEPA, 1990a).
Percent calcium dependent	Measures the number of crustacean and mollusc individuals. These taxa are calcium dependent and are generally most diverse in alkaline-fed streams. Stress such as habitat degradation or chemical contamination may eliminate certain taxa represented in this measure (Florida Department of Environmental Protection [FDEP], 1990).
Hilsenhoff biotic index (HBI)	Developed to summarize overall pollution tolerance of the benthic arthropod community. Similar in concept to the Florida index, but incorporates abundance and a slightly different weighing factor for tolerance. Tolerance values are assigned ranging from 0 to 10 (10 signifying the most tolerant). The 0 to 10 scale was modified to include nonarthropod species. The HBI decreases in value with increasing water resource integrity. Although it may be applicable for other types of pollutants, use of the HBI in detecting nonorganic pollutant effects has not been thoroughly evaluated (FDEP, 1990; USEPA, 1990a).

Table 5-7
Selected Metrics for Description of Macroinvertebrates Sampled in Dip Nets

Baseline Risk Assessment
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Station	Taxa Richness	Florida Index	HBI	EPT Index	Chironomid Taxa	Percent Dominant Taxon	Percent Shredders	Percent Filter Collectors
RC-BIO-3	12	3	6.4	0	3	59.6	60.2	4.7
Five Mile Creek[1]	32	12	6.9	4	7	10.7	15.5	9.7

[1] Five Mile Creek is the Florida regional reference station considered in this study.

Notes: Methods for calculation of metrics are reported in Appendix I.
HBI = Hilsenhoff biotic index.
EPT = ephemeroptera-plecoptera-trichoptera.

total metric score relative to Five Mile Creek. It is unclear whether the residential sewage treatment plant outfall, the poor habitat quality, or the groundwater plume from Site 3 is responsible for the lower metrics observed in dip net samples from RC-BIO-3.

5.2.4.2 **Hester-Dendy Samples** The Hester-Dendy artificial substrates primarily attract pioneer benthic species that colonize the samplers. These organisms originate from recruitment or drift from the benthic populations established in the stream. Community colonization is a function of the environmental conditions that existed during the sampling period. The metrics used to analyze the results of the sampling with the artificial substrates includes percent dominant taxon, the Florida index, the Shannon-Weaver index, percent diptera, percent chironomid, dependant taxa, and the Hilsenhoff biotic index (Table 5-8).

Table 5-8
Selected Metrics for Macroinvertebrate Samples Collected by Ponar Dredge

Baseline Risk Assessment
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Station	Taxa Richness	Density[1]	Florida Index	HBI	EPT Index	Percent Chironomid Taxa	Percent Dominant Taxon
RC-BIO-3	14	10,736	3	7.7	0	77.2	42.2

[1] Density is equal to the number of individuals per square meter.

Notes: Methods for calculation of metrics reported in Appendix I.
HBI = Hilsenhoff biotic index.
EPT = Ephemeroptera-plecoptera-trichoptera.

The State of Florida regional reference site, Five Mile Creek, was used to compare the OU 8 Hester-Dendy metric values. Hester-Dendy substrate sampler results generally support those obtained from dip net samples. The total number of taxa was decreased at RC BIO 3, and consisted primarily (97 percent) of the

dominant chironomid species, *Polypedilum illinoense*, a pollution-tolerant taxon. None of the most pollution-sensitive species were detected (as reflected in a 0 percent EPT value).

The Florida index was only slightly lower at RC-BIO-3 (12) than that at Five Mile Creek (15), a less dramatic difference than that found in dip net samples. The Hilsenhoff biotic index values obtained in Hester-Dendy samples were similar for RC-BIO-3 (6.0) and the regional reference station (6.4). As this index may be insensitive to the presence of nonorganic pollutants such as those containing chlorine, the effect of sewage outfall versus contributions from Site 3 effluent cannot be delineated. Percent diptera was 99.5, as also was percent chironomid, as compared to 60.5 percent for both metrics at Five Mile Creek. The percent EPT and percent collector filterers was 0.0 percent, and 98.6 percent shredders were noted.

The relatively large decrease in the Shannon-Weaver index at RC-BIO-3 (0.279) as compared to the regional reference station value (4.612) suggests that the Rowell Creek environment has been modified. However, these data warrant careful consideration, given habitat quality differences between Rowell Creek and Five Mile Creek.

The artificial substrate sampling indicates a poorly developed benthic macroinvertebrate community. However, due to lack of adequate reference data, the source of this impact is not defined. The decreased condition of the benthic macroinvertebrate community may be due to the residential sewage treatment plant outfall or to the influence of the Site 3 groundwater plume, or to the generally poor habitat quality of RC-BIO-3.

5.2.4.3 **Ponar Samples** The taxa identified from the ponar samples are indicative of the infaunal benthic community, although some epifaunal components are also represented. Station-to-station differences in the community may be due to variations in substrate composition and/or man-induced alterations on the population. No State of Florida regional reference exists for this gear type.

The metrics used to describe the structure and function of the benthic macroinvertebrate community as sampled by the ponar dredge include total taxa, total number of individuals, density, Shannon-Weaver diversity index, the Florida index, percent EPT, and the Hilsenhoff biotic index. The metric values calculated for the ponar samples for sampling station RC-BIO-3 are included in Appendix R; selected metrics are included in Table 5-8.

The dominant taxon (42 percent) was a chironomid species, *Polypedilum illinoense*, a pollution-tolerant taxon. None of the most pollution-sensitive species were detected (as reflected in a 0 percent EPT value). Density of macroinvertebrates was high at RC-BIO-3 (10,736 per square meter).

5.2.5 **Summary of Macroinvertebrate Study** A review of the macroinvertebrate habitat quality parameter data suggests that habitat quality conditions at RC-BIO- 3 represent a poor environment for many types of aquatic organisms. Data from dip net, ponar, and Hester-Dendy studies support this conclusion. Adequate reference data were not available, limiting interpretation of the benthic results. Aquatic habitat conditions at Site 3 are dissimilar from that of the regional reference station. Five Mile Creek is deeper, cooler, more acidic, more oxygenated, and has a lower conductivity than RC-BIO-3. These differences

in habitat structure may be sufficient to explain the decreased biological condition at RC-BIO-3. However, the residential sewage treatment plant discharge or the Site 3 groundwater plume may also contribute to the differences in community structure at this sampling location.

The benthic community results are also discussed in relation to the results for aquatic toxicity testing and chemical analyses in the risk characterization for surface water and sediment at Site 3 in Chapter 6.0.

5.3 RARE, ENDANGERED, AND THREATENED SPECIES. Certain species that potentially reside on NAS Cecil Field are protected by Federal and/or State laws. The FAC defines protected species as follows.

1. Endangered species are those that are so few or depleted in number or so restricted in range or habitat as to be in imminent danger (or may attain such status in the immediate future) of extinction or extirpation.

2. Threatened species are that which are acutely vulnerable to environmental alteration, or whose range or habitat is declining rapidly, thus leading to, or potentially leading to, rapid population decline. These species are likely to become endangered within the foreseeable future.

3. Species of special concern are those in need of special protection, recognition, or consideration because they are inherently vulnerable to habitat alteration, human disturbance, or human exploitation, which in turn may lead to their becoming threatened. The Florida Committee on Rare and Endangered Plants and Animals (FCREPA) also designates a category of rare to those species having a limited geographic distribution, special habitat requirements, or occurring at the periphery of their range (Envirodyne Engineers, 1985). These status designations are applied to the species in the following sections.

Rare, endangered, and threatened species identified as potentially residing on NAS Cecil Field are listed in Table 5-9. The list is based on a review of available information including the Initial Assessment Study (Envirodyne Engineers, 1985), a rare and endangered plant survey report (Environmental Services and Permitting, Inc., 1990), and the Technical Memorandum for Supplemental Sampling at Ous 1, 2, and 7 (ABB-ES, 1992b), which initially addressed Site 3 as a part of OU 2. Confirmation of the information in Table 5-9 has been requested from appropriate personnel of the USFWS, NAS Cecil Field personnel, the Florida Game and Fresh Water Fish Commission (FGFWFC), and the National Oceanic and Atmospheric Administration (NOAA) (Wood, 1994).

Although no rare and endangered animal species are known to occur at Site 3, several records exist for occurrences near the site. The gopher tortoise (*Gopherus polyphemus*), a State species of special concern (SSC) and a Federal-candidate species, is a confirmed resident at NAS Cecil Field. This reptile has been observed by ABB-ES ecologists within 1,000 feet of Site 5, which is north of Site 3, suggesting this species may occur transiently in the study area.

Further, a number of gopher tortoise burrows were observed on the NAS property, some in association with Sites 1 and 4 (Envirodyne Engineers, 1985). Also, the

Table 5-9
Rare, Endangered, and Threatened Flora and Fauna at or in the Vicinity of Naval Air Station Cecil Field

Baseline Risk Assessment
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Common Name	FGFWFC[1]	USFWS[2]	FDA[3]	Comments
Florida gopher frog (*Rana capita*)	SSC	C2		Possible resident at NAS Cecil Field (Envirodyne Engineers, 1985). Suitable habitat exists at Site 3.
American alligator (*Alligator mississippiensis*)	SSC	T(S/A)		Confirmed resident in Lake Fretwell (Envirodyne Engineers, 1985).
Eastern indigo snake (*Drymarchon corais couperi*)	T	T		Confirmed resident at NAS Cecil Field (Envirodyne Engineers, 1985). Suitable habitat exists at Site 3.
Gopher tortoise (*Gopherus polyphemus*)	SSC	C2		Confirmed resident at NAS Cecil Field (Envirodyne Engineers, 1985). Possible resident at Site 3.
Wood stork (*Mycteria americana*)	E	E		Confirmed migrant; observed feeding at Lake Fretwell (Cochran, 1994). Suitable habitat is present in shallow water areas at Site 3.
Southeastern kestrel (*Falco sparverius paulus*)	T	C2		Possible migrant (Cochran, 1994).
Arctic peregrine falcon (*Falco peregrinus tundrius*)	E	T		Probable migrant (Cochran, 1994).
Bald eagle (*Haliaeetus leucocephalus*)	T	E		Confirmed migrant (Envirodyne Engineers, 1985).
Sherman's fox squirrel (*Sciurus niger shermani*)	SSC	C2		Possible resident near Site 18 (ABB Environmental Services, Inc. [ABB-ES] biologist). Unlikely to occur at Site 3.
Florida black bear (*Ursus americanus floridanus*)	T	C2		Evidence of black bears reported in outlying areas in 1982 (Envirodyne Engineers, 1985). Unlikely to occur at Site 3.
Florida mouse (*Podomys floridanus*)	SSC	C2		Known from Clay County, may range into habitats (sand pine scrub and longleaf pine-turkey oak communities) present at NAS Cecil. Not known to be a resident at NAS Cecil Field (Envirodyne Engineers, 1985).
Hooded pitcher plant (*Sarracenia minor*)			T	Found in wetlands at Site 3 (ABB-ES biologist).
Spoon-leaved sundew (*Drosera intermedia*)			T	Found at one location at Yellow Water Weapons Area in drainage ditch (Environmental Services & Permitting [ESP], 1990).

See notes on following page.

Table 5-9 (Continued)
Rare, Endangered, and Threatened Flora and Fauna at or in the Vicinity of Naval Air Station Cecil Field

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
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Common Name	FGFWFC[1]	USFWS[2]	FDA[3]	Comments
Cinnamon fern (*Osmunda cinnamomea*)			CE	Observed at Site 3 (Camp, Dresser and McKee [CDM], 1994).
Royal fern (*Osmunda regalis*)			CE	Confirmed at NAS Cecil Field. Possibly present at Site 3.
Bartram's ixia (*Salpingostylis coelestina*)			E	Observed by Navy personnel in the southwest quadrant of NAS Cecil Field (Burst, 1994; Cochran, 1994). Possibly present at Site 3.
Variable-leaf crown beard (*Verbesina heterophylla*)		C2		Found at one location at NAS Cecil Field in sandhill habitat (ESP, 1990). Possibly present at Site 3.
Netted chain fern (*Woodwardia areolata*)			T	Found at Site 3 (CDM, 1994).
Grass pink (*Calopogon tuberosus*)			T	Found at Site 17 by ABB-ES ecologist; possibly present at Site 3.

[1] Published in Chapter 39-27.003-005, Florida Administrative Code (FGFWFC, 1994).
[2] List published in List of Endangered and Threatened Wildlife and Plants, 50 Code of Federal Regulations, 17.11-12.
[3] Florida Department of Agriculture and Consumer Services (list is statutorily designated by the Preservation of Native Flora of Florida Act (581.185-187, Florida Statutes) (FGFWFC, 1994).

Notes: FGFWFC = Florida Game and Fresh Water Fish Commission.
USFWS = U.S. Fish and Wildlife Service.
FDA = Florida Department of Agriculture.
SSC = species of special concern.
C2 = a candidate for Federal listing with some evidence of vulnerability, but for which not enough information exists to justify listing.
NAS = Naval Air Station.
T(S/A) = threatened due to similarity of appearance.
T = threatened.
E = endangered.
CE = commercially exploited.

Federal- and State-listed endangered species, the woodstork (*Mycteria americana*), and the American alligator (*Alligator mississippiensis*), a State-listed SSC, have been observed at Lake Fretwell, located to the northeast of Site 3. As discussed in OU 2 RI report (ABB-ES, 1994a), Lake Fretwell is not being evaluated in this RA but will be considered in a future study. Sherman's fox squirrel (*Sciurus niger shermani*), a State-listed SSC and Federal-candidate species, may be a resident of the forested area north of Site 18. However, due to the disturbed nature of Site 3, it is unlikely that this fox squirrel occurs at the site.

One State-listed (threatened) plant species is known to occur at the Site 3 study area. The hooded pitcher plant (*Sarracenia minor*) was found at Site 3 near the helicopter crash by an ABB-ES biologist. Two additional species, listed by the Food and Drug Administration as commercially exploited (FGFWFC, 1994) were observed at Site 3. The cinnamon fern (*Osmunda cinnamomea*) and the netted chain fern (*Woodwardia areolata*) were observed in the wetlands on the southeastern part of the site (CDM, 1994). In addition, the wetlands to the north of Site 3 contain another commercially exploited fern species (i.e., *O. regalis*) and the threatened grass pink (*Calopogon tuberosus*).

6.0 ECOLOGICAL RISK ASSESSMENT

This ERA evaluates actual and potential adverse effects to ecological receptors associated with exposure to contamination from Site 3, which comprises OU 8 at NAS Cecil Field. The ERA for OU 8 was completed in accordance with current guidance materials for ERAs at Superfund sites including the following:

- Risk Assessment Guidance for Superfund, Environmental Evaluation Manual (USEPA, 1989g);
- Ecological Assessment of Hazardous Waste Sites, A Field and Laboratory Reference (USEPA, 1989a);
- Ecological Assessment of Superfund Sites, An Overview (USEPA, 1991c); and
- Framework for Ecological Risk Assessment (USEPA, 1992i).

Recent risk assessment guidance including the USEPA "Eco Update" bulletins (USEPA, 1991b; 1992b; 1992c) and recent publications (e.g., Maughan, 1993; Suter, 1993) were also consulted.

The problem formulation and general methodology for completing the OU 8 ERA is included as Section 6.1. The ERA for OU 8 is presented in Sections 6.2 through 6.6, and includes hazard assessment and selection of ECPCs (Section 6.2), exposure assessment (Subsection 6.3), ecological effects assessment (Section 6.4), risk characterization (Subsection 6.5), and uncertainty analyses (Section 6.6). Each of these sections discusses surface soil, surface water, sediment, and groundwater. The summary of the ecological and public health risk assessment is presented in Section 6.7.

6.1 PROBLEM FORMULATION AND ECOLOGICAL ASSESSMENT METHODOLOGY. The following subsections describe the approach and methodologies for the ERA at OU 8. The assessment approach integrates a variety of methodologies to assess risks. The decisions regarding overall risk to ecological receptors are based on the weight-of-evidence from the results of all components of the assessment methodology (i.e., an approach that integrates results of physical, biological, toxicological, and modeling studies to draw risk-based conclusions). The weight-of-evidence components were designed to provide measures of risks for different ecological receptors, exposure pathways, and potential adverse effects.

Problem formulation is the initial step of the ERA process. Figure 6-1 presents a conceptual model of the contaminant pathway from source to ecological receptors for OU 8. Problem formulation is composed of identification of receptors, identification of exposure pathways for those receptors, and the assessment and measurement endpoints selected for the ERAs.

6.1.1 Identification of Receptors Ecological receptors at OU 8 include terrestrial and wetland plants and animals. Terrestrial and wetland flora and fauna potentially using OU 8 are identified in Chapter 5.0 and in Appendix Q.

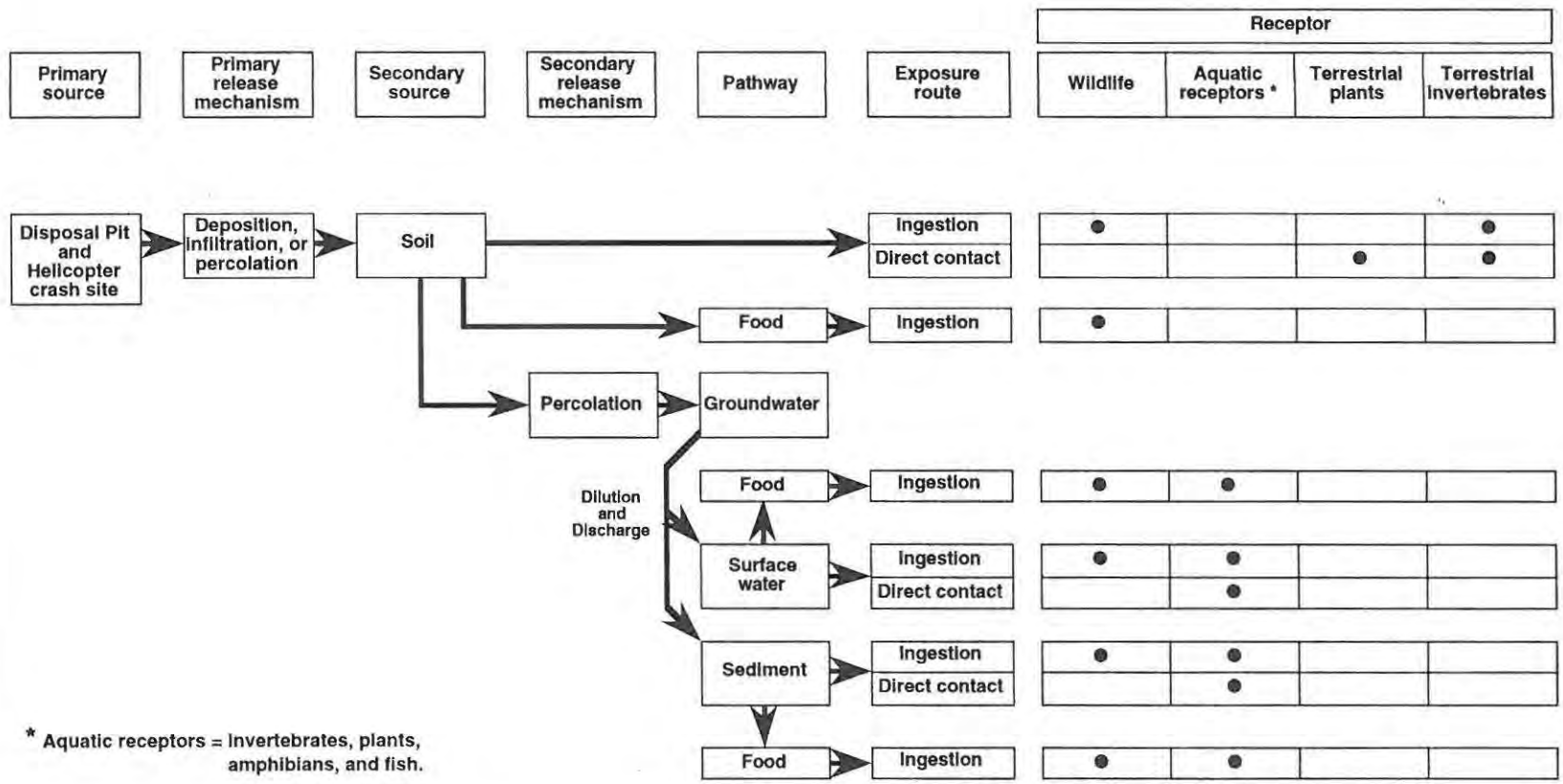


FIGURE 6-1
CONTAMINANT PATHWAY MODEL FOR ECOLOGICAL RECEPTORS, OPERABLE UNIT 8

BASELINE RISK ASSESSMENT, OPERABLE UNIT 8

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

8500-12-TKH FIG 6-1 032296MAW

Aquatic receptors present in Rowell Creek adjacent to OU 8 and the OU 8 wetland include invertebrates, plants, algae, amphibians, and fish. Aquatic species identified in Rowell Creek during field sampling events are discussed in Appendix R.

6.1.2 Identification of Exposure Pathways Exposure pathways are identified for four groups of ecological receptors (terrestrial and wetlands wildlife, terrestrial plants, terrestrial invertebrates, and aquatic receptors). The exposure pathway includes a source of contamination, potentially contaminated media (surface soil, food, groundwater, surface water, and sediment), and an exposure route. The exposure pathways from the OU 8 hazardous waste source to ecological receptors are depicted in the contaminant pathway model illustrated on Figure 6-1.

Not all potential routes of exposure are presented in the contaminant pathway model. The model represents only those pathways that are evaluated in the ERA for OU 8. This limitation is necessary to focus the risk evaluation on the pathways for which (1) contaminant exposures are the highest and most likely to occur and (2) there are adequate data pertaining to the receptors, contaminant exposures, and toxicity for completion of risk analyses. Exposure pathways evaluated include portions of food chains (e.g., surface soil → primary consumer → secondary consumer → tertiary consumer), as well as other direct and indirect exposures.

Terrestrial and Wetland Wildlife. The exposure routes evaluated for wildlife represent those pathways that are believed to contribute the highest potential contaminant exposures. These exposure routes include ingestion of soil, sediment, and food items that are contaminated as a result of accumulation of constituents from site media. An assumption is made that fur, feathers, or chitinous exoskeletons limit the transfer of contamination across the dermis; therefore, exposures related to dermal contact are not evaluated as part of this ERA. Exposures related to inhalation are not evaluated because this pathway is generally considered an insignificant route of exposure except in unusual circumstances, such as following a spill or release.

Potential contaminant exposures for reptiles and amphibians exist at OU 8, but are not evaluated due to a lack of availability of data relating contaminant exposures to adverse responses for reptiles and amphibians.

Terrestrial Plants and Invertebrates. Terrestrial plants and soil invertebrates may be exposed to contamination in surface soil by direct contact with and ingestion of the soil. Terrestrial plants may also be exposed to contamination in groundwater where roots reach a zone of saturation. The groundwater exposure pathway was not selected for evaluation because of difficulties estimating contaminant exposures for terrestrial plants from groundwater.

Aquatic Receptors. Exposure pathways evaluated for aquatic receptors at OU 8 (including invertebrates, plants, amphibians, and fish) include direct contact with surface water, sediment, and groundwater (as it discharges to the surface). Aquatic life may also be exposed to contamination in sediment as the result of ingestion of the sediment. This pathway was not chosen for evaluation because information on the amount of sediment ingested by aquatic organisms and associated toxicity is generally not available.

6.1.3 Identification of Endpoints The endpoints selected for the ERA for OU 8 are listed in Table 6-1. Measurements of actual toxicity and adverse effects were completed when possible to decrease uncertainties and to measure the combined effects associated with exposure to the actual mixture of contamination present in soil and groundwater at OU 8. The endpoints for aquatic receptors, terrestrial and wetland wildlife, and terrestrial plants and invertebrates are discussed separately. Both measurement and assessment endpoints are identified in Table 6-1. 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.

Terrestrial and Wetland Wildlife. The assessment endpoint selected for terrestrial and wetland wildlife is the maintenance of wildlife populations and communities within the habitats present at OU 8. Because no long-term wildlife population data are available at NAS Cecil Field, a direct measurement of this assessment endpoint is not possible. The literature-derived results of laboratory toxicity studies that relate the dose of a contaminant 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 assessment endpoint.

Terrestrial Plants and Invertebrates. The assessment endpoint selected for terrestrial plants and soil invertebrates is the survival, growth, and reproduction of terrestrial invertebrate and plant communities. This endpoint is measured through toxicity testing of earthworm (*Eisenia foetida)* and lettuce (*Lactuca sativa*) seed with surface soil samples from OU 8. This laboratory toxicity testing provides a direct measure of the toxicity of the mixture of chemicals in soil to a terrestrial invertebrate and plant species. It is assumed that the responses of these test species are an adequate indicator for other terrestrial invertebrates and plants occurring at OU 8.

Aquatic Receptors. The selected assessment endpoint for aquatic receptors at OU 8 is the survival and maintenance of a well-balanced benthic macroinvertebrate community structure and function. This endpoint was measured based on the results of the semi-quantitative benthic macroinvertebrate sampling described in Section 5.2. Survival and maintenance of fish and aquatic plant populations is a second assessment endpoint for aquatic life. The survival and maintenance of fish, plant, and invertebrate populations were estimated based on literature-reported concentrations of a contaminant in water or sediment in a laboratory or field toxicity test that is associated with adverse effects on reproduction, growth, or survival of a test population.

To assess the potential toxicity of contaminated shallow groundwater discharging from OU 8 to Rowell Creek, aquatic toxicity tests were performed using diluted and undiluted groundwater samples collected from monitoring wells located in the OU 8 plume upgradient of its discharge into Rowell Creek. By characterizing toxic effects from undiluted and diluted groundwater, these toxicity tests provide information regarding the effects of OU 8 chemicals on aquatic receptors in Rowell Creek in the absence of possible contamination contributed by upgradient sources.

Table 6-1
Endpoints for Ecological Assessment of Operable Unit 8

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Medium	Receptor	Assessment Endpoint	Measurement Endpoint
Surface Water	Aquatic life (invertebrates, fish, plants, and amphibians).	Survival and maintenance of benthic macroinvertebrate community structure and function.	Direct measurement of macroinvertebrate community structure and function.
		Survival and maintenance of fish and macroinvertebrate populations.	Toxicity testing of shallow groundwater collected from within the organic plume downgradient of Operable Unit 8.
			Contaminant concentrations in surface water and shallow groundwater associated with adverse effects to growth, reproduction, or survival of aquatic organisms.
Sediment	Aquatic life (invertebrates, fish, plants, and amphibians).	Survival and maintenance of benthic macroinvertebrate community structure and function.	Field sampling and measurement of macroinvertebrate community structure and function.
		Survival and maintenance of fish, macroinvertebrate, and aquatic plant populations.	Contaminant concentrations in sediment associated with adverse effects to growth, reproduction, or survival of aquatic organisms.
Surface Water, Sediment, and Surface Soil	Terrestrial and wetland wildlife.	Survival of wildlife populations and communities.	Oral contaminant exposure concentrations representing adverse effects to growth, reproduction, or survival of mammalian or avian laboratory test populations.
Surface Soil	Terrestrial invertebrates.	Survival of terrestrial invertebrate communities.	Survival of earthworms exposed to surface soil samples in laboratory toxicity tests.
Surface Soil	Terrestrial plants	Survival, reproduction, and growth of plant communities.	Germination of lettuce seeds exposed to surface soil samples in laboratory toxicity tests.

6.2 HAZARD ASSESSMENT AND SELECTION OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN (ECPCs). The hazard assessment includes a review of analytical data and selection of ECPCs. ECPCs represent the analytes detected in environmental media (surface soil, surface water, sediment, and groundwater) that are considered in the ERA. The ECPCs are assumed to be associated with waste disposal practices at OU 8 and could present a potential risk for ecological receptors. The process for selection of ECPCs is depicted on Figure 6-2. Surface water and sediment ECPCs were selected separately for wildlife and aquatic receptors because available ECPC screening tools distinguish between these two groups of receptors. The upgradient (surface water, sediment, and groundwater) and background (surface soil) analyte concentrations used in the screening process are discussed in Section 3.3.

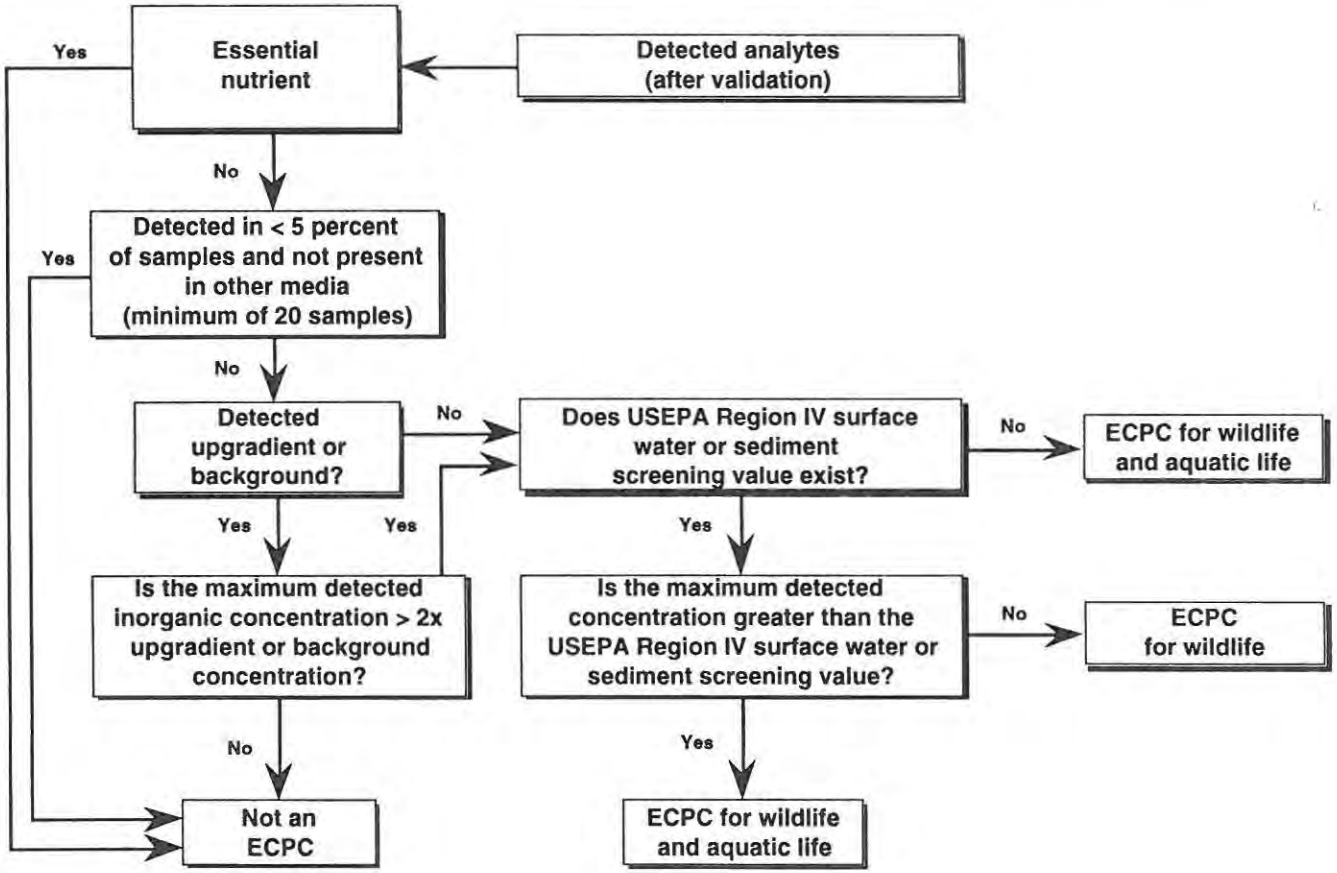
Pursuant to USEPA (1989a; 1989g) national guidance, analytical data for each site at NAS Cecil Field were evaluated to determine their validity for use in risk assessment. Analytes were not selected as ECPCs if the site concentrations were within 5 to 10 times the concentrations in associated trip blanks or method blanks. In addition, analytes in surface soil, surface water, sediment, and groundwater were not selected as ECPCs if the analyte was detected in 5 percent or fewer of the samples analyzed and were not selected as ECPCs in any other media. In accordance with USEPA Region IV guidance (USEPA, 1991e), if the maximum detected concentration of an inorganic analyte was less than 2 times the average inorganic concentration detected in the respective upgradient (surface water, sediment, or groundwater) or background samples (surface soil), then the analyte was not selected as an ECPC.

All analytes in surface soil, surface water, and sediment retained as ECPCs following data validation and background comparison were selected as ECPCs for terrestrial or wetland wildlife. ECPCs for aquatic receptors for groundwater, surface water, and sediment were selected based on an additional screening step in accordance with USEPA Region IV guidance (USEPA, 1991e; 1992h). Analytes were eliminated as aquatic ECPCs if the detected concentration was less than the Region IV screening value for surface water (USEPA, 1992h) or sediment (USEPA, 1994e). Analytes were eliminated as wildlife ECPCs if the detected concentrations were less than 2 times the upstream surface water or sediment concentration. If no Region IV screening concentration was available and the detected concentration was less than 2 times the upstream concentration, the analyte was eliminated as an ECPC for either aquatic or wildlife receptors.

Calcium, magnesium, potassium, and sodium were excluded as ECPCs for all media, and iron was excluded as an ECPC for surface soil and sediment; these analytes are considered to be essential nutrients and are only toxic at extremely elevated concentrations. Evidence suggests that there is little potential for toxic effects resulting from over-exposure to these essential nutrients. The highly controlled physiological regulatory mechanisms of these inorganics suggest that there is little, if any, potential for bioaccumulation, and available toxicity data demonstrate that high dietary intakes of these nutrients are well-tolerated (NAS, 1977; National Research Council, 1982; 1984).

All ECPCs selected for the ERA are summarized in tables that include:

- the frequency of detection,
- range of detection limits,



Notes:

USEPA = U.S. Environmental Protection Agency

ECPC = Ecological chemical of potential concern

> = Greater than

< = Less than

x = Times

FIGURE 6-2

ECOLOGICAL CHEMICAL OF POTENTIAL CONCERN SELECTION PROCESS

BASELINE RISK ASSESSMENT, OPERABLE UNIT 8

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

8500-12 CF OU8 BRA 950426WEM

- range of detected concentrations,
- average detected concentration,
- average of all concentrations (only for analytes selected as ECPCs),
- 95th percentile UCL (only for analytes selected as ECPCs),
- USEPA Region IV screening criteria (surface water and sediment only), and
- twice the average background or upgradient concentration for each of the inorganic analytes.

6.2.1 Surface Soil Twenty-four surface soil samples were collected in November, 1994, at OU 8 (CEF-3-SS1 through CEF-3-SS24) (Figure 3-1). All 24 samples were evaluated in the OU 8 ERA. Background surface soil samples were collected at 14 stations (CEF-BSS-01 through CEF-BSS-08, and CEF-BSS-10 through CEF-BSS-15). The results of the background investigation are presented in Table 3-1.

Two surface soil data sets were evaluated in the OU 8 ERA. The first data set included the 20 samples (CF3-SS-1 through CF3-SS-10, and CF3-SS-14 through CF3-SS-23) collected from the grassy OU 8 disposal area. The second data set includes four surface soil samples (CF3-SS-11 through CF3-SS-13, and CF3-SS-24) collected from the forested area in the vicinity of the helicopter crash site. Table 6-2 and Table 6-3 present the summary of samples from the disposal area and the helicopter crash area, respectively.

Four VOCs, 18 SVOCs, 5 pesticides, Aroclor-1254, and 19 inorganic analytes were detected in surface soil samples collected in the OU 8 disposal area. Five SVOCs and selenium were eliminated as ECPCs because they were identified in only 5 percent of the samples and were not detected in any other media. Nine inorganic analytes were eliminated as ECPCs because their maximum detected concentrations were either less than 2 times the mean background soil concentration or are essential nutrients. The remaining 4 VOCs, 13 SVOCs, 5 pesticides, Aroclor-1254, and 9 of the inorganic analytes were retained as ECPCs for evaluation in the OU 8 ERA. TPH was detected in four soil samples from the disposal area at concentrations ranging from 61 mg/kg (CF3-SS-15) to 270 mg/kg (CF3-SS-20) (Table 6-4).

Three VOCs, 5 pesticides, and 1 of the 12 inorganic analytes detected in the four surface soil samples from the helicopter crash area were retained as ECPCs for evaluation in the OU 8 ERA. The 11 remaining inorganic analytes were eliminated as ECPCs because either the maximum detected concentration was less than 2 times the mean background screening concentration or the analyte is considered an essential nutrient. TPH was detected in three of the four soil samples from the helicopter crash site, at concentrations ranging from 29 to 370 mg/kg (Table 6-4).

6.2.2 Surface Water In June 1993, one unfiltered surface water sample (RC-SW-3) was collected in Rowell Creek approximately in the center of the OU 8 plume discharge location. Two additional unfiltered surface water samples were collected in November 1994 from Rowell Creek above and below RC-SW-3 (CF3-SW-1 and CF3-SW-2, respectively) (Figure 3-1). All three surface water samples were

Table 6-2
Selection of Ecological Chemicals of Potential Concern for Disposal Area Surface Soils

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detection Limits	Range of Detected Concentrations	Average of Detected Concentrations[2]	2X Average Background Concentration[3]	Ecological Chemical of Potential Concern?	95th % UCL[4]	Average of All Concentrations[5]	Exposure Point Concentrations	
									Maximum[6]	Average[7]
Volatile Organic Compounds (µg/kg)										
Acetone	1/20	12 to 31	4	4	NA	Yes	8	7.1	4	4
2-Butanone	2/20	11.5 to 14	2 to 3	2.5	NA	Yes	6.8	5.9	3	3
Methylene chloride	2/20	6 to 12	3 to 4	3.5	NA	Yes	NC	3.1	4	3.1
Xylenes (total)	12/20	6 to 14	3 to[8] 8	4	NA	Yes	3.9	3.6	3.9	3.6
Semivolatile Organic Compounds (µg/kg)										
Acenaphthylene	1/20	350 to 480	170	170	NA	No[9]				
Anthracene	1/20	350 to 480	59	59	NA	No[9]				
Benzo(a)anthracene	2/20	350 to 480	44 to 620	332	NA	Yes	270	217	270	217
Benzo(a)pyrene	4/20	350 to 480	23 to 440	174	NA	Yes	273	199	273	199
Benzo(b)fluoranthene	4/20	350 to 480	30 to 870	294	NA	Yes	296	223	296	223
Benzo(g,h,i)perylene	4/20	350 to 480	28 to 270	116	NA	Yes	262	188	262	188
Benzo(k)fluoranthene	2/20	350 to 480	85 to 280	183	NA	Yes	224	202	224	202
Butylbenzylphthalate	1/20	350 to 480	48	48	NA	No[9]				
Carbazole	1/20	350 to 480	24	24	NA	No[9]				
Chrysene	4/20	350 to 480	22 to 700	225	NA	Yes	302	210	302	210
Dibenz(a,h)anthracene	2/20	350 to 480	32 to 100	66	NA	Yes	242	191	100	100
Di-n-butylphthalate	1/20	350 to 480	1,400	1,400	NA	Yes	302	264	302	264
bis(2-Ethylhexyl)phthalate	2/20	350 to 480	180 to 290	235	NA	Yes	217	208	217	208

See notes at end of table.

Table 6-2 (Continued)
Selection of Ecological Chemicals of Potential Concern for Disposal Area Surface Soils

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detection Limits	Range of Detected Concentrations	Average of Detected Concentrations[2]	2X Average Background Concentration[3]	Ecological Chemical of Potential Concern?	95th % UCL[4]	Average of All Concentrations[5]	Exposure Point Concentrations	
									Maximum[6]	Average[7]
Semivolatile Organic Compounds (µg/kg) (Continued)										
Fluoranthene	4/20	350 to 480	29 to 720	228	NA	Yes	299	210	299	210
Indeno(1,2,3-cd)pyrene	3/20	350 to 480	22 to 330	157	NA	Yes	270	199	270	199
2-Methylphenol	1/20	350 to 480	24	24	NA	Yes	257	195	[illegible]	24
Phenanthrene	1/20	350 to 480	44	44	NA	No[9]				
Pyrene	3/20	350 to 480	23 to 890	323	NA	Yes	324	224	324	224
Pesticides and PCBs (µg/kg)										
Aroclor-1254	1/20	38.5 to 200	[8]14.75	14.8	NA	Yes	27.7	24.3	14.75	14.75
alpha-Chlordane	6/20	1.95 to 10	0.099 to [8] 0.595	0.39	NA	Yes	1.7	1.1	0.6	0.6
gamma-Chlordane	4/20	1.95 to 10	[8] 0.119 to 0.8	0.36	NA	Yes	1.7	1.1	0.8	0.8
4,4'-DDT	7/20	3.9 to 20	1.3 to 10	5.3	NA	Yes	6.2	4.3	6.2	4.3
Dieldrin	1/20	2.1 to 20	1.6	1.6	NA	Yes	2.2	2	1.6	1.6
Endosulfan II	3/20	3.85 to 20	0.17 to 0.63	0.35	NA	Yes	3.8	2.2	0.63	0.63
Inorganic Analytes (mg/kg)										
Aluminum	20/20	40 to 40	527 to 2,010	1,449	10,100	No[10]				
Antimony	1/20	12 to 12	2.1	2.1	NA	Yes	6.4	5.8	2.1	2.1
Barium	19/20	40 to 40	1.8 to 27.6	6.3	12	Yes	10.3	7	10.3	7
Cadmium	5/20	1 to 1	0.24 to 2.6	1.1	NA	Yes	0.79	0.64	0.79	0.64

See notes at end of table.

Table 6-2 (Continued)
Selection of Ecological Chemicals of Potential Concern for Disposal Area Surface Soils

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detection Limits	Range of Detected Concentrations	Average of Detected Concentrations[2]	2X Average Background Concentration[3]	Ecological Chemical of Potential Concern?	95th % UCL[4]	Average of All Concentrations[5]	Exposure Point Concentrations	
									Maximum[6]	Average[7]
Inorganic Analytes (mg/kg) (Continued)										
Calcium	19/20	1,000 to 1,000	513 to 66,100	12,597	458	No[11]				
Chromium	10/20	2 to 2	0.4 to 6.2	2	25.8	No[10]				
Copper	18/20	5 to 5	0.48 to 42.4	6.4	NA	Yes	11.9	6	11.9	6
Iron	20/20	20 to 20	185 to 2,100	621	2,792	No[10,11]				
Lead	20/20	0.6 to 0.6	2.2 to 258	18.3	9.4	Yes	20.3	18.3	20.3	18.3
Magnesium	19/20	1,000 to 1,000	58 to [8] 1,622	252	230	No[11]				
Manganese	19/20	3 to 3	2.6 to 41.5	11.8	11	Yes	17.5	11.3	17.5	11.3
Mercury	3/20	0.1 to 0.1	0.16 to 0.32	0.26	NA	Yes	0.1	0.08	0.1	0.08
Nickel	8/20	8 to 8	0.57 to 2.4	1.2	7.2	No[10]				
Potassium	16/20	1,000 to 1,000	24.1 to [8] 298.9	55.6	310	No[10,11]				
Selenium	1/20	1 to 1	[8]0.75	0.75	NA	No[9]				
Silver	5/20	2 to 2	0.33 to 4.4	1.7	NA	Yes	1.4	1.2	1.4	1.2
Sodium	9/20	1,000 to 1,000	122 to 241	171	NA	No[11]				
Vanadium	20/20	10 to 10	0.79 to 4.6	2	13	No[10]				
Zinc	6/20	4 to 4	13.5 to 93.9	35.4	NA	Yes	24.8	12	24.8	12

See notes on following page.

Table 6-2 (Continued)
Selection of Ecological Chemicals of Potential Concern for Disposal Area Surface Soils

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

[1] Frequency of detection is equal to the number of samples in which the analyte is detected divided by the total number of samples analyzed (excluding rejected values).
[2] Arithmetic mean of all samples in which analyte was detected.
[3] Background sample locations include CEFBSS01, CEFBSS02 plus duplicate, CEFBSS03, CEFBSS04, CEFBSS05, CEFBSS06, CEFBSS07, CEFBSS08, CEFBSS10, CEFBSS11, CEFBSS12, CEFBSS13, CEFBSS14, and CEFBSS15. Two times the mean background concentration for inorganics was calculated.
[4] The 95th percent UCL is calculated on the log-transformed average of all concentrations using the formula provided in the U.S. Environmental Protection Agency (USEPA) Region IV supplemental guidance (USEPA, 1991e).
[5] The average of all concentrations assigns a value of 1/2 the detection limit to all nondetections.
[6] Maximum exposure point concentration (EPC) is the lesser of the maximum detected concentration or the 95th percent UCL.
[7] Average EPC is equal to the mean of all concentrations. When the mean is greater than the maximum EPC, the maximum EPC was used.
[8] The detected concentration has been elevated due to averaging a detection with a nondetection (using 1/2 the sample quantitation limit SQL) detection limit in a duplicate pair.
[9] Detected in less than 5 percent of the samples, and not selected as an ecological contaminant of potential concern in any other medium.
[10] Maximum analyte concentration is less than 2 times the average background concentration for inorganic compounds.
[11] Analyte is an essential nutrient, and not considered toxic except at high concentrations.

Notes: Sample locations include CF3-SS-1 through CF3-SS-10 (and its duplicate), and CF3-SS-14 through CF3-SS-23 (including a duplicate at CF3-SS-20).

2x = two times.
% = percent.
UCL = upper confidence limit.
μg/kg = micrograms per kilogram.
NA = not available.
NC = not able to calculate value.
PCB = polychlorinated biphenyl.
DDT = dichlorodiphenyltrichloroethane.
mg/kg = milligrams per kilogram.

Table 6-3
Selection of Ecological Chemicals of Potential Concern for Helicopter Crash Site Surface Soil

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detection Limits	Range of Detected Concentrations	Average of Detected Concentrations[2]	2X Average Background Concentration[3]	Ecological Contaminant of Potential Concern?	95th % UCL[4]	Average of All Concentrations[5]	Exposure Point Concentrations	
									Maximum[6]	Average[7]
Volatile Organic Compounds (µg/kg)										
1,1-Dichloroethylene	1/4	7 to 43.5	3	3	NA	Yes	245	7.9	3	3
1,2-Dichloroethylene (total)	1/4	7 to 43.5	4	4	NA	Yes	185	8.2	4	4
Toluene	1/4	7 to 43.5	3	3	NA	Yes	245	7.9	3	3
Semivolatile Organic Compounds (µg/kg)										
Phenol	1/4	480 to 565	[8]33	33	NA	Yes	10,199	188	33	33
Pesticides and PCBs (µg/kg)										
alpha-BHC	1/4	2.5 to 3	[8]0.89	0.89	NA	Yes	1.5	1.2	0.89	0.89
alpha-Chlordane	1/4	2.5 to 2.9	[8]0.805	0.81	NA	Yes	1.6	1.1	0.81	0.81
4,4'-DDT	1/4	4.8 to 5.45	[8]2.575	2.6	NA	Yes	NC	2.5	2.575	2.5
Endosulfan II	1/4	0.2 to 5.7	[8]1.55	1.6	NA	Yes	18,034	1.1	1.6	1.1
Endrin ketone	1/4	4.8 to 5.65	4	4	NA	Yes	4.1	2.9	4	2.9
Inorganic Analytes (mg/kg)										
Aluminum	4/4	40 to 40	540 to 830	637	10,100	No[9]				
Barium	4/4	40 to 40	2.5 to [8].3	4.5	12	No[9]				
Calcium	4/4	1,000 to 1,000	1,040 to [8]2,660	2,090	458	No[10]				
Chromium	2/4	2 to 2	[8]0.905 to 1.4	1.2	25.8	No[9]				
Copper	4/4	5 to 5	1.2 to [8]2.3	1.9	NA	Yes	2.9	1.9	2.3	1.9
Iron	4/4	20 to 20	305 to 562	420	2,792	No[9,10]				
Lead	4/4	0.6 to 0.6	2.9 to 6	4.6	9.4	No[9]				
Magnesium	4/4	1,000 to 1,000	70.8 to 234	139	230	No[10]				

See notes at end of table.

Table 6-3 (Continued)
Selection of Ecological Chemicals of Potential Concern for Helicopter Crash Site Surface Soil

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detection Limits	Range of Detected Concentrations	Average of Detected Concen-trations[2]	2X Average Background Concen-tration[3]	Ecological Contaminant of Potential Concern?	95th % UCL[4]	Average of All Concen-trations[5]	Exposure Point Concentrations	
									Maximum[6]	Average[7]
Inorganic Analytes (mg/kg) (Continued)										
Manganese	4/4	3 to 3	3.2 to 8.6	5.7	11	No[9]				
Nickel	1/4	8 to 8	0.76	0.76	7.2	No[9]				
Potassium	4/4	1,000 to 1,000	33.9 to 68.5	46.8	310	No[9,10]				
Vanadium	4/4	10 to 10	1.3 to[8] 1.55	1.4	13	No[9]				

[1] Frequency of detection is equal to the number of samples in which the analyte is detected divided by the total number of samples analyzed (excluding rejected values).
[2] Arithmetic mean of all samples in which analyte was detected.
[3] Background sample locations include CEFBSS01, CEFBSS02 plus duplicate, CEFBSS03, CEFBSS04, CEFBSS05, CEFBSS06, CEFBSS07, CEFBSS08, CEFBSS10, CEFBSS11, CEFBSS12, CEFBSS13, CEFBSS14, and CEFBSS15. Two times the mean background concentration for inorganics was calculated.
[4] The 95th percent UCL is calculated on the log-transformed average of all concentrations using the formula provided in the U.S. Environmental Protection Agency (USEPA) Region IV supplemental guidance (1991e).
[5] The average of all concentrations assigns a value of 1/2 the detection limit to all nondetections.
[6] Maximum exposure point concentration (EPC) is the lesser of the maximum detected concentration or the 95th percent UCL.
[7] Average EPC is equal to the mean of all concentrations. When the mean is greater than the maximum EPC, the maximum EPC was used.
[8] The detected concentration has been elevated due to averaging a detection with a nondetection (using 1/2 the sample quantitation limit SQL) detection limit in a duplicate pair.
[9] Maximum analyte concentration is less than 2 times the average background concentration for inorganic compounds.
[10] Analyte is an essential nutrient, and not considered toxic except at high concentrations.

Notes: Sample locations include CF5-SS-11 through CF3-SS-13, and CF3-SS-24 (and its duplicate).

2x = two times.
% = percent.
UCL = upper confidence limit.
μg/kg = micrograms per kilogram.
NA = not available.
PCB = polychlorinated biphenyl.
BHC = benzene hexachloride.
DDT = dichlorodiphenyltrichloroethane.
NC = not able to calculate value.
mg/kg = milligrams per kilogram.

Table 6-4
Summary of Operable Unit 8 Total Petroleum Hydrocarbon (TPH) Data

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Medium	Sampling Location	TPH
Surface Soil (mg/kg)		
	CF3-SS-6	68
	CF3-SS-7	110
	CF3-SS-11	29
	CF3-SS-12	370
	CF3-SS-15	61
	CF3-SS-20	[1] 270
	CF3-SS-24	[1] 104
Groundwater (μg/ℓ)		
	CF3-MW-3S	1,800
	CF3-MW-4S	1,700
	CF3-MW-6S	2,100
	CF3-MW-7S	1,000
	CF3-MW-17DD	700
	CF3-MW-24D	600

[1] Average of duplicate samples.

Notes: mg/kg = milligrams per kilogram.
μg/ℓ = micrograms per liter.

collected downgradient of the Navy wastewater treatment plant. Surface water from sampling station CF3-SW-2 was collected to represent upgradient conditions unimpacted by the OU 8 groundwater plume, whereas surface water from CF3-SW-1 was collected to represent conditions within and downgradient from plume discharge. Surface water analytical results for OU 8 are summarized in Table 6-5.

Fourteen analytes were detected in the upstream surface water sample. Two times the detected upstream concentrations were used for screening surface water inorganic ECPCs in Rowell Creek adjacent to OU 8. Endosulfan I was the only analyte detected in the upstream sample (0.008 micrograms per liter [μg/ℓ]) that was not present in either of the downstream locations.

Four analytes were identified as ECPCs in the mid-plume location adjacent to OU 8 (station CF3-SW-3). Chloroform was selected only as a wildlife ECPC because the maximum detected concentration was less than the USEPA Region IV surface water screening criterion for aquatic species. The remaining three analytes were selected as both wildlife and aquatic ECPCs.

In the downstream sample (CF3-SW-1), eight analytes were retained as ECPCs, five of which were selected only as wildlife ECPCs because the maximum detected concentrations were less than the USEPA Region IV surface water screening criteria for aquatic species.

Table 6-5
Selection of Ecological Chemicals of Potential Concern (ECPC) for Unfiltered Surface Water

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Detection Limits	Mid-Plume ECPC					Downstream ECPC				
		Detected Concen-tration at RC-SW-3	Region IV Chronic Water Quality Screening Value[1]	2X Average Upstream Concen-tration[2]	Ecological Contaminant of Potential Concern?[3]		Detected Concentration at CF3-SW-1	Region IV Chronic Water Quality Screening Value[1]	2X Average Upstream Concen-tration[2]	Ecological Contaminant of Potential Concern?[3]	
Volatile Organic Compounds (µg/ℓ)											
Bromodichloromethane	1	2	NA	NA	Yes	A/W[4]	3.5	NA	NA	Yes	A/W[4]
Chloroform	[5]2	5	289	NA	Yes	W[4,6]	5	289	NA	Yes	W[4,6]
Dibromochloromethane	2	ND					2	NA	NA	Yes	A/W[4]
Methylene chloride	2	ND					3.5	1,930	NA	Yes	W[4,8]
Inorganic Analytes (µg/ℓ)											
Aluminum	200	141	[7]87	ND	Yes	A/W	559	[7]87	ND	Yes	A/W
Antimony	60	ND					2.3	160	ND	Yes	W[6]
Barium	200	ND					26.1	NA	55.6	No[8]	
Calcium	5,000	26,500	NA	46,400	No[8,9]		16,700	NA	46,400	No[8,9]	
Copper	25	ND					4.6	[10] 12	4.6	No[6,8]	
Iron	100	702	1,000	910	No[6,8]		976	1,000	910	Yes	W[6]
Lead	5	ND					2.2	[10] 3.3	ND	Yes	W[6]
Magnesium	5,000	9,670	NA	12,100	No[8,9]		3,490	NA	12,100	No[8,9]	
Manganese	15	10.7	NA	35.6	No[8]		19.7	NA	35.6	No[8]	
Potassium	5,000	4,500	NA	5,380	No[8,9]		1,260	NA	5,380	No[8,9]	
Silver	10	0.24	0.012	ND	Yes	A/W	ND				

See notes at end of table.

Table 6-5 (Continued)
Selection of Ecological Chemicals of Potential Concern (ECPCs) for Unfiltered Surface Water

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Detection Limits	Mid-Plume ECPC				Downstream ECPC			
		Detected Concentration at RC-SW-3	Region IV Chronic Water Quality Screening Value[1]	2X Average Upstream Concentration[2]	Ecological Contaminant of Potential Concern?[3]	Detected Concentration at CF3-SW-1	Region IV Chronic Water Quality Screening Value[1]	2X Average Upstream Concentration[2]	Ecological Contaminant of Potential Concern?[3]
Inorganic Analytes (μg/ℓ) (Continued)									
Sodium	5,000	27,200	NA	38,000	No[8,9]	10,800	NA	38,000	No[8,9]
Vanadium	50	ND				1.8	NA	2.8	No[8]
Hardness	NA	106	NA	NA	NA	97	NA	NA	NA

[1] U.S. Environmental Protection Agency (USEPA) Region IV Waste Management Division Chronic Freshwater Quality Screening Values based on the Water Quality Standards Units Screening List (USEPA, 1992h).
[2] Surface water location CF3-SW-2 was used as the upstream sample location. Two times the upstream concentration is calculated for inorganics only.
[3] A = Contaminant of Potential Concern (CPC) for aquatic receptors
W = CPC for terrestrial wildlife
[4] Analyte was detected in upstream sample at similar concentration.
[5] The detection limit for chloroform for sample CF3-SW-3 was 10 μg/ℓ.
[6] Maximum analyte concentration is below the Region IV chronic surface water screening value.
[7] Criterion is based on a pH of 6.5-9 (USEPA, 1988e).
[8] Maximum analyte concentration is less than or equal to 2 times the average upstream concentration for inorganic compounds.
[9] Analyte is an essential nutrient, and is not considered toxic except at high concentrations.
[10] Hardness-dependent criterion based on a mean site-specific hardness concentration of 104 milligrams per liter as calcium carbonate.

Notes: 2x = two times.
μg/ℓ = micrograms per liter.
NA = not available/not applicable.
ND = not detected.

6.2.3 Sediment In June 1993, one sediment sample (RC-SD-3) was collected in Rowell Creek approximately in the center of the OU 8 plume discharge location. Two additional sediment samples were collected in November 1994 from Rowell Creek above and below RC-SD-3 (CF3-SD-2 and CF3-SD-1, respectively) (Figure 3-1). Sediment from sampling station CF3-SD-2 was collected to represent upgradient conditions unimpacted by the OU 8 groundwater plume, whereas sediment from CF3-SD-1 was collected to represent conditions within and downgradient from plume discharge. Table 6-6 lists all analytes detected in sediment at these two stations. All sediment sample locations were collocated with surface water sample locations.

Seven inorganic analytes detected in upgradient sediment samples were used to screen ECPCs. Two times the detected upgradient concentrations were used for screening sediment inorganic ECPCs in Rowell Creek adjacent to OU 8. All analytes detected in the upgradient sample (CF3-SD-2) were present in the downgradient location (CF3-SD-1), and all but calcium and magnesium were present in the RC-SD-3 sample.

At RC-SD-3, 2-butanone, 2 phthalate esters, Aroclor-1254, 4,4'-DDE, and 4 of the 10 detected inorganic analytes were identified as ECPCs. Four ECPCs (4,4'-DDE, copper, lead, and zinc) were selected only as wildlife ECPCs because their maximum detected concentrations were less than the USEPA Region IV sediment screening criteria for aquatic species. TPH was not detected in RC-SD-3.

In the downgradient sample (CF3-SD-1), three analytes were identified as ECPCs: 2-butanone, 4,4'-DDT, and endrin ketone. None of the seven detected inorganic analytes were selected as ECPCs because maximum analyte concentrations were less than 2 times the average upstream concentration and/or the analyte is an essential nutrient. TPH was undetected at CF3-SD-1.

6.2.4 Groundwater Aquatic receptors in Rowell Creek adjacent to OU 8 may be exposed to groundwater contamination as it discharges to the surface. For this reason, analytes detected in the OU 8 aquifer are screened as potential ECPCs. The unfiltered groundwater data for OU 8 are summarized in Table 6-7; evaluation of unfiltered groundwater data is highly conservative because particulates in the groundwater are not likely to be discharged to Rowell Creek (i.e., soluble or dissolved metals are far more mobile than particulates).

Data collected in 1994 from 14 monitoring wells were used to evaluate groundwater conditions potentially contributing to surface water contamination in Rowell Creek adjacent to OU 8. All wells screened at shallow, intermediate, and deep intervals from the upper aquifer were included in the summary of groundwater data; groundwater from any of these intervals could conceivably discharge to the OU 8 wetland or Rowell Creek. In addition, data from two of the monitoring wells sampled in November 1994 were used to evaluate groundwater toxicity to fish and aquatic invertebrates through laboratory toxicity testing. These data are presented in Section 6.5.

Data from three upgradient monitoring well locations (CF3-MW-8S, CF3-MW-9, and CF3-MW-10D) were used for screening groundwater ECPCs. The locations of all 17 monitoring wells considered in this ERA are shown on Figure 3-3.

Table 6-6
Selection of Ecological Chemicals of Potential Concern (ECPCs) for Sediment

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Detection Limits	Mid-Plume ECPC					Downstream ECPC				
		Detected Concentration at RC-SD-3	Region IV Chronic Sediment Quality Screening Value[1]	2X Average Upstream Concentration[2]	Ecological Contaminant of Potential Concern?[3]		Detected Concentration at CF3-SD-1	Region IV Chronic Sediment Quality Screening Value[1]	2X Average Upstream Concentration[2]	Ecological Contaminant of Potential Concern?[3]	
Volatile Organic Compounds (µg/kg)											
2-Butanone	14	6	NA	NA	Yes	A/W	4	NA	NA	Yes	A/W
Semivolatile Organic Compounds (µg/kg)											
Di-n-butylphthalate	460	310	NA	NA	Yes	A/W	ND				
bis(2-Ethylhexyl)phthalate	460	260	NA	NA	Yes	A/W	ND				
Pesticides and PCBs (µg/kg)											
Aroclor-1254	45	180	33	NA	Yes	A/W	ND				
4,4'-DDE	4	1.8	[4]3.3	NA	Yes	W[5]	ND				
4,4'-DDT	4	ND					4.4	3.3	NA	Yes	A/W
Endrin ketone	4	ND					0.55	3.3	NA	Yes	W[5]
Inorganic Analytes (mg/kg)											
Aluminum	40	1,010	NA	1,136	No[6]		394	NA	1,136	No[6]	
Barium	40	6.9	NA	NA	Yes	A/W	ND				
Calcium	1,000	912	NA	1,040	No[6,7]		351	NA	1,040	No[6,7]	
Copper	5	3.4	28	NA	Yes	W[5]	ND				
Iron	20	599	NA	526	No[7]		271	NA	526	No[6,7]	

See notes at end of table.

Table 6-6 (Continued)
Selection of Ecological Chemicals of Potential Concern (ECPCs) for Sediment

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Detection Limits	Mid-Plume ECPC					Downstream ECPC			
		Detected Concentration at RC-SD-3	Region IV Chronic Sediment Quality Screening Value[1]	2X Average Upstream Concentration[2]	Ecological Contaminant of Potential Concern?[3]		Detected Concentration at CF3-SD-1	Region IV Chronic Sediment Quality Screening Value[1]	2X Average Upstream Concentration[2]	Ecological Contaminant of Potential Concern?[3]
Inorganic Analytes (mg/kg) (Continued)										
Lead	[8]0.6	6.2	21	5.8	Yes	W[5]	3.5	21	5.8	No[5,6]
Magnesium	1,000	85.8	NA	99.6	No[6],7		49.9	NA	99.6	No[6,7]
Manganese	3	3	NA	8.6	No[6]		2.7	NA	8.6	No[6]
Vanadium	10	1.2	NA	2.2	No[6]		0.84	NA	2.2	No[6]
Zinc	4	14.6	68	NA	Yes	W[5]	ND			
Total organic carbon	NA	6,340	NA	NA	NA		1,300	NA	NA	NA

[1] Draft Region IV Waste Management Division Sediment Screening Values (U.S. Environmental Protection Agency, 1994e).
[2] Sediment sample CF3-SD-1 (and its duplicate) were used as upstream sample locations. Two times the upstream concentration is calculated for inorganics only.
[3] A = Contaminant of Potential Concern (CPC) for aquatic receptors
W = CPC for terrestrial wildlife
[4] Compound uses the 4,4'-DDT criterion as a surrogate based on structural and toxicological similarities.
[5] Maximum analyte concentration is below the Region IV chronic surface water screening value.
[6] Maximum analyte concentration is less than 2 times the average upstream concentration for inorganic compounds.
[7] Analyte is an essential nutrient, and is not considered toxic except at high concentrations.
[8] The detection limit for lead for sample CF3-SD-3 was 1.0.

Notes: 2x = two times.
μg/kg = micrograms per kilogram.
NA = not available.
ND = not detected.
PCB = polychlorinated biphenyl.
DDE = dichlorodiphenyldichloroethene.
DDT = dichlorodiphenyltrichloroethane.
mg/kg = milligrams per kilogram.

Table 6-7
Selection of Ecological Chemicals of Potential Concern for Undiluted Unfiltered Groundwater from the Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detection Limits	Range of Detected Concen-trations	Average of Detected Concen-trations[2]	Region IV Chronic Water Quality Screening Value[3]	2X Average Background Concen-tration[4]	Ecological Contam-inant of Potential Concern?	95th % UCL[5]	Average of All Concen-trations[6]	Exposure Point Concentrations	
										Maximum[7]	Average[8]
Volatile Organic Compounds (μg/ℓ)											
Acetone	1/14	2 to 550	180	180	NA	NA	Yes	781	47.7	180	47.7
Benzene	1/14	1 to 83	26	26	53	NA	No[9]				
2-Butanone	3/14	2 to 170	1 to 25	9	NA	NA	Yes	134	15.2	25	15.2
1,1-Dichloroethane	8/14	1 to 170	1 to 590	167	[10]2,000	NA	No[9]				
1,1-Dichloroethylene	8/14	1 to 170	2 to 350	115	303	NA	Yes	14,186	65.7	350	65.7
1,2-Dichloroethylene	4/14	1 to 83	9 to 1,900	517	1,350	NA	Yes	10,301	151	1,900	151
1,1,1-Trichloroethane	4/14	1 to 170	96 to 860	342	528	NA	Yes	36,316	98.9	860	98.9
Trichloroethylene	6/14	1 to 83	9 to 1,700	476	NA	NA	Yes	228,662	206	1,700	206
Xylenes (total)	5/14	1 to 170	9 to 150	51	NA	NA	Yes	645	20.9	150	20.9
Semivolatile Organic Compounds (μg/ℓ)											
Benzo(b)fluoranthene	1/14	10 to 2,000	3	3	NA	NA	Yes	276	87.5	3	3
1,2-Dichlorobenzene	4/14	10 to 2,000	350 to 9,800	2,963	15.8	NA	Yes	62,318	852	9,800	852
1,3-Dichlorobenzene	4/14	10 to 2,000	9 to 240	75.5	50.2	NA	Yes	48.4	26.8	48.4	26.8
1,4-Dichlorobenzene	4/14	10 to 2,000	49 to 1,300	401	11.2	NA	Yes	567	120	567	120
Diethylphthalate	2/14	10 to 2,000	1 to 3	2	521	NA	No[9]				
2,4-Dimethylphenol	3/14	10 to 2,000	0.5 to 10	4.2	21.2	NA	No[9]				
Di-n-butylphthalate	1/14	10 to 2,000	0.8	0.8	9.4	NA	No[9]				

See notes at end of table.

Table 6-7 (Continued)
Selection of Ecological Chemicals of Potential Concern for Undiluted Unfiltered Groundwater from the Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detection Limits	Range of Detected Concen-trations	Average of Detected Concen-trations[2]	Region IV Chronic Water Quality Screening Value[3]	2X Average Back-ground Concen-tration[4]	Ecological Contam-inant of Potential Concern?	95th % UCL[5]	Average of All Concen-trations[6]	Exposure Point Concentrations	
										Maximum[7]	Average[8]
Semivolatile Organic Compounds (μg/ℓ) (Continued)											
bis(2-Ethylhexyl)phthalate	3/14	10 to 2,000	0.6 to 5	2.2	0.3	NA	Yes	679	88.5	5	5
2-Methylnaphthalene	7/14	10 to 2,000	0.8 to 200	86.3	NA	NA	Yes	633	52.4	200	52.4
2-Methylphenol	2/14	10 to 2,000	8 to 19	13.5	NA	NA	Yes	268	89.3	19	19
4-Methylphenol	4/14	10 to 2,000	3 to 61	20	NA	NA	Yes	365	90.4	61	61
Naphthalene	8/14	10 to 2,000	0.6 to 450	148	62	NA	Yes	1,882	86.5	450	86.5
Phenol	3/14	10 to 2,000	0.5 to 2	1	256	NA	No[9]				
Pesticides and PCBs (μg/ℓ)											
Aroclor 1248	2/14	0.8 to 1	0.6 to 0.79	0.7	0.014	NA	Yes	0.56	0.52	0.56	0.52
Endosulfan II	1/14	0.1 to 0.1	0.042	0.04	0.056	NA	No[9]				
Inorganic Analytes (μg/ℓ)											
Aluminum	9/14	200 to 200	37.4 to 47,400	6,087	[11]87	17,200	Yes	28,854	3,949	28,854	3,949
Arsenic	6/14	10 to 10	1.5 to 24.7	8.8	[12]190	7.6	No[9]				
Barium	14/14	200 to 200	6 to 48.1	25	NA	42	Yes	41.7	25	41.7	25
Calcium	14/14	5,000 to 5,000	1,440 to 69,900	32,840	NA	47,100	No[13]				
Chromium	1/14	10 to 10	36.6	36.6	[14] 11	NA	Yes	9	7.3	9	7.3
Cobalt	1/14	50 to 50	10.7	10.7	NA	20	No[15]				

See notes at end of table.

Table 6-7 (Continued)
Selection of Ecological Chemicals of Potential Concern for Undiluted Unfiltered Groundwater from the Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detection Limits	Range of Detected Concentrations	Average of Detected Concentrations[2]	Region IV Chronic Water Quality Screening Value[3]	2X Average Background Concentration[4]	Ecological Contaminant of Potential Concern?	95th % UCL[5]	Average of All Concentrations[6]	Exposure Point Concentrations	
										Maximum[7]	Average[8]
Inorganic Analytes (µg/ℓ) (Continued)											
Copper	4/14	25 to 25	6.1 to 73.5	29.9	[16]12	NA	Yes	23.3	17.5	23.3	17.5
Iron	12/14	100 to 100	44.6 to 36,500	5,717	1,000	2,500	Yes	293,608	4,907	36,500	4,907
Lead	3/14	3 to 3	1.8 to 7.6	4	[16]3.3	13	Yes[13]	2.5	2	2.5	2
Magnesium	14/14	5,000 to 5,000	247 to 12,400	4,615	NA	6,820	No[13]				
Manganese	14/14	15 to 15	4.2 to 170	40.5	NA	99	Yes	122	40.5	122	40.5
Nickel	1/14	40 to 40	12.8	12.8	[16]162	38	No[9]				
Potassium	14/14	5,000 to 5,000	159 to 4,600	1,627	NA	3,920	No[13]				
Sodium	14/14	5,000 to 5,000	1,920 to 13,100	7,200	NA	12,400	No[13]				
Vanadium	1/14	50 to 50	26.5	26.5	NA	NA	Yes	NC	25.1	26.5	25.1
Zinc	5/14	20 to 20	2.1 to 10.1	5.9	110	NA	No[10]				

See notes at end of table.

Table 6-7 (Continued)
Selection of Ecological Chemicals of Potential Concern for Undiluted Unfiltered Groundwater from the Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

[1] Frequency of detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples.
[2] Arithmetic mean of all samples in which analyte was detected.
[3] U.S. Environmental Protection Agency (USEPA) Region IV Waste Management Division Chronic Freshwater Quality Screening Values based on the Water Quality Standards Units Screening List (USEPA, 1992h).
[4] Monitoring wells CF3-MW-8S, CF3-MW-9I, and CF3-MW-10D were used as upgradient sample locations. Two times the upgradient concentration is calculated for inorganics only.
[5] The 95th percent UCL is calculated on the log-transformed average of all concentrations using the formula provided in the USEPA Region IV Supplemental Guidance (USEPA, 1991e).
[6] The average of all concentrations assigns a value of 1/2 the detection limit to all nondetects.
[7] Maximum exposure point concentrations (EPCs) were selected using the following criteria:
- When the sample size was ≤ 3, the maximum detected concentration was used.
- When the sample size was ≥ 4, the lesser of the maximum detected concentration or the 95th percent UCL was selected.

[8] Average EPCs are equal to the mean of all concentrations. When the mean is greater than the maximum EPC, the maximum EPC was used.
[9] Maximum analyte concentration is below the Region IV chronic surface water screening value.
[10] Screening value for 1,2-dichloroethane was used as a surrogate.
[11] Criterion is based on a pH of 6.5-9 (USEPA, 1988a). This value is protective of fish species that are not expected to be found in Rowell Creek. The chronic values for aquatic species expected to be found in Rowell Creek include 742.2 μg/ℓ for *Daphnia magna*, 1,908 μg/ℓ for *Ceriodaphnia dubia*, and 3,288 μg/ℓ for the fathead minnow.
[12] Screening value for the trivalent species of arsenic.
[13] Analyte is an essential nutrient, and is not considered toxic except at high concentrations.
[14] Screening value for the hexavalent species of chromium.
[15] Maximum analyte concentration is less than 2X the average upgradient concentration for inorganic compounds.
[16] Hardness-dependent criterion based on a mean site-specific surface water hardness concentration of 104 milligrams per liter as calcium carbonate.

Notes: Sample locations include: CF3-MW-3S, CF3-MW-4S, CF3-MW-6S, CF3-MW-7D, CF3-MW-7S, CF3-MW-13S, MF3-MW-14I, MF3-MW-15D, MF3-MW-18S, MF3-MW-19D, CF3-MW-28S, CF3-MW-29D, CF3-MW-31S, and CF3-MW-32D.

2x = two times.
% = percent.
UCL = upper confidence limit.
μg/ℓ = micrograms per liter.
NA = not available.
PCB = polychlorinated biphenyl.
NC = not able to calculate value.
≤ = less than or equal to.
≥ = greater than or equal to.

Twenty-five ECPCs were identified in OU 8 undiluted, unfiltered groundwater (Table 6-7). ECPCs include seven VOCs, nine SVOCs, Aroclor 1248, and eight inorganic analytes. The nine selected SVOC ECPCs included one phthalate ester, three dichlorobenzene isomers, two phenolic analytes, and three PAHs. Organic analytes that were not selected as ECPCs included two VOCs (benzene and 1,1-dichloroethane), four SVOCs (diethphthalate, 2,4-dimethylphenol, di-n-butylphthalate, and phenol), and endosulfan. The basis for elimination was that the maximum analyte concentration was below the USEPA Region IV chronic water quality screening value. Eight inorganic analytes were not selected as ECPCs because the maximum analyte concentration was below the USEPA Region IV chronic water quality screening value, the maximum analyte concentration was less than two times the average upgradient concentration for inorganic compounds, and/or the analyte is an essential nutrient. TPH concentrations in OU 8 groundwater ranged from 600 to 2,100 $\mu g/\ell$ (Table 6-4).

Filtered groundwater samples were also collected from the 14 OU 8 monitoring wells (Table 6-8). Evaluation of the filtered groundwater data (inorganics only) resulted in the selection of six inorganic ECPCs. Two inorganic ECPCs selected for unfiltered groundwater analysis (chromium and vanadium) were undetected in filtered groundwater from OU 8, indicating that they may be sorbed to suspended particulates within the groundwater.

An additional evaluation was performed whereby ECPCs were selected in diluted groundwater. Table 6-9 presents the unfiltered groundwater data with a dilution factor of 133-fold (7.53×10^{-3}) applied to the maximum detected concentration. This dilution factor was calculated to represent the concentration of ECPCs in surface water when groundwater discharges to Rowell Creek (Appendix X). These dilution-adjusted values were then screened against the USEPA Region IV surface water screening values; 14 of the 25 analytes identified as ECPCs in undiluted groundwater were eliminated as diluted groundwater ECPCs. Analytes that no longer qualified as ECPCs following dilution included many of the chlorinated volatile compounds, two of the dichlorobenzene isomers, bis(2-ethylhexyl)phthalate, naphthalene, Aroclor-1248, endosulfan II, and all the inorganic analytes except aluminum and vanadium.

6.3 EXPOSURE ASSESSMENT. Exposure assessment is the process of estimating or measuring the amount of an ECPC to which an ecological receptor may be exposed. The following subsections discuss how contaminant exposures were estimated or measured for aquatic receptors, wildlife, terrestrial plants, and terrestrial soil invertebrates at OU 8. The site conceptual model (Figure 6-1) provides a summary of the potential exposure pathways that exist at OU 8 for each group of receptors.

6.3.1 Calculation of EPCs To assess exposure to terrestrial and aquatic receptors from ECPCs in OU 8 media, maximum and average EPCs were chosen for all ECPCs in surface soil and groundwater. When the sample size was less than or equal to three, the maximum detected concentration was used as the maximum EPC. When the sample size was greater than or equal to four, the lesser of the maximum detected concentration or the 95th percentile UCL calculated on the log-transformed arithmetic average was selected as the maximum EPC. The average of all samples represents a value of one-half the detection limit of all samples in

Table 6-8
Selection of Inorganic Ecological Chemicals of Potential Concern for Undiluted Filtered Groundwater from the Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detection Limits	Range of Detected Concentrations	Average of Detected Concentrations[2]	Region IV Chronic Water Quality Screening Value[3]	2X Average Background Concentration[4]	Ecological Contaminant of Potential Concern?	95th % UCL[5]	Average of All Concentrations[6]	Exposure Point Concentrations	
										Maximum[7]	Average[8]
Inorganic Analytes (µg/ℓ)											
Aluminum	6/14	200 to 200	37.4 to 876	285	[9]87	NA	Yes	284	179	284	179
Arsenic	5/14	10 to 10	1.4 to 26.4	10.3	[10]190	13.2	No[11]				
Barium	14/14	200 to 200	4.6 to 43.7	21.7	NA	30	Yes	37	21.7	37	21.7
Calcium	14/14	5,000 to 5,000	800 to 67,200	32,065	NA	45,500	No[12]				
Copper	3/14	25 to 25	5.8 to 24.8	12.2	[13]12	NA	Yes	15.2	12.4	15.2	12.4
Iron	10/14	100 to 100	20.9 to 35,800	5,871	1,000	400	Yes	488,942	4,208	35,800	4,208
Lead	2/14	3 to 3	1.2 to 4	2.6	[13]3.3	NA	Yes	1.9	1.7	1.9	1.7
Magnesium	14/14	5,000 to 5,000	289 to 11,900	4,412	NA	6,550	No[12]				
Manganese	13/14	15 to 15	4.3 to 163	40.1	NA	104	Yes	105	37.8	105	37.8
Potassium	13/14	5,000 to 5,000	165 to 3,560	1,527	NA	3,840	No[12, 14]				
Sodium	14/14	5,000 to 5,000	1,960 to 12,400	6,765	NA	11,600	No[12]				
Zinc	4/14	20 to 20	2.9 to 38.5	20.2	[13]110	NA	No[11]				

See notes on the following page.

Table 6-8 (Continued)
Selection of Inorganic Ecological Chemicals of Potential Concern for Undiluted Filtered Groundwater from the Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

[1] Frequency of detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples.
[2] Arithmetic mean of all samples in which analyte was detected.
[3] U.S. Environmental Protection Agency (USEPA) Region IV Waste Management Division Chronic Freshwater Quality Screening Values based on the Water Quality Standards Units Screening List (USEPA, 1992h).
[4] Monitoring wells CF3-MW-8S, CF3-MW-9I, and CF3-MW-10D were used as upgradient sample locations. Two times the upgradient concentration is calculated for inorganics only.
[5] The 95th percent UCL is calculated on the log-transformed average of all concentrations using the formula provided in the USEPA Region IV Supplemental Guidance (1991e).
[6] The average of all concentrations assigns a value of 1/2 the detection limit to all nondetects.
[7] Maximum exposure point concentrations (EPCs) were selected using the following criteria:

- When the sample size was ≤ 3, the maximum detected concentration was used.
- When the sample size was ≥ 4, the lesser of the maximum detected concentration or the 95th percent UCL was selected.

[8] Average EPCs are equal to the mean of all concentrations. When the mean is greater than the maximum EPC, the maximum EPC was used.
[9] Criterion is based on a pH of 6.5-9 (USEPA, 1988a). This value is protective of fish species that are not expected to be found in Rowell Creek. The chronic values for aquatic species expected to be found in Rowell Creek include 742.2 μg/ℓ for *Daphnia magna*, 1,908 μg/ℓ for *Ceriodaphnia dubia*, and 3,288 μg/ℓ for the fathead minnow.
[10] Screening value for the trivalent species of arsenic.
[11] Maximum analyte concentration is below the Region IV chronic surface water screening value.
[12] Analyte is an essential nutrient, and is not considered toxic except at high concentrations.
[13] Hardness-dependent criterion based on a mean site-specific hardness concentration of 103.5 milligrams per liter as calcium carbonate.
[14] Maximum analyte concentration is less than 2 times the average upgradient concentration for inorganic compounds.

Notes: Sample locations include CF3-MW-3S, CF3-MW-4S, CF3-MW-6S, CF3-MW-7D, CF3-MW-7S, CF3-MW-13S, MF3-MW-14I, MF3-MW-15D, MF3-MW-18S, MF3-MW-19D, CF3-MW-28S, CF3-MW-29D, CF3-MW-31S, and CF3-MW-32D.

2x = two times.
% = percent.
UCL = upper confidence limit.
μg/ℓ = micrograms per liter.
NA = not available.
≤ = less than or equal to.
≥ = greater than or equal to.

Table 6-9
Selection of Ecological Chemicals of Potential Concern for Diluted Unfiltered Groundwater from the Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detection Limits	Range of Detected Concentrations	Maximum Detected Concentration After Dilution[2]	Average of Detected Concentrations[3]	Region IV Chronic Water Quality Screening Value[4]	2X Average Background Concentration[5]	Ecological Contaminant of Potential Concern?	95th % UCL[6]	Average of All Concentrations[7]	Exposure Point Concentrations	
											Maximum[8]	Average[9]
Volatile Organic Compounds (µg/ℓ)												
Acetone	1/14	2 to 550	180	1.4	180	NA	NA	Yes	781	47.7	1.4	1.4
Benzene	1/14	1 to 83	26	0.20	26	53	NA	No[10]				
2-Butanone	3/14	2 to 170	1 to 25	0.19	9	NA	NA	Yes	134	15.2	0.19	0.19
1,1-Dichloroethane	8/14	1 to 170	1 to 590	4.4	167	[11]2,000	NA	No[10]				
1,1-Dichloroethylene	8/14	1 to 170	2 to 350	2.6	115	303	NA	No[10]				
1,2-Dichloroethylene	4/14	1 to 83	9 to 1,900	14	517	1,350	NA	No[10]				
1,1,1-Trichloroethane	4/14	1 to 170	96 to 860	6.5	342	528	NA	No[10]				
Trichloroethylene	6/14	1 to 83	9 to 1,700	13	476	NA	NA	Yes	228,662	206	13	13
Xylenes (total)	5/14	1 to 170	9 to 150	1.1	51	NA	NA	Yes	645	20.9	1.1	1.1
Semivolatile Organic Compounds (µg/ℓ)												
Benzo(b)fluoranthene	1/14	10 to 2,000	3	0.02	3	NA	NA	Yes	276	87.5	0.02	0.02
1,2-Dichlorobenzene	4/14	10 to 2,000	350 to 9,800	74	2,963	15.8	NA	Yes	62,318	852	74	74
1,3-Dichlorobenzene	4/14	10 to 2,000	9 to 240	1.8	75.5	50.2	NA	No[10]				

See notes at end of table.

Table 6-9 (Continued)
Selection of Ecological Chemicals of Potential Concern for Diluted Unfiltered Groundwater from the Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detection Limits	Range of Detected Concentrations	Maximum Detected Concentration After Dilution[2]	Average of Detected Concentrations[3]	Region IV Chronic Water Quality Screening Value[4]	2X Average Background Concentration[5]	Ecological Contaminant of Potential Concern?	95th % UCL[6]	Average of All Concentrations[7]	Exposure Point Concentrations	
											Maximum[8]	Average[9]
Semivolatile Organic Compounds (μg/ℓ) (Continued)												
1,4-Dichlorobenzene	4/14	10 to 2,000	49 to 1,300	9.8	401	11.2	NA	No[10]				
Diethylphthalate	2/14	10 to 2,000	1 to 3	0.02	2	521	NA	No[10]				
2,4-Dimethylphenol	3/14	10 to 2,000	0.5 to 10	0.08	4.2	21.2	NA	No[10]				
Di-n-butylphthalate	1/14	10 to 2,000	0.8	0.006	0.8	9.4	NA	No[10]				
bis(2-Ethylhexyl)phthalate	3/14	10 to 2,000	0.6 to 5	0.04	2.2	0.3	NA	No[10]				
2-Methylnaphthalene	7/14	10 to 2,000	0.8 to 200	2	86.3	NA	NA	Yes	633	52.4	2	2
2-Methylphenol	2/14	10 to 2,000	8 to 19	0.14	13.5	NA	NA	Yes	268	89.3	0.14	0.14
4-Methylphenol	4/14	10 to 2,000	3 to 61	0.46	20	NA	NA	Yes	365	90.4	0.46	0.46
Naphthalene	8/14	10 to 2,000	0.6 to 450	3.4	148	62	NA	No[10]				
Phenol	3/14	10 to 2,000	0.5 to 2	0.02	1	256	NA	No[10]				
Pesticides and PCBs (μg/ℓ)												
Aroclor 1248	2/14	0.8 to 1	0.6 to 0.79	0.0059	0.7	0.014	NA	No[10]				
Endosulfan II	1/14	0.1 to 0.1	0.042	0.00030	0.04	0.056	NA	No[10]				

See notes at end of table.

Table 6-9 (Continued)
Selection of Ecological Chemicals of Potential Concern for Diluted Unfiltered Groundwater from the Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Detection Limits	Range of Detected Concentrations	Maximum Detected Concentration After Dilution[2]	Average of Detected Concentrations[3]	Region IV Chronic Water Quality Screening Value[4]	2X Average Background Concentration[5]	Ecological Contaminant of Potential Concern?	95th % UCL[6]	Average of All Concentrations[7]	Exposure Point Concentrations	
											Maximum[8]	Average[9]
Inorganic Compounds (µg/ℓ)												
Aluminum	9/14	200 to 200	37.4 to 47,400	357	6,087	[12]87	17,200	Yes[13]	28,854	3,949	357	357
Arsenic	6/14	10 to 10	1.5 to 24.7	0.19	8.8	[14]190	7.6	No[10]				
Barium	14/14	200 to 200	6 to 48.1	0.36	25	NA	42	No[13]				
Calcium	14/14	5,000 to 5,000	1,440 to 69,900	526	32,840	NA	47,100	No[13, 15]				
Chromium	1/14	10 to 10	36.6	0.28	36.6	[16]11	NA	No[10]				
Cobalt	1/14	50 to 50	10.7	0.081	10.7	NA	20	No[13]				
Copper	4/14	25 to 25	6.1 to 73.5	0.55	29.9	[17]12	NA	No[10]				
Iron	12/14	100 to 100	44.6 to 36,500	275	5,717	1,000	2,500	No[10]				
Lead	3/14	3 to 3	1.8 to 7.6	0.057	4	[17]3.3	13	No[10]				
Magnesium	14/14	5,000 to 5,000	247 to 12,400	93.4	4,615	NA	6,820	No[13, 15]				
Manganese	14/14	15 to 15	4.2 to 170	1.3	40.5	NA	99	No[13]				
Nickel	1/14	40 to 40	12.8	0.096	12.8	[17]162	38	No[10]				
Potassium	14/14	5,000 to 5,000	159 to 4,600	35	1,627	NA	3,920	No[13, 15]				
Sodium	14/14	5,000 to 5,000	1,920 to 13,100	98.6	7,200	NA	12,400	No[13,15]				
Vanadium	1/14	50 to 50	26.5	0.20	26.5	NA	NA	Yes	NC	25.1	0.20	0.20
Zinc	5/14	20 to 20	2.1 to 10.1	0.076	5.9	[17]110	NA	No[10]				

See notes at end of table.

Table 6-9 (Continued)
Selection of Ecological Chemicals of Potential Concern for Diluted Unfiltered Groundwater from the Surficial Aquifer

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

[1] Frequency of detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples.
[2] Maximum detected concentration multiplied by a dilution factor of 7.53×10^{-3}. The calculation of the dilution factor is presented in Appendix X.
[3] Arithmetic mean of all samples in which analyte was detected.
[4] U.S. Environmental Protection Agency (USEPA) Region IV Waste Management Division Chronic Freshwater Quality Screening Values based on the Water Quality Standards Units Screening List (USEPA, 1992h).
[5] Monitoring wells CF3-MW-8S, CF3-MW-9I, and CF3-MW-10D were used as upgradient sample locations. Two times the upgradient concentration is calculated for inorganics only.
[6] The 95th percent UCL is calculated on the log-transformed average of all concentrations using the formula provided in the USEPA Region IV Supplemental Guidance (USEPA, 1991e).
[7] The average of all concentrations assigns a value of 1/2 the detection limit to all nondetects.
[8] Maximum exposure point concentrations (EPCs) were selected using the following criteria:

- When the sample size was ≤ 3, the maximum detected concentration was used.
- When the sample size was ≥ 4, the lesser of the maximum detected concentration or the 95th percent UCL was selected.

[9] Average EPCs are equal to the mean of all concentrations. When the mean is greater than the maximum EPC, the maximum EPC was used.
[10] Maximum analyte concentration is below the Region IV chronic surface water screening value.
[11] Screening value for 1,2-dichloroethane is used as a surrogate.
[12] Criterion is based on a pH of 6.5-9 (USEPA, 1988a). This value is protective of fish species that are not expected to be found in Rowell Creek. The chronic values for aquatic species expected to be found in Rowell Creek include 742.2 μg/ℓ for *Daphnia magna*, 1,908 μg/ℓ for *Ceriodaphnia dubia*, and 3,288 μg/ℓ for the fathead minnow.
[13] Maximum analyte concentration is less than 2 times the average upgradient concentration for inorganic compounds.
[14] Screening value for the trivalent species of arsenic.
[15] Analyte is an essential nutrient, and is not considered toxic except at high concentrations.
[16] Screening value for the hexavalent species of chromium.
[17] Hardness-dependent criterion based on a mean site-specific surface water hardness concentration of 104 milligrams per liter as calcium carbonate.

Notes: Sample locations include CF3-MW-3S, CF3-MW-4S, CF3-MW-6S, CF3-MW-7D, CF3-MW-7S, CF3-MW-13S, MF3-MW-14I, MF3-MW-15D, MF3-MW-18S, MF3-MW-19D, CF3-MW-28S, CF3-MW-29D, CF3-MW-31S, and CF3-MW-32D.

2x = two times.
% = percent.
UCL = upper confidence limit.
μg/ℓ = micrograms per liter.
NA = not available.
PCB = polychlorinated biphenyl.
NC = not able to calculate value.
≤ = less than or equal to.
≥ = greater than or equal to.

which the analyte was not detected. The average of all samples is used to represent the average EPC at each site unless it exceeded the maximum EPC, in which case the maximum EPC was used for both scenarios.

Both maximum and average EPCs are presented in each site-specific ECPC table. A tiered approach was used to efficiently evaluate exposure and risk at the OU 8 sites. If no risk was calculated from exposure to the maximum EPC, then no average exposure scenarios were evaluated (i.e., if no risk was estimated at maximum EPCs, average exposure will result in even less risk and was, therefore, not calculated).

Surface water and sediment EPCs are equal to the concentration of ECPCs measured in either of the two samples collected downstream from the point of groundwater discharge in Rowell Creek.

6.3.2 **Terrestrial and Wetland Wildlife** Exposure routes for wildlife receptors for which EPCs were selected include direct or indirect ingestion of OU 8 soil, surface water, and sediment and ingestion of contaminated food. Table 6-10 provides a summary of receptors evaluated at OU 8.

The actual amount of an ECPC taken in by wildlife species as the result of indirect or direct ingestion depends on a number of factors. To evaluate exposures at OU 8, representative wildlife species were selected for evaluation in food chain models that estimate contaminant exposures to wildlife species respective to their position in the food chain. Contaminant exposures for terrestrial and aquatic wildlife are related to the foraging characteristics of the species; therefore, terrestrial receptors were chosen to represent the trophic levels typical of a southeastern disturbed upland and forested community and aquatic receptors were chosen to represent the trophic levels typical of a wooded riparian environment. The following representative wildlife species were selected for OU 8.

- **Cotton mouse** (*Peromyscus gossypinus*). The cotton mouse represents a small mammalian herbivore. This species could potentially be exposed to contamination in soil and in plant tissue (accumulated from the soil). The cotton mouse represents the small mammal herbivore community at OU 8.

- **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). Relative to other small mammals, insectivorous species may receive high doses of contamination as a result of their voracious appetite relative to their small body size and the ability of their prey items to accumulate constituents. The shrew represents small mammal omnivores found in wooded sections of OU 8.

- **Red fox** (*Vulpes*) This omnivorous mammal prefers open woodlands and grassy fields, and is most active at dawn, dusk, and night. 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 predatory mammals at OU 8.

Table 6-10
Ecological Receptors Evaluated at Operable Unit 8

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Receptor Evaluated		Media			
Common Name	Scientific Name	Surface Soil		Surface Water and Sediment	Groundwater[1]
		Upland Disposal Area	Helicopter Crash Site	Rowell Creek	
Food-Web Modeling					
Cotton mouse	*Peromyscus gossypinus*	✓	✓	✓	
Short-tailed shrew	*Blarina brevicauda*		✓		
Rufous-sided towhee	*Pipilpo erythrophthalmus*		✓	✓	
Meadowlark	*Sturnella magna*	✓			
Mourning dove	*Zenaida macroura*	✓		✓	
Red fox	*Vulpes*	✓	✓		
Great horned owl	*Bubo virginianus*	✓	✓		
American woodcock	*Scolopax minor*		✓		
Raccoon	*Procyon lotor*			✓	
Great blue heron	*Ardea herodias*			✓	
Biological Sampling					
Benthic macroinvertebrates				✓	
Toxicity Testing					
Water flea	*Ceriodaphnia dubia*			✓	✓
Fathead minnow	*Pimephales promelas*			✓	✓
Earthworm	*Eisenia foetida*	✓	✓		
Lettuce seed	*Lactuca sativa*	✓	✓		

[1] Groundwater samples were collected for toxicity tests from two monitoring wells.

- **American woodcock** (*Scolopex minor*). The woodcock is a vermivorous (feeding primarily on earthworms) bird that inhabits areas of fertile, moist soil where earthworms are plentiful. These areas include open pastures, cultivated fields, and stream banks (DeGraaf and Rudis, 1986). The woodcock represents avian receptors found in forested areas at OU 8.

- **Rufous-sided towhee** (*Pipilpo erythrophthalmus*). The towhee inhabits dense brushy cover in woodland edges, and is an omnivore that forages in the leaf litter layer of the forest floor for insects, seeds, and fruits (DeGraaf and Rudis, 1986). The home range of the towhee is 1.5 acres. The towhee represents avian omnivores found in forested areas at OU 8.

- **Great horned owl** (*Bubo virginianus*). The great horned owl is primarily a nocturnal hunter of small mammals. Its habitat includes low, wet, 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 home range of the owl is 15 acres. The owl represents predatory avian carnivores at OU 8 that may be exposed to contamination via accumulation in mammalian and avian tissue.

- **Eastern meadowlark** (*Sturnella magna*). The meadowlark feeds primarily on invertebrates, supplementing its diet with plants. Meadowlarks are most commonly found in open pastures, prairies, farms, and meadows, and have a home range of approximately 5 acres. The meadowlark represents insectivorous avian receptors found in open areas at OU 8.

- **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 eat occasional insects, snails, and gravel to facilitate seed digestion (Terres, 1991). The mourning dove will nest in a variety of manmade or natural structures, and its estimated home range is 5 acres. The dove represents herbivorous avian receptors found in open areas at OU 8.

- **Raccoon** (*Procyon lotor*). The raccoon represents an opportunistic species that may be exposed to contamination in surface water and sediment both as a result of direct ingestion and ingestion of aquatic prey. Aquatic prey (plants, invertebrates, and fish) may become contaminated as a result of accumulation of chemicals from the surface water and sediment. The raccoon represents higher trophic level omnivorous mammals found in riparian environments at OU 8.

- **Great blue heron** (*Ardea herodias*). This species represents a higher trophic level avian receptor that may be exposed to surface water and sediment contamination in Rowell Creek adjacent to OU 8. Great blue herons feed primarily on aquatic prey items, including fish, frogs, and invertebrates. The great blue heron has been selected to represent higher trophic-level ecological receptors found in riparian areas at OU 8.

The acreage of the contaminated disposal area at OU 8 (estimated at 6.7 acres) is larger than the home range for the cotton mouse, the meadowlark, and the mourning dove. The area of contamination at the helicopter crash area (0.7 acre)

Table 6-11
Exposure Parameters for Representative Wildlife Species

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Representative Wildlife Species	Body Weight (kg)	Reported Diet	Soil and Sediment Ingestion (% of diet)	Assumed Diet for Exposure Assessment (% of diet)	Food Ingestion Rate (kg/day)	Water Intake Rate (ℓ/day)	Home Range (acres)
Cotton mouse [a] (*Peromyscus gossypinus*)	0.021 [b]	Seeds and some insects [c]	2% soil [d] 1% sediment [e]	88% Plants 10% Invertebrates	0.0029 [f]	0.0031 [g]	0.147 [h]
Short-tailed shrew (*Blarina brevicauda*)	0.017 [i]	Earthworms, slugs and snails, fungi, insects, and vegetation [c]	10% soil [d] 5% sediment [e]	78% Invertebrates 12% Plants	0.0024 [f]	0.0039 [g]	0.96 [c]
Rufous-sided Towhee (*Pipilo erythrophthalmus*)	0.039 [j]	30% animals (moths, ants, caterpillars, beetles, bugs, spiders, snails) 70% vegetation (seeds of weeds, grasses, and berries) [j,k]	5% soil [d] 2.5% sediment [e]	65% Plants 30% Invertebrates	0.0071 [l]	0.0067 [m]	1.5 [k]
Meadowlark (*Sturnella magna*)	0.087 [j]	Insects, weed seeds and grass seeds. 75% of diet is invertebrates (beetles, grubs, bugs, grasshoppers, crickets, ants and spiders [j]	5% soil [j]	75% Invertebrates 20% Plants	0.0119 [l]	0.011 [m]	5 [j,k]
Mourning dove (*Zenaida macroura*)	0.13 [j]	Seeds, some insects [j] Weed seeds, waste grain of agriculture, occasionally takes small snails [k]	5% soil 5% sediment	94% Plants 1% Invertebrates	0.0154 [l]	0.015 [m]	5 [k]
Red fox (*Vulpes*)	4.69 [n]	Small mammals, birds, and invertebrates, as well as berries and other fruits [c]	2.8% soil [c]	57% Small mammals 20% Invertebrates 10% Birds 10% Plants	0.24 [f]	NE	1,727 [c]
Raccoon (*Procyon lotor*)	3.99 [o]	Mostly fleshy fruits, nuts acorns, corn; also frogs, crayfish, and insects [c]	7% sediment [e]	93% Aquatic organisms	0.214 [f]	0.344 [g]	385 [p]
American woodcock (*Scolopax minor*)	0.197 [q]	Primarily earthworms and insects with some plants [c]	10% soil [c] 5% sediment [e]	80% Invertebrates 10% Plants	0.02 [l]	0.019 [m]	80.1 [c]
Great horned owl (*Bubo virginianus*)	1.59 median [r]	Mostly rabbits; also mice, rats, chipmunks, weasels, squirrels, skunks, birds, bats, snakes, frogs, crayfish, perch, grasshoppers [r]	1% soil [d] 0.5% sediment [e]	80% Small mammals 19% Birds	0.079 [l]	0.081 [m]	15 [s]

See notes at end of table.

Table 6-11 (Continued)
Exposure Parameters for Representative Wildlife Species

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Representative Wildlife Species	Body Weight (kg)	Reported Diet	Soil and Sediment Ingestion (% of diet)	Assumed Diet for Exposure Assessment (% of diet)	Food Ingestion Rate (kg/day)	Water Intake Rate (ℓ/day)	Home Range (acres)
Great blue heron (*Ardea herodias*)	2.23 ± 0.76 [c]	Mostly fish; some amphibians, crustaceans, and birds [c]	<2% sed. [e]	>98% Aquatic organisms	0.401 [t]	0.101 [m]	1.5 [u]

References:
[a] Values for the deer mouse were used for the cotton mouse, (U.S. Environmental Protection Agency [USEPA], 1993e).
[b] Average of adult male and female deer mice in North America, (USEPA, 1993e).
[c] *Wildlife Exposure Factors Handbook*, (USEPA, 1993e).
[d] Deer mouse value used for cotton mouse. Surrogates were chosen based on similarities in diet. Other values were based on diet composition (USEPA, 1993e). Rufous-sided towhee value from Beyer et al. (Beyer et al., 1991).
[e] Sediment ingestion assumed to be 50% of soil ingestion, except for the raccoon and the heron.
[f] Calculated using the mammal equation based on body weight (Wt.) in kg. Food ingestion (kg/day) = $0.0687 \times Wt^{0.822}$ (USEPA, 1993e).
[g] Calculated using the mammal equation based on body weight (Wt.) in kg. Water ingestion (ℓ/day) = $0.099 \times Wt^{0.90}$ (USEPA, 1993e).
[h] Average for male and female deer mice, Virginia/mixed deciduous forest (USEPA, 1993e).
[i] Mean of means reported for male and female shrews in summer and fall (USEPA, 1993e).
[j] Median of weights in Terres (Terres, 1980).
[k] (DeGraaf & Rudis, 1986). Rufous-sided towhee home range taken from savanna sparrow average (similar species).
[l] Calculated using the bird equation based on body weight (Wt.) in kg. Food ingestion (kg/day) = $0.0582 \times Wt^{0.651}$ (USEPA, 1993e).
[m] Calculated using the bird equation based on body weight (Wt.) in kg. Water ingestion (ℓ/day) = $0.059 \times Wt^{0.67}$ (USEPA, 1993e).
[n] Average of adult male and female foxes in spring (USEPA, 1993e).
[o] Median of mean weights for male and female raccoons in Alabama (USEPA, 1993e).
[p] Average of adult male and female raccoons from May to December. (USEPA, 1993e).
[q] Median of mean weights reported for adult male and female American woodcocks (USEPA, 1993e).
[r] (Terres, 1991).
[s] Great horned owl home range taken from low end of range in SE Madison County, NY (Hager, 1957).
[t] As reported estimating from Kushlan's (1978) allometric equation for wading birds, assuming a body weight of 2,230 grams (USEPA, 1993e).
[u] Size of heron feeding territory in summer (USEPA, 1993e).

Notes: kg = kilograms.
% = percent.
kg/day = kilograms per day.
ℓ/day = liters per day.
NE = not evaluated.
± = plus or minus.
< = less than.
> = greater than.

is larger than the cotton mouse home range. All representative wildlife species are expected to actively forage at the site year around. Exposure assumptions (body weights, food ingestion rates, relative consumption of food items, etc.) for each of the representative wildlife species for Site 5 are provided in Table 6-11.

Wildlife species may be exposed to ECPCs in surface soil, surface water, and sediment by incidental ingestion of these media, or by bioaccumulation of these ECPCs from prey items. To estimate this exposure, a potential dietary exposure (PDE) is estimated for all representative wildlife species for each ECPC in all media according to the equations in Table 6-12. The PDE is calculated based on the estimated concentrations of the ECPCs in food items that the species would consume; the amount of soil, surface water, or sediment that it would ingest; the relative amount of different food items in its diet; body weight; and food ingestion rate.

Tissue concentrations of ECPCs in prey items were estimated using bioaccumulation factors (BAFs). BAFs were extrapolated from site-specific toxicity test bioaccumulation data (i.e., for earthworms), literature values, or regression equations in the scientific literature. The general approach used to select BAFs for OU 8 is summarized in Table 6-13. BAFs for each of the ECPCs evaluated at OU 8 are included in Appendix T.

Terrestrial BAFs for invertebrates and plant prey items were defined as the ratio of the ECPC concentration in plant or invertebrate tissue to the ECPC concentration in surface soil. Terrestrial BAFs reported for avian and mammalian receptors were defined as the reported ratios of ECPC concentrations in the tissues of these receptors to the concentrations of ECPCs in their food items. Invertebrate BAFs were obtained from tissue analyses of the earthworms exposed to surface soil in the laboratory toxicity tests described in Appendix S.

Bioaccumulation of hydrophobic organics from sediment to biota were estimated based on BAFs found in the literature, which are the reported ratio of the ECPC in an aquatic invertebrate to the concentration in sediment (Appendix T). Sediment BAFs have been identified for DDT_R and PCBs. The ECPCs detected in surface water all have bioconcentration factors (BCFs) less than 300 (Appendix T); therefore, an assumption was made that bioconcentration from water to biota was generally insignificant (USEPA, 1989e).

The site foraging frequency (SFF) considers the frequency 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. By definition, the SFF cannot exceed 1.

The PDEs calculated from exposure to surface soil ECPCs for each receptor are presented in Appendix U. The PDEs calculated from exposure to surface water and sediment ECPCs in Rowell Creek for each receptor are presented in Appendix V.

6.3.3 Terrestrial Plants and Invertebrates Terrestrial plants and soil invertebrates may be exposed to ECPCs from root uptake of and/or direct contact with ECPCs measured in OU 8 surface soil. Laboratory grown earthworms (*Eisenia foetida*) and lettuce seed (*Lactuca sativa*) were exposed to nine surface soil samples collected from OU 8 in chronic toxicity tests. The results of these

Table 6-12
Model for Estimation of Chemical Exposures for Representative Wildlife Species

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Estimation of Contaminant Exposures Related to Surface Soil

Description: Estimates the amount (dose) of a contaminant ingested and accumulated by a species via incidental ingestion of contaminated surface soil and ingestion of contaminated food items.

Soil Contaminant Concentration:

Maximum: The maximum detected concentration of the ecological chemicals of potential concern (ECPCs) when the number of samples is ≤ 3, and the lesser of the maximum detected concentration or the 95th percent upper confidence limit (UCL) when the number of samples is ≥ 4.

Average: Average of detected concentrations. If the average is greater than the maximum exposure point concentration (EPC), the maximum EPC was selected.

Concentration of a Contaminant in a Food Item (T_N):

$$\underset{(mg/kg)}{\text{Food Contaminant Concentration}} = BAF \times \underset{(mg/kg)}{\text{Soil Contaminant or Prey Item Concentration}}$$

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.

Potential Dietary Exposure (PDE):

$$PDE = \frac{[P_1 \times T_1 + P_2 \times T_2 + \ldots + P_N \times T_N + \text{soil exposure}] \times IR_{Diet} \times SFF}{BW}$$

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, and
SFF = site foraging frequency (site area [acres] divided by home range [acres]), assumed to be equal to 1 for lethal exposure scenario.

Soil Exposure:

$$\underset{(mg/kg)}{\text{Soil Exposure}} = (\%\ \text{of Diet as Soil}) \times \underset{(mg/kg)}{\text{Soil Contaminant Concentration}}$$

Estimation of Contaminant Exposures Related to Surface Water and Sediment

Description: Estimates the amount of a contaminant ingested and accumulated by a species resulting from ingestion of surface water, incidental ingestion of sediment, and ingestion of contaminated aquatic food items.

Contaminant Concentration: Same as described above for soil.

See notes at end of table.

Table 6-12 (Continued)
Model for Estimation of Chemical Exposures for Representative Wildlife Species

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Estimation of Contaminant Exposures Related to Surface Water and Sediment (Continued)

Contaminant Concentration in Aquatic Prey Tissue (mg/kg):

$$\text{Aquatic Prey Contaminant Concentration (mg/kg)} = [\text{BAF} \times \text{Sediment Contaminant Concentration (mg/kg)}] + [\text{BCF} \times \text{Surface Water Contaminant Concentration (mg/}\ell)]$$

where

BCF = bioconcentration factor (mg/kg of contaminant in food item per mg/ℓ of contaminant in water). Only BCFs greater than 300 were considered as per U.S. Environmental Protection Agency, 1989g.

BAF = bioaccumulation factor (see note above).

Sediment Exposure:

$$\text{Sediment Contaminant Exposure (mg/day)} = \text{\% of Diet as Sediment} \times IR_{diet}\ \text{(kg/day)} \times \text{Sediment Contaminant Concentration (mg/kg)}$$

Surface Water Exposure:

$$\text{Surface Water Contaminant Exposure (mg/day)} = \text{Surface Water Contaminant Concentration (mg/}\ell) \times \text{Water Ingestion Rate (}\ell\text{/day)}$$

Aquatic Prey Exposure:

$$\text{Aquatic Prey Exposure (mg/day)} = \text{\% Diet as Aquatic Prey} \times IR_{diet}\ \text{(kg/day)} \times \text{Aquatic Prey Contaminant Concentration (mg/kg)}$$

where

IR_{diet} = food ingestion rate of receptor (kg of food per day).

Total Exposure Related to Surface Water and Sediment:

$$\text{Potential Dietary Exposure (mg/kg)} = \frac{\text{Aquatic Prey Exposure (mg/kg)} + \text{Surface Water Exposure (mg/kg)} + \text{Sediment Exposure (mg/kg)}}{BW}$$

where BW = body weight (kg) of receptor.

See notes at end of table.

Table 6-12 (Continued)
Model for Estimation of Chemical Exposures for Representative Wildlife Species

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Notes: ≤ = less than or equal to.
≥ = greater than or equal to.
mg/kg = milligrams per kilogram.
mg/kg/bw-day = milligrams per kilogram body weight per day.
kg = kilogram.
% = percent.
mg/ℓ = milligrams per liter.
kg/day = kilograms per day.
ℓ/day = liters per day.
mg/day = milligrams per day.

Table 6-13
Estimation of Bioaccumulation and Bioconcentration Factors

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Receptor Group	Nature of Approach	General Approach
Terrestrial Surface Soil		
Plants Unit: mg/kg wet tissue per mg/kg dry soil	Literature values	When available, literature values were used to estimate plant BAFs.
	SAR	When literature values were unavailable, plant BAFs for semivolatile organic compounds and pesticides were calculated using a regression equation based on the uptake of organic chemicals into plant tissue from Travis and Arms (1988).[1] Log K_{ow}s of the following classes of compounds were averaged to provide one BAF for that compound class: PAHs, phthalates, and phenols.
	Extrapolation and empirical data	When literature values were unavailable, plant BAFs for inorganic compounds were obtained from Baes, and others (1984)[2].
	Assumption	It was assumed that transfer of volatile organic compounds into plant tissue does not occur.
Terrestrial Invertebrates Unit: mg/kg wet tissue per mg/kg dry soil	Site-specific data	BAFs for inorganics in invertebrates were calculated based on tissue concentrations of worms exposed to OU 8 soil.
	Literature values	When site-specific data were unavailable, literature values were used to estimate BAFs for invertebrates.
	Assumption	Earthworm data were used to represent all invertebrates.
	Empirical data and assumption	When site-specific data were unavailable, 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	It was assumed that soil invertebrates do not bioaccumulate volatile organic compounds.
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 unavailable for semivolatile organic compounds, 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]. Log K_{ow}s ≥ 5 of the following classes of compounds were averaged to provide one BAF for that compound class: PAHs, phthalates, and phenols.
Unit: mg/kg wet tissue per mg/kg wet food	Extrapolation and empirical data	When literature values were unavailable, BAFs for small mammals for inorganics were derived from ingestion-to-beef biotransfer factors (BTFs) presented in Baes and others (1984)[4].
	Assumption	It was assumed that small mammals do not bioaccumulate volatile organic compounds.

See notes at end of table.

Table 6-13 (Continued)
Estimation of Bioaccumulation and Bioconcentration Factors

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Receptor Group	Nature of Approach	General Approach
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.
	Assumption	BAFs were not obtained for volatile and semivolatile organic compounds or for many inorganic compounds as there are little bioaccumulation data available for birds.
Semiterrestrial and Aquatic Media		
Surface Water Unit: mg/kg tissue per mg/ℓ water	Empirical data and conservative assumption	Analytes with BCFs <300 were not considered in the surface water ingestion model.
Sediment Unit: mg/kg wet tissue per mg/kg wet sediment	Literature values	When available, literature values were used to estimate BAFs for macroinvertebrates for 4,4'-DDT, 4,4'-DDE, and PCBs.
	Assumption	It was assumed that bioaccumulation of volatile organic compounds does not occur. Little to no literature values exist for sediment to biota accumulation; therefore, bioaccumulations of semivolatile organic compounds and inorganic compounds were not considered in the sediment ingestion model.

[1] BAFs calculated using the following Travis and Arms (1988) regression: log BAF = 1.588 to 0.578 log K_{ow}.
[2] BAFs derived from Baes and others (1984). Values are based on analysis of literature references, correlations with other chemical and physical parameters, elemental systematics, 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) and, therefore, this assumption likely overestimates exposure to graminivorous receptors.
[3] Small mammal BAFs calculated using the following Travis and Arms (1988) regression: log 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: BAF = bioaccumulation factor.
mg/kg = milligrams per kilogram.
SAR = structural analysis relationship.
PAH = polynuclear aromatic hydrocarbon.
OU = operable unit.
≥ = greater than or equal to.
BCF = bioconcentration factor.
< = less than.
mg/ℓ = milligrams per liter.
DDT = dichlorodiphenyltrichloroethane.
DDE = dichlorodiphenyldichloroethane.
PCB = polychlorinated biphenyl.

tests were used to evaluate the bioavailability of chemicals and receptor vulnerability from exposure to soil contamination. Results of the OU 8 toxicity testing are presented in Appendix S.

6.3.4 **Aquatic Receptors** Exposure concentrations for aquatic receptors are equal to the concentrations of ECPCs detected in Rowell Creek surface water and sediment, and in groundwater prior to discharge to Rowell Creek adjacent to OU 8. The fathead minnow (*Pimephales promelas*) and the water flea (*Ceriodaphnia dubia*) were exposed to groundwater samples collected from two monitoring wells at OU 8 in toxicity tests. Laboratory test organisms were exposed initially to 100 percent of the groundwater from OU 8, and subsequently to 50, 20, 10, and 5 percent of the groundwater in a dilution series toxicity test. This dilution series was conducted to evaluate the dilution of groundwater from OU 8 prior to discharge to Rowell Creek. Appendix X contains a derivation of the 133-fold dilution factor ($7.53X10^{-3}$) calculated for groundwater constituents entering Rowell Creek. This site-specific dilution factor represents a greater potential for dilution than the 20-fold dilution estimated in the toxicity test. Therefore, the toxicity test represents a conservative evaluation of groundwater exposure to aquatic receptors. The two groundwater samples collected for toxicity testing may have been mislabeled in the field (see Appendix S); therefore, the actual EPC in the groundwater toxicity tests have a degree of uncertainty associated with them.

6.4 **Ecological Effects Assessment**. The ecological effects assessment describes the potential adverse effects to ecological receptors from exposure to ECPCs in site media and discusses the type of assessment endpoints selected. The methods used for identifying and characterizing ecological effects for ECPCs in surface soil, surface water, sediment, and groundwater are described in the following subsections.

6.4.1 **Surface Soil** The measures of adverse ecological effects for terrestrial wildlife, terrestrial plants, and soil invertebrates are discussed separately. Potential adverse ecological effects from ingestion of chemicals in surface soil, surface water, and sediment and direct exposure to chemicals in surface water and sediment for wildlife are estimated for each ECPC based on available literature information. Adverse effects for terrestrial invertebrates and plants from direct exposure and root uptake of chemicals in surface soil and for aquatic receptors from exposure to chemicals in groundwater (as it discharges to Rowell Creek surface water) are directly measured for the entire mixture of ECPCs by the use of toxicity testing.

Terrestrial and Wetland Wildlife. For the purposes of food web modeling (completed for incidental ingestion and bioaccumulation of chemicals in surface soil, surface water, and sediment), reference toxicity values (RTVs) were determined for each ECPC for avian and mammalian receptors. The RTV relates the dose of a respective ECPC from oral exposure with an adverse effect. For each ECPC identified and each representative wildlife species selected, two RTVs are identified. A lethal RTV represents the threshold for lethal effects and is based on oral (lethal dose where 50 percent of test population dies [LD_{50}]) data (oral dose [in mg/kg body weight per day] LD_{50} of a test population). The lethal RTV is equal to one-fifth of the lowest reported LD_{50} for the most closely related test species. One fifth of an oral LD_{50} value is considered to be protective against lethal effects for 99.9 percent of individuals in a test

population (USEPA, 1986b); therefore, an assumption was made that this represents an adequate level of protection to terrestrial wildlife populations at OU 8.

A sublethal RTV is also identified that represents a threshold body weight-normalized dose for sublethal effects. Sublethal effects are defined as those that impair or prevent reproduction or growth. The sublethal RTV reflects the assessment endpoint chosen as the basis for establishing risk from chronic exposures.

If neither lethal nor sublethal toxicity information was available for an ECPC, it was not possible to identify RTVs, and risks associated with the predicted exposure for the respective ECPC were not quantitatively evaluated. Wildlife RTVs are presented in Appendix T.

Terrestrial Plants and Invertebrates. The toxicity of surface soil to plants and soil invertebrates at OU 8 was measured by use of two soil laboratory toxicity tests: a subacute toxicity test with earthworms (*Eisenia foetida*) and a seed germination toxicity test with lettuce seed (*Lactuca sativa*). Protocols used in the 28-day survival test with earthworms and the seed germination toxicity tests are included in Appendix S. The methods described in the earthworm and seed germination protocols generally meet the standard procedures described in the protocol for short-term toxicity screening of hazardous waste site soil (Green and others, 1989). For the purpose of estimating bioaccumulation, worms were obtained following the 28-day study and were analyzed for inorganic analytes (Appendix S and T). The lack of organic analytes in the surface soil samples selected for the bioaccumulation study, coupled with limited sample size and resultant high detection limits, precluded the analyses of organics in earthworm tissue.

The results of earthworm and lettuce seed toxicity testing of surface soil samples are presented in Table 6-14. Earthworm survival in all OU 8 samples was similar to the control and reference soil, ranging from 98 to 100 percent. Earthworm survival was not adversely affected during the 28-day exposure.

Lettuce seed germination in the artificial soil control was 95 percent, whereas germination in the reference soil sample was 50 percent. Seed germination in two samples were statistically different from the reference soil sample, CF3-SS-1 (CF3-SS-17 where $p=0.05$ and CF3-SS-20 where $p<0.10$), whereas the remaining six samples showed no statistical difference ($p>0.10$). Interpretation of these results is confounded by apparently low statistical power. The lower germination of seeds seen in the reference soil sample (and some test soil) and variability of the replicates of many of the test soil samples, combined with use of a low number of replicates (three) established by the test protocol may have contributed to loss of statistical sensitivity. CF3-SS-22, which showed low germination but not statistical significance, may be affected by high replicate variability.

6.4.2 Surface Water and Sediment The measure of adverse ecological effects for wildlife and aquatic receptors from exposure to chemicals in surface water and sediment are discussed separately. Potential adverse ecological effects for terrestrial and wetland wildlife are predicted for each ECPC based on available literature information, whereas adverse effects for aquatic life are directly measured for the entire mixture of ECPCs.

Table 6-14
Results of Surface Soil Toxicity Testing

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Sample Location	Earthworm (Eisenia foetida)	Lettuce Seed (*Lactuca sativa*)
	Mortality (percent)	Germination (percent)
CEF3SS1[1]	0	0.50
CEF3SS4	0.02	0.65
CEF3SS9	0.02	0.68
CEF3SS12	0	0.78
CEF3SS15	0	0.56
CEF3SS17	0	0.22[2]
CEF3SS20	0.02	0.19[3]
CEF3SS22	0	0.24
CEF3SS24	0	0.93
Control[4]	0	0.95

[1] Reference soil sample.
[2] Significantly different from the reference location ($p = 0.05$).
[3] Significantly different from the reference location ($p < 0.1$).
[4] Control was artificial soil (10 percent peat); 20 percent Kaolinite clay; and 70 percent silica sand.

Note: Toxicity testing methods and results (including controls) are described in Appendix S.
< = less than.

Terrestrial and Wetland Wildlife. For the purposes of food-web modeling, lethal and sublethal RTVs were identified for each surface water and sediment ECPC for each representative wildlife species, as previously described.

Aquatic Receptors. Potential adverse ecological effects associated with ECPCs in surface water and sediment were evaluated based on the results of the benthic macroinvertebrate community structure and function study. In addition, adverse effects to aquatic receptors from direct contact with ECPCs in surface water and sediment were also evaluated by comparing the ECPC concentrations in these media with available standards and reported reference toxicity values (RTVs).

Section 5.2 describes the sampling of the aquatic macroinvertebrate community at one station in Rowell Creek adjacent to OU 8 (RC-BIO-3). The sampling station coincides with the locations for the chemical analyses of surface water and sediment (CF3-SW-3 and CF3-SD-3), allowing for comparison of the results of the chemical analyses of surface water and sediment with the measurements of the macroinvertebrate community structure and function.

The results of the semiquantitative sampling and analyses of the benthic macroinvertebrate community at the Rowell Creek sampling station (RC-BIO-3) is provided in Subsection 5.2.4. The biological community at this station was found to be poorly developed relative to that of Five Mile Creek, the regional reference station. Although differences in habitat structure may be sufficient to explain the reduced biological condition at RC-BIO-3, the OU 8 groundwater plume and the NAS Cecil Field industrial FOTW may also have contributed to the poorly developed macroinvertebrate community.

Surface water RTVs selected for comparison to surface water exposure concentrations include State of Florida surface water quality standards (Florida Legislature, 1995) and Federal Ambient Water Quality Criteria (AWQC) (USEPA, 1991g; 1988a). Additional aquatic toxicity information for the ECPCs was obtained from searches of the USEPA Aquatic Information Retrieval (AQUIRE) computer database. Information on the AQUIRE database is included in Appendix T.

Sediment RTVs selected for comparison to detected sediment concentrations included NOAA effects range-low (ER-L) and effects range-median (ER-M) sediment guidelines (Long and others, 1993), USEPA sediment quality guidelines (SQG) based on equilibrium partitioning (USEPA, 1988c), and the Ontario Ministry of the Environment (OME) lowest effect level (LEL) provincial sediment quality guidelines (Persaud and others, 1992).

6.4.3 Groundwater As discussed in Subsection 6.3.4, the toxicity of OU 8 groundwater to aquatic receptors was evaluated through chronic toxicity testing with the water flea (*Ceriodaphnia dubia*) and fathead minnow (*Pimephales promelas*). The toxicity tests generally follow the protocols outlined in Appendix S.

Results of the survival and reproduction toxicity tests using OU 8 groundwater are provided in Table 6-15. Chronic toxicity was demonstrated in fathead minnows exposed to groundwater samples CF3-MW-13S and CF3-MW-28S; the chronic no observed effect concentration (C-NOEC) in both samples was 50 percent, and the maximum acceptable toxicant concentration (MATC) in both samples was 71 percent. Chronic toxicity was not reported for the water flea at Station CF3-MW-13S, however, a reproductive response was noted in the 50 percent groundwater sample but was

Table 6-15
Results of Groundwater Toxicity Testing

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Sample Location Percent Sample	Water Flea (*Ceriodaphnia dubia*)		Fathead Minnow (*Pimephales promelas*)	
	Survival (%)	Reproduction (offspring per adult)	Survival (%)	Dry Weight (mg) per Minnow
CEF3MW13S				
5	100	27.2	77	0.37
10	90	27.2	92	0.34
20	100	25.7	93	0.35
50	100	[1]22.1	95	0.29
100	100	26.2	78	[1] 0.26
Control	100	30.9	93	0.33
[2]C-NOEC = 100	**[2]MATC = NC**	**[2]LOEC > 100**	**[2]C-NOEC = 50 [2]MATC = 71**	**[2]LOEC = 100**
CEF3MW28S				
5	100	[1]25.0	90	0.36
10	[1]60	14.4	90	0.38
20	[1]60	10.6	93	0.35
50	[1]40	4.2	88	0.36
100	90	[1]4.7	[1]12	0.36
Control	100	30.2	97	0.38
[2]C-NOEC ≤ 5	**[2]MATC = NC**	**[2]LOEC = 5**	**[2]C-NOEC = 50 [2]MATC = 71**	**[2]LOEC = 100**

[1] Statistically different relative to control ($p < 0.05$).
[2] All C-NOEC, MATC, and LOEC values presented as a percent of the groundwater sample.

Notes: Groundwater toxicity testing methods and results are described in Appendix S.

% = percent.
mg = milligram.
C-NOEC = chronic no observed effects concentration.
MATC = maximum acceptable toxicant concentration.
NC = not calculated.
LOEC = lowest observed effects concentration.
≤ = less than or equal to.
< = less than.

considered an anomaly because no response was observed in the 100 percent sample. Chronic toxicity was observed in both species exposed to groundwater sample CF3-MW-28S, with the water flea exhibiting more sensitivity than the fathead minnow. The C-NOEC for the water flea was <5 percent of sample CF3-MW-28S, and the lowest observed effect concentration was 5 percent. Some uncertainty is associated with the results of the daphnid toxicity test at CF3-MW-28S; no significant mortality was observed in the 100 percent sample, yet 60 percent mortality was observed in the 50 percent dilution sample.

Potential adverse effects associated with OU 8 groundwater ECPCs were also evaluated based on aquatic toxicity information obtained from searches of the USEPA AQUIRE database. Information on the AQUIRE database is included in Appendix T. Additional toxicity benchmarks used to assess the potential for adverse effects include the State of Florida surface water quality standards (Florida Legislature, 1995) and USEPA AWQC (USEPA, 1991g; 1988a). This information is used qualitatively to discuss the known aquatic toxicity of the ECPCs and their potential association with any adverse responses observed in the toxicity testing and macroinvertebrate communities.

6.5 RISK CHARACTERIZATION. This subsection presents the risk characterization for ecological receptors exposed to contaminated surface soil, surface water, sediment, and groundwater at OU 8. The methodology represents an integrated approach using both field and theoretical methods to provide a measure of actual or potential risks.

6.5.1 Surface Soil Potential risks associated with exposures to ECPCs in surface soil at OU 8 are discussed separately for wildlife and terrestrial plants and soil invertebrates. Risks to wildlife are characterized by comparing PDE concentrations for each surface soil ECPC with a respective RTV (estimated threshold for toxicity). Risks for terrestrial plants and soil invertebrates are evaluated based on the results of the respective soil toxicity tests.

Terrestrial Wildlife. Risks for the representative wildlife species associated with ingestion and bioaccumulation of ECPCs in surface soil and prey items are quantitatively evaluated using HQs, which are calculated for each ECPC by dividing the PDE concentration by the toxicity benchmark (RTV). HIs are determined for each receptor by summing the HQs for all ECPCs. When the estimated PDE is less than the RTV (i.e., the HQ < 1), it is assumed that chemical exposures would not be associated with adverse effects to receptors (i.e., inhibited growth, reproduction, and survival of the individual organism) and that no risks to wildlife populations are assumed. When an HQ or HI is greater than 1, a discussion of the ecological significance and an evaluation of the Hqs comprising the HI was completed.

This hazard ranking scheme 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, 1989e). 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 HIs and HQs calculated based on maximum exposure point concentrations for each representative wildlife species are provided in Appendix U, Tables U-9 to U-10 for the grassy OU 8 disposal area, and Appendix U, Tables U-11 to U-12 for the forested OU 8 helicopter crash area. Summary HIs for all wildlife receptors exposed to maximum ECPCs for both lethal and sublethal effects were less than 1. Lethal endpoint HIs ranged from 0.000022 for the great-horned owl to 0.13 for the hispid cotton mouse. Sub-lethal endpoints ranged from 0.00000043 for the red fox to 0.88 for the mourning dove. As a result, no evaluation of risk from average ECPCs was conducted.

The results of the food web modeling suggest that wildlife receptors are not likely to be at risk from exposure to OU 8 surface soil.

Terrestrial Plants and Invertebrates. Risks for terrestrial plants and soil invertebrates are characterized based on the results of laboratory toxicity tests. The surface soil analytical and toxicity test samples were collected concurrently and split for the two separate analyses; therefore, the analytical results for the surface soil samples can be used to help interpret the contaminant exposures and responses of the test species (earthworms and lettuce seeds) in the toxicity tests.

As previously discussed in Subsection 6.4.1, earthworm survival was not adversely affected following exposure to OU 8 soil. This suggests that invertebrates may not be at risk from exposure to surface soil at the site (i.e., no lethal toxicity is associated with exposure to surface soil).

Statistically significant differences in lettuce seed germination rates were observed between the control soil location (CF3-SS-01) and surface soil locations (CF3-SS-17 and CF3-SS-20). As discussed in Section 6.4.1, the reliability of these results is questionable based on the high variability between sample replicates and the relatively low germination observed in the reference soil location. Appendix W presents a series of simple linear regression analyses evaluating statistical relationships between biological effects observed in the lettuce seed toxicity test and concentrations of seven inorganic analytes (chromium, copper, lead, vanadium, iron, aluminum, and calcium) detected in OU 8 surface soil. These analytes were selected because they were detected in the majority of samples with toxicity testing, and because in some cases (i.e., calcium), their concentrations were elevated in the samples with limited lettuce seed germination.

Neither organic analytes nor TPH were included in the regression analyses for OU 8, because these compounds were only detected at low levels in a few of the surface soil samples selected for toxicity testing.

The results of the regressions indicate that reduced lettuce seed germination is poorly correlated with concentrations of the selected analytes. The square of the correlation coefficient (R^2) values ranged from 0.008 (iron) to 0.35 (chromium), indicating little correlation between toxicity testing results and these surface soil chemicals. It is likely that factors other than these chemicals are responsible for the reduced lettuce seed germination rates at CF3-SS-17 and CF3-SS-20. This suggests that plants may not be at risk from exposure

to surface soil at the site (i.e., no lethal toxicity is associated with exposure to OU 8 surface soil).

6.5.2 Surface Water and Sediment Potential risks associated with the ECPCs in OU 8 surface water and sediment are characterized for wildlife and aquatic receptors. Risks for wildlife are characterized by comparing PDE concentrations from ingestion and bioaccumulation of surface water and sediment ECPCs with a respective RTV (estimated threshold for toxicity). Risks for aquatic life are characterized based on field measurements and comparison of exposure concentrations of the ECPCs in surface water and sediment samples with respective RTVs or standards.

Terrestrial and Wetland Wildlife. Risks for the representative wildlife species associated with ingestion of surface water, potentially contaminated aquatic life, and sediment is quantitatively evaluated using the HI and HQ approach discussed in Section 6.5.1.

The lethal and sublethal HIs and HQs calculated for each of the representative wildlife species from exposure to Rowell Creek surface water and sediment ECPCs are provided in Appendix V, Tables V-3 to V-4. HIs for lethal effects to receptors ranged from 0.0004 for the rufous-sided towhee to 0.0043 for the great blue heron, and HIs for sublethal effects to receptors ranged from 0.0003 for the raccoon to 0.012 for the great blue heron. The results of the food-web modeling indicate that no lethal or sublethal adverse effects to wildlife from exposure to maximum surface water or sediment ECPCs are anticipated at OU 8. As a result, no evaluation of risk from exposure to average ECPCs was performed.

Aquatic Receptors. Risks for aquatic receptors from exposure to surface water and sediment were characterized based on a weight-of-evidence evaluation of the following factors:

- measurements of the aquatic macroinvertebrate community structure and function;
- comparison of concentrations of ECPCs in unfiltered surface water to reported toxicity of the ECPC in laboratory tests (AQUIRE information), Federal AWQC (USEPA, 1991c), and State of Florida surface water quality standards (Florida Legislature, 1995); and
- comparison of concentrations of ECPCs in sediment relative to NOAA ER-L and ER-M sediment guidelines (Long and others, 1993), USEPA sediment quality guidelines based on equilibrium partitioning (USEPA, 1988a), and OME LEL provincial sediment quality guidelines (Persaud and others, 1992).

Surface water. A review of the macroinvertebrate habitat quality parameter data presented in Section 5.2 suggests that habitat quality conditions at RC-BIO-3 represent a poor environment for many types of aquatic organisms. Data from dip net, ponar, and Hester-Dendy studies support this conclusion. Adequate reference data were not available, limiting interpretation of the benthic results. Aquatic habitat conditions at OU 8 are dissimilar from that of the regional reference station. Five Mile Creek is deeper, cooler, more acidic, more oxygenated, and has a lower conductivity than RC-BIO-3. These differences in habitat structure may be sufficient to explain the decreased biological condition at RC-BIO-3. The

NAS Cecil Field sewage treatment plant discharge may also contribute to the differences in community structure at this sampling location.

In addition to the macroinvertebrate community data, the potential for adverse effects to aquatic receptors was evaluated by comparing unfiltered surface water concentrations with RTVs, as provided in Table 6-16, which indicates that only surface water concentrations of aluminum and silver exceed aquatic benchmark values.

Aluminum was detected at both downstream surface water sample locations at concentrations ranging from 141 to 559 $\mu g/\ell$; both concentrations exceed the USEPA chronic water quality criterion (87 $\mu g/\ell$) for aluminum. A review of the aluminum AWQC document (USEPA, 1988a) indicates that larval trout are among the most sensitive ecological receptors with regard to aluminum exposure. No salmonids occur in Rowell Creek, a warmwater system. AQUIRE data (Appendix T) indicate that several species of frogs, minnows, snails, and bass also exhibit sensitivity to low concentrations of certain aluminum salts. Although these sensitivities exist, the majority of species evaluated in AQUIRE are tolerant of the concentrations of aluminum detected in Rowell Creek adjacent to OU 8. Further more, the evaluation of unfiltered surface water may overestimate the risk associated with exposure to inorganics such as aluminum (USEPA, 1993f). Therefore, it is unlikely that the levels of aluminum in surface water pose a risk to the site's aquatic receptors (since the aluminum concentrations are below the acute ambient water quality criterion of 750 $\mu g/\ell$), but aluminum could pose a chronic risk to sensitive aquatic species in Rowell Creek.

Silver was detected in Rowell Creek at station RC-SW-3, downgradient of OU 8, at a concentration of 0.24 $\mu g/\ell$. This sample was collected and analyzed in 1993.

Silver was undetected in all surface water samples collected in 1994 at identical detection limits as in the 1993 sampling event ($\mu g/\ell$). The RC-SW-3 concentration (0.24 $\mu g/\ell$) is approximately 3 times the FDEP freshwater quality standard, and 2 times the Federal chronic AWQC for silver. A review of the aluminum AWQC document (USEPA, 1988d) indicates that larval trout are among the most sensitive ecological receptors with regard to silver exposure. No salmonids occur in Rowell Creek, a warmwater system. It is unlikely that silver in surface water is posing a risk to the site's aquatic receptors.

Based on the results of the surface water analyses, it is unlikely that Rowell Creek aquatic receptors are currently at risk from exposure to chemicals in surface water at OU 8.

Sediment. The potential for adverse effects to aquatic receptors was also evaluated by comparing sediment concentrations with RTVs, as provided in Table 6-17. With the exception of Aroclor 1254 and 4,4'-DDT, no analytes detected in Rowell Creek sediment exceeded sediment RTVs.

Aroclor 1254 (180 micrograms per kilogram [$\mu g/kg$]) was detected in Rowell Creek in 1993 at Station RC-SD-3, downgradient of OU 8. PCBs were undetected in all sediment samples collected in 1994. The detected concentration of Aroclor 1254 at RC-SD-3 is less than the USEPA draft SQG for PCBs (195 micrograms per kilogram [$\mu g/kg$]) at 1 percent TOC, but is approximately 3 times the OME LEL value (Persaud and others, 1992) and an order of magnitude above the NOAA ER-L (Long and others, 1993). The OME LEL value corresponds to the 5 percent lower

Table 6-16
Comparison of Surface Water Ecological Chemicals of Potential Concern Exposure Concentrations to Reference Toxicity Values

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Rowell Creek		Upstream	Florida Class III Fresh Water Quality Standards[2]	AWQC[3]	AQUIRE Lowest Reported Adverse Effect Concentration[4] Test Species	Result
	CF3-SW-1	RCSW3	CF3-SW-2				
Volatile Organic Compounds (μg/ℓ)							
Bromodichloromethane	3.5	2	5	22	NA	NA	
Dibromochloromethane	2	ND	2	34	NA	NA	
Inorganic Analytes (μg/ℓ)							
Aluminum	559	141	ND	NA	[5]87	15 / Brown trout LC_{50}	Exceeds RTV and effect concentration.
Silver	ND	0.24	ND	0.07	0.12	11 / Water flea LC_{50}	Exceeds RTV, less than effect concentration.

[1] Value represents average of duplicate samples.
[2] Chapter 62-302, Florida Administrative Code Surface Water Quality Standards (Florida Legislature, 1995).
[3] Federal Ambient Water Quality Criteria (U.S. Environmental Protection Agency [USEPA], 1991g; 1988a).
[4] From Appendix T, Table T.2-3. Only growth, mortality, and reproductive effects to plants, invertebrates, reptiles, amphibians, and fish were considered.
[5] Based on a pH of 6.5 to 9 (USEPA, 1988a).

Notes: Results of analyses of surface water samples are included in Appendix D.

AWQC = Ambient Water Quality Criteria (guidance criteria established under the Clean Water Act).
AQUIRE = Aquatic Information Retrieval database.
μg/ℓ = micrograms per liter.
NA = not available.
ND = not detected.
= detection exceeds the most conservative criteria or no criteria exist.
LC_{50} = lowest concentration that is lethal in 50 percent of a population.
RTV = reported toxicity value.

Table 6-17
Comparison of Sediment Ecological Chemical of Potential Concern Exposure Concentrations to Reference Toxicity Values

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Rowell Creek		Upstream	NOAA[1]		OME LEL[3]	USEPA SQGs[4]	Result
	CEF3SD1[2]	RC3SD3	CEF3SD2	ER-L	ER-M			
Volatile Organic Compounds (μg/kg)								
2-Butanone	4	6	ND	NA	NA	NA	NA	No RTV
Semivolatile Organic Compounds (μg/kg)								
Di-n-butylphthalate	ND	310	ND	NA	NA	NA	NA	No RTV
bis(2-Ethylhexyl)phthalate	ND	260	ND	NA	NA	NA	NA	No RTV
Pesticides and PCBs (μg/kg)								
Aroclor-1254	ND	180	ND	22.7	180	60	195	Exceeds
4,4'-DDT	4.4	ND	ND	1.58	46.1	8	8.28	Exceeds
Inorganic Analytes (mg/kg)								
Barium	ND	6.9	ND	NA	NA	NA	NA	No RTV

[1] NOAA ER-L and ER-M sediment guidelines correspond to the concentration that is protective of 90 percent of the population and 50 percent of the population, respectively (Long and others, 1993).
[2] Value represents average of duplicate samples.
[3] OME LEL provincial sediment quality guidelines (Persaud and others, 1992) correspond to a concentration that can be tolerated by the majority of benthic organisms.
[4] USEPA (1988c) mean SQCs values at 1 percent total organic carbon (TOC) (used instead of site-specific TOC of 0.34 percent). All values represent final residue values.

Results of analyses of sediment samples are included in Appendix A.

Notes: NOAA = National Oceanic and Atmospheric Administration.
ER-L = effects range-low.
ER-M = effects range-median.
OME = Ontario Ministry of the Environment.
LEL = low effects level.
USEPA = U.S. Environmental Protection Agency.
SQGs = Sediment Quality Guidelines.
μg/kg = micrograms per kilogram.
ND = not detected.
NA = not available.
RTV = reference toxicity value.
PCB = polychlorinated biphenyl.
= detection exceeds the most conservative screening value or no screening value exists.
DDT = dichlorodiphenyltrichloroethane.
mg/kg = milligrams per kilogram.

confidence limit of sediment contamination in the Great Lakes that most benthic organisms can tolerate, and is 2 orders of magnitude lower than the 95 percent UCL of sediment contamination in the Great Lakes that would cause pronounced effects to benthic organisms.

The pesticide 4,4'-DDT (4.4 μg/kg) was detected in Rowell Creek at station CF-SD-1, downgradient of OU 8. This sample was collected and analyzed in 1994. The detected concentration of 4,4'-DDT at RC-SD-3 is less than the USEPA draft SQG for 4,4'-DDT (8.28 μg/kg) at 1 percent TOC and is less than the OME LEL value (8 μg/kg); however, the detected 4,4'-DDT is approximately twice the NOAA ER-L for this pesticide.

Neither of these analytes were detected in OU 8 groundwater, but both were detected in OU 8 surface soil. Contaminants in surface soil at OU 8 could potentially migrate to Rowell Creek via surface water runoff. Aroclor 1254 had a very low frequency of detection in surface soil, was not detected in surface water, and is unlikely to pose a future threat to receptors in Rowell Creek. 4,4'-DDT had a higher detection frequency in surface soil, occurring mainly in the Disposal Area. The concentration of 4,4'-DDT at the sampling station nearest Rowell Creek was estimated at 2.2 μg/kg, a level that is well below the NOAA ER, OME LEL, and USEPA SQGB (Table 6-17). Should this contaminant migrate to Rowell Creek via surface water runoff, it would likely be diluted to an even lower concentration. Neither of these compounds were found to pose a risk to wildlife at the concentrations present at the site. The presence of Aroclor-124 A and 4,4-DDT in sediment is most likely the results of previous basewide use of pesticides and TCBs (rather than from disposal operations at OU 8) and the subsequent migration of these contaminants to the creek by surface water runoff. It is unlikely that aquatic receptors are currently at risk from exposure to the low levels of Aroclor 1254 or 4,4'-DDT detected in OU 8 sediment.

6.5.3 **Groundwater**. The risks associated with ECPCs in groundwater as discharged to Rowell Creek were evaluated based on the following factors:

- comparison of maximum and average ECPCs in groundwater relative to reported toxicity benchmarks of the ECPC in laboratory tests (AQUIRE information, USEPA, 1994a), Federal AWQC (USEPA, 1991g), and State of Florida Surface Water Quality Standards for Class III waters (Florida Legislature, 1995) and

- responses of *P. promelas* and *C. dubia* in the groundwater laboratory toxicity tests.

OU 8 Shallow Groundwater, March 1994 Sampling. Fourteen shallow groundwater monitoring wells were sampled in March 1994. A simple dilution model was used to relate ECPC concentrations in the 14 groundwater samples to surface water conditions (Appendix X). The predicted future concentrations of undiluted and unfiltered, undiluted and filtered, and diluted and unfiltered ECPCs resulting from discharge of groundwater to Rowell Creek were compared to aquatic RTVs (Table 6-18).

The maximum and average undiluted and unfiltered concentrations of 1,2-, 1,3-, and 1,4-dichlorobenzene; bis(2-ethylhexyl)phthalate; Aroclor-1248; aluminum; chromium; copper; and iron all exceed their respective RTVs. However, unfiltered data are likely to overestimate the potential for adverse effects to aquatic

Table 6-18
Comparison of Groundwater Ecological Chemical of Potential Concern Exposure Concentrations to Reference Toxicity Values

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Unfiltered EPCs		Filtered EPCs		Diluted Unfiltered EPCs		Florida Class III Fresh Water Quality Standards[1]	AWQC[2]	AQUIRE Lowest Reported Adverse Effect Concentration[3] (µg/ℓ/test species)	Result
	Average	Maximum	Average	Maximum	Average	Maximum				
Volatile Organic Compounds (µg/ℓ)										
Acetone	47.4	180	NE	NE	1.4	1.4	NA	NA	550,000 / water flea mortality	
2-Butanone	15.2	25	NE	NE	0.19	0.19	NA	NA	70,000 / water flea mortality	
1,1-Dichloroethylene	65.7	350	NE	NE	NE	NE	([4])	NA	2,400 / water flea lethality	
1,2-Dichloroethylene	151	1,900	NE	NE	NE	NE	NA	NA	2,400 / water flea lethality	
1,1,1-Trichloroethane	98.9	860	NE	NE	NE	NE	173,000	NA	1,300 / water flea reproductive endpoints	
Trichloroethylene	206	1,700	NE	NE	13	13	([4])	[5]21,900	1,900 / medaka LC_{50}	
Xylenes (total)	20.9	150	NE	NE	1.1	1.1	NA	NA	NA	No RTV
Semivolatile Organic Compounds (µg/ℓ)										
Benzo(b)fluoranthene	3	3	NE	NE	0.02	0.02	NA	NA	NA	No RTV
1,2-Dichlorobenzene	852	9,800	NE	NE	7.4	7.4	NA	[5]763	1.8 / trout mortality	Exceeds
1,3-Dichlorobenzene	26.8	48.4	NE	NE	NE	NE	NA	[5]763	1.8 / trout mortality	
1,4-Dichlorobenzene	120	567	NE	NE	NE	NE	NA	[5]763	1.8 / trout mortality	Exceeds

See notes at end of table.

Table 6-18 (Continued)
Comparison of Groundwater Ecological Chemical of Potential Concern Exposure Concentrations to Reference Toxicity Values

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Unfiltered EPCs		Filtered EPCs		Diluted Unfiltered EPCs		Florida Class III Fresh Water Quality Standards[1]	AWQC [2]	AQUIRE Lowest Reported Adverse Effect Concentration[3] (µg/ℓ/test species)	Result
	Average	Maximum	Average	Maximum	Average	Maximum				
bis(2-Ethylhexyl)phthalate	5	5	NE	NE	NE	NE	3.0	[8]360	0.89 / moorfrog hatchability	Exceeds
2-Methylnaphthalene	52.4	200	NE	NE	2	2	NA	NA	2,000,000 / green algae growth	
2-Methylphenol	19	19	NE	NE	0.14	0.14	([7])	NA	NA	No RTV
4-Methylphenol	61	61	NE	NE	0.46	0.46	([7])	NA	NA	No RTV
Naphthalene	86.5	450	NE	NE	NE	NE	NA	[5]620	NA	
Pesticides and PCBs (µg/ℓ)										
Aroclor 1248	0.52	0.56	NE	NE	NE	NE	0.014	0.014	[8] 0.01 / trout mortality	Exceeds
Inorganic Analytes (µg/ℓ)										
Aluminum	3,949	28,854	179	284	357	357	NA	[9]87	15 / trout LC_{50}	Exceeds
Barium	25	41.7	21.7	37	NE	NE	NA	NA	26,000 / duckweed growth	
Chromium	7.3	9	NE	NE	NE	NE	11	11	5 / water flea growth, reproduction, and mortality	Exceeds
Copper	17.5	23.3	12.4	15.2	NE	NE	[10]12	[10]12	1.5 / water flea reproduction	Exceeds
Iron	4,907	36,500	4,208	35,800	NE	NE	1,000	1,000	460 / trout hatchability	Exceeds
Lead	2	2.5	1.7	1.9	NE	NE	[10]3.3	[10]3.3	52 / trout mortality	
Manganese	40.5	122	37.8	105	NE	NE	NA	NA	280 / phytoplankton population endpoints	
Vanadium	25.1	26.5	NE	NE	0.20	0.20	NA	NA	[11] 128 / guppy LC_{50}	

See notes at end of table.

Table 6-18 (Continued)
Comparison of Groundwater Ecological Chemical of Potential Concern Exposure Concentrations to Reference Toxicity Values

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

[1] Chapter 62-302, Florida Administrative Code Surface Water Quality Standards (Florida Legislature, 1995).
[2] Federal Ambient Water Quality Chronic Criteria (U.S. Environmental Protection Agency [USEPA], 1991g and 1988a).
[3] From Appendix T, Table T.2-3. Only growth, mortality, and reproductive effects to plants, invertebrates, reptiles/amphibians, and fish were considered.
[4] This standard is based on human health effects and was not used for comparative purposes in this ecological risk assessment.
[5] Insufficient data to develop criteria. Value presented is the lowest observed effect level.
[6] Proposed criterion.
[7] Phenolic compounds other than those produced by the natural decay of plant material shall not taint the flesh of edible fish or shellfish or produce objectionable taste or odor in a drinking water supply.
[8] Aroclor 1254 used as a surrogate.
[9] Based on a pH of 6.59 (USEPA, 1988a).
[10] Criteria calculated based on a mean site-specific hardness concentration of 103.5 milligrams per liter as calcium carbonate.
[11] Value for vanadium as vanadium oxide sulfate.

Notes: Results of analyses of groundwater samples included in Appendix A.

EPC = exposure point concentration.
AWQC = Ambient Water Quality Criteria (guidance criteria established under the Clean Water Act).
AQUIRE = Aquatic Information Retrieval.
= concentration exceeds the most conservative toxicity benchmark.
$\mu g/\ell$ = micrograms per liter.
NE = not evaluated, not a CPC.
NA = not available.
LC_{50} = lethal concentration to 50 percent of test population.
RTV = reference toxicity value.
PCB = polychlorinated biphenyl.

organisms from inorganics due to the presence of suspended particles, ligands, and colloidal material. Inorganic analytes may sorb to these particles, which reduce their bioavailability. Consequently, filtered groundwater data were also compared to RTVs. Following filtration, all inorganic concentrations in undiluted groundwater remained greater than their respective RTVs, with the exception of chromium.

Analysis of undiluted groundwater data is likely to overestimate the potential for adverse effects to aquatic organisms; therefore, a dilution factor of 7.53×10^{-3} (Appendix X) was calculated to model future groundwater discharges to Rowell Creek. This dilution factor indicates that constituents detected in groundwater are likely to be diluted 133-fold prior to discharge to Rowell Creek. The comparison of diluted groundwater with aquatic RTVs provides a more realistic evaluation of the potential for adverse effects from ECPCs in OU 8 groundwater. 1,2-Dichlorobenzene and aluminum are the only ECPCs that exceed aquatic RTVs in diluted groundwater.

The maximum predicted concentration of aluminum in diluted unfiltered groundwater was 357 $\mu g/\ell$, higher than the chronic AWQC for aluminum (87 $\mu g/\ell$). As shown in Table 6-18, filtration of groundwater significantly reduced concentrations of aluminum. The maximum and average predicted exposure concentrations of aluminum in diluted filtered groundwater are 2.1 $\mu g/\ell$ and 1.3 $\mu g/\ell$, respectively. Based on these concentrations, it is unlikely that future discharges of aluminum will pose a risk to aquatic receptors in Rowell Creek.

The potential effects of the groundwater contaminant 1,2-dichlorobenzene upon discharge to Rowell Creek are presented int he follow subsection.

OU 8 Shallow Groundwater Toxicity Testing, November 1994 Groundwater toxicity testing and chemical analytical samples from two monitoring wells (CF3-MW-17S and CF3-MW-28S) were collected concurrently in November, 1994 and split for the two separate analyses. The results of the chemical analyses for these two groundwater samples were used to interpret the contaminant exposures for the toxicity test species (*P. promelas* and *C. dubia*). As discussed in Section 6.4 and presented in Table 6-15, exposure to undiluted OU 8 groundwater resulted in reduced growth and mortality in the fathead minnow, and reduced survival and reproduction in the water flea. Up to a 20-fold dilution was required to reduce OU 8 groundwater toxicity.

The detected concentrations of ECPCs from monitoring wells CF3-MW-13S and CF3-MW-28S were compared to the aquatic RTVs in Table 6-19. The results of this comparison indicate that seven analytes (1,1-dichloroethane, dichlorobenzene, aluminum, chromium, copper, iron, and lead) exceeded aquatic RTVs and may have contributed to the adverse effects observed to *C. dubia* and *P. promelas* in the toxicity tests. The range of reproductive, growth, and mortality effects concentrations for daphnids and fathead minnows from the AQUIRE database (Appendix T, Table T.2-3) are presented in Table 6-20 for each of these seven analytes. A review of these data suggests that three dichlorobenzene isomers (1,2-, 1,3-, and 1,4-dichlorobenzene) are likely to be primary groundwater risk contributors, although additive and synergistic effects from other toxicants are also possible.

Table 6-19
Comparison of Chemical Concentrations in CF3-MW-13S and CF3-MW-28S Undiluted Groundwater to Reference Toxicity Values

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	CF3-MW-13S	CF3-MW-28S	Background Screening Concentrations for Groundwater[1]	Florida Class III Fresh Water Quality Standards[2]	AWQC[3]	AQUIRE Lowest Reported Adverse Effect Concentration[4] (µg/ℓ/test species)	Result
Volatile Organic Compounds (µg/ℓ)							
1,1-Dichloroethane	ND	58	NA	NA	[5]20,000	[6] 34 / trout LC_{50}	Exceeds
1,1-Dichloroethylene	ND	120	NA	([7])	NA	2,400 / water flea lethality	
1,2-Dichloroethylene	1,400	120	NA	NA	NA	2,400 / water flea lethality	
4-Methyl-2-pentanone	ND	38	NA	NA	NA	7,800 / water flea reproduction	
Trichloroethylene	1,200	450	NA	([7])	[5]21,900	1,900 / medaka LC_{50}	
Semivolatile Organic Compounds (µg/ℓ)							
Butylbenzylphthalate	0.6	ND	NA	3	3	NA	
2-Chlorophenol	ND	0.9	NA	400	NA	NA	
1,2-Dichlorobenzene	3,600	430	NA	NA	[5]763	1.8 / trout mortality	Exceeds
1,3-Dichlorobenzene	140	15	NA	NA	[5]763	1.8 / trout mortality	Exceeds
1,4-Dichlorobenzene	830	64	NA	NA	[5]763	1.8 / trout mortality	Exceeds
2,4-Dichlorophenol	ND	5	NA	790	[5]365	NA	
Di-n-butylphthalate	0.8	ND	NA	3	3	NA	
2-Methylnaphthalene	140	38	NA	NA	NA	2,000,000 / green algae growth	

See notes at end of table.

Table 6-19 (Continued)
Comparison of Chemical Concentrations in CF3-MW-13S and CF3-MW-28S Undiluted Groundwater to Reference Toxicity Values

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	CF3-MW-13S	CF3-MW-28S	Background Screening Concentrations for Groundwater[1]	Florida Class III Fresh Water Quality Standards[2]	AWQC[3]	AQUIRE Lowest Reported Adverse Effect Concentration[4] (µg/ℓ/test species)	Result
Semivolatile Organic Compounds (µg/ℓ) (Continued)							
2-Methylphenol	ND	0.5	NA	([8])	NA	NA	No RTV
Naphthalene	240	46	NA	NA	[5]620	NA	
N-Nitrosodiphenylamine	2	ND	NA	NA	NA	NA	No RTV
1,2,4-Trichlorobenzene	12	2	NA	NA	NA	NA	No RTV
Inorganic Analytes (µg/ℓ)							
Aluminum	22,000	2,220	17,200	NA	[9]87	15 / trout LC_{50}	Exceeds
Antimony	2.7	2	ND	4,300	[10]30	NA	
Barium	40.5	16.8	42	NA	NA	26,000 / duckweed growth	
Chromium	15.8	ND	ND	11	11	5 / water flea growth, reproduction, and mortality	Exceeds
Copper	3.8	2.2	ND	[11]12	[11]12	1.5 / water flea reproduction	Exceeds
Iron	9,470	977	2,500	1,000	1,000	460 / trout hatchability	Exceeds
Lead	10.1	ND	13	[11]3.3	[11]3.3	52 / trout mortality	Exceeds
Manganese	21.3	5.8	99	NA	NA	280 / phytoplankton population endpoints	
Nickel	5.6	2.8	38	[11]162	[11]162	50 / water flea mortality	
Vanadium	13.8	2.6	ND	NA	NA	[13]128 / guppy LC_{50}	

See notes on the following page.

Table 6-19 (Continued)
Comparison of Chemical Concentrations in CF3-MW-13S and CF3-MW-28S Undiluted Groundwater to Reference Toxicity Values

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

[1] Background concentrations from Table 3-3.
[2] Chapter 62-302, Florida Administrative Code, Surface Water Quality Standards (Florida Legislature, 1995).
[3] Federal Ambient Water Quality Chronic Criteria (U.S. Environmental Protection Agency [USEPA], 1991g and 1988a).
[4] From Appendix T, Table T.2-3. Only growth, mortality, and reproductive effects to plants, invertebrates, reptiles/amphibians, and fish were considered.
[5] Insufficient data to develop criteria. Value presented is the lowest observed effect level.
[6] 1,2-Dichloroethane used as a surrogate for 1,1-dichloroethane.
[7] This standard is based on human health effects and was not used for comparative purposes in this ecological risk assessment.
[8] Phenolic compounds other than those produced by the natural decay of plant material shall not taint the flesh of edible fish or shellfish or produce objectionable taste or odor in a drinking water supply.
[9] Based on a pH of 6.5-9 (USEPA, 1988a).
[10] Proposed criterion.
[11] Criteria calculated based on a mean site-specific surface water hardness concentration of 104 milligrams per liter as calcium carbonate.
[12] Value for vanadium as vanadium oxide.

Notes: Results of analyses of groundwater samples are included in Appendix A.

AWQC = Ambient Water Quality Criteria (guidance criteria established under the Clean Water Act).
AQUIRE = Aquatic Information Retrieval.
$\mu g/\ell$ = micrograms per liter.
ND = not detected.
NA = not available.
LC_{50} = lethal concentration to 50 percent of test population.
RTV = reference toxicity value.
= concentration exceeds the most conservative toxicity benchmark.

Table 6-20
Toxicity of Groundwater Ecological Chemicals of Potential Concern to Aquatic Receptors

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	*Daphnia magna*[1] (Reproduction) (Range/No. of studies)	*Daphnia magna*[1] (Mortality) (Range/No. of studies)	*Ceriodaphnia dubia* (Reproduction) (Range/No. of studies)	*Ceriodaphnia dubia* (Mortality) (Range/No. of studies)	*Pimephales promelas* (Growth) (Range/No. of studies)	*Pimephales promelas* (Mortality) (Range/No. of studies)
Volatile Organic Compounds (μg/ℓ)						
1,1-Dichloroethane	11,000 - 21,000 / 3	68,000 - 1,430,000 / 9	NA	NA	29,000 - 59,000 / 2	59,000 - 141,000 / 7
Semivolatile Organic Compounds (μg/ℓ)						
1,4-Dichlorobenzene	300 - 930 / 3	680 - 42,000 / 3	NA	NA	2,200 - 3,700 / 2	570 - 35,400 / 16
Inorganic Analytes (μg/ℓ)						
Aluminum[2]	680 / 1	NA	NA	NA	35 - 66 / 1	35 - 400 / 4
Chromium	5 / 1	5 - 22 / 2	NA	NA	NA	37,000 - 61,000 / 4
Copper	NA	54 - 772 / 2	1.5 - 6.3 / 2	1.5 - 127 / 32	9.89 - 221.8 / 3	70 - 21,000 / 20
Iron	NA	NA	NA	NA	NA	NA
Lead	NA	4,400 / 1	NA	NA	NA	NA

[1] Aquatic Information Retrieval (AQUIRE) toxicity data was reported for *Daphnia magna* when no data were available for *Ceriodaphnia dubia*.
[2] Value for aluminum is aluminum chloride.

Notes: Only the values reflecting risk assessment endpoints (growth, reproduction, and mortality) were selected for risk evaluation. Toxicity information was retrieved from AQUIRE database and is included as Appendix T.

μg/ℓ = micrograms per liter.
NA = not available.

The VOA 1,1-dichloroethane was detected in monitoring well CF3-MW-28S at a concentration of 58 $\mu g/\ell$, well below the USEPA chronic LOEL (20,000 $\mu g/\ell$), and only slightly above the lowest effect level from AQUIRE (34 $\mu g/\ell$). The AQUIRE value represents a trout embryo (lethal concentration where 50 percent of test population dies [LC_{50}]) study; all other species included in the AQUIRE database are considerably less sensitive than trout. Concentrations of aluminum, iron, and lead in OU 8 groundwater are similar to those in the background monitoring wells; therefore, it is unlikely that these inorganic analytes contribute additional toxicity in OU 8 groundwater. Chromium is present in monitoring well CF3-MW-13S at a concentration slightly in excess of State and Federal standards. Copper concentrations in these wells are an order of magnitude below the standards, but exceed a water flea reproductive effect level in the AQUIRE database. Although both of these inorganics may be risk contributors, their low concentrations coupled with the reductions in concentrations observed in filtered groundwater at OU 8 suggest that they are not the primary constituents of concern at monitoring wells CF3-MW-13S and CF3-MW-28S.

Dichlorobenzenes are a class of halogenated aromatic compounds represented by three structurally similar isomers (1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene). These compounds are water- and lipid-soluble, relatively volatile, and degradable at low concentrations (USEPA, 1980; 1994a; Calamari and others 1982). Although slight differences in toxicity for the dichlorobenzene isomers have been observed, in general the toxicity of these isomers to individual species is similar. Acute toxicity from exposure to chlorinated benzenes is positively correlated with the degree of chlorination, with chlorobenzene being the least toxic, followed by dichlorobenzene, trichlorobenzene, tetrachlorobenzene, and pentachlorobenzene.

Acute toxicity from dichlorobenzene has been demonstrated in several taxa, including fish, invertebrates, and plants (USEPA, 1980; 1994a). Cladoceran (*Daphnia magna*) 48-hour effective concentration for 50 percent of test population (EC_{50}) or mortality values ranged from 680 to 42,000 $\mu g/\ell$, and midge (*Tanytarsus dissimilis*) 24-hour and 48-hour EC_{50} values ranged from 13,000 to 22,100 $\mu g/\ell$. The range of LC_{50} values for five fish species (rainbow trout [*Oncorhynchus mykiss*], fathead minnow, zebrafish [*Brachydanio rerio*], guppy [*Poecilia reticulata*], and bluegill [*Lepomis macrochirus*]) was 800 to 35,400 $\mu g/\ell$, with the rainbow trout exhibiting more sensitivity than the warm water species.

Limited data are available regarding chronic toxicity of dichlorobenzene. Calamari and others (1982) reported fertility impairment to *D. magna* at 400 $\mu g/\ell$ dichlorobenzene (with a NOEC of 220 $\mu g/\ell$), and a 14-day LC_{50} for trout of 800 $\mu g/\ell$. MATC concentrations cited in Calamari and others (1982) range from 220 to 440 $\mu g/\ell$ for the water flea, and 100 to 800 $\mu g/\ell$ for trout. Chronic embryo-larval tests with fathead minnows and dichlorobenzene have resulted in chronic values ranging from 763 to 2,000 $\mu g/\ell$ (USEPA, 1980; 1994a). Toxicity tests with freshwater algae (*Selenastrum capricornutum* and *Scenedesmus subspicatus*) have found EC_{50} values ranging from 1,600 to 179,000 $\mu g/\ell$.

The acute-chronic ratio for several dichlorobenzene isomers in fish and invertebrate studies was 5.2, according to the USEPA (1980). Bioconcentration studies with dichlorobenzene have generally indicated that little potential exists for tissue accumulation in aquatic systems; Calamari and others (1982) observed higher BCFs in hatchlings and in fish embryos than in older life stages of fish.

To further evaluate dichlorobenzene toxicity, geometric mean effects concentrations based on acute EC_{50} and LC_{50} AQUIRE data (USEPA, 1994a) for eight taxa were derived. Although relatively few studies of chronic duration are available, chronic values were estimated in the same manner for five taxa. The species mean acute and chronic values are provided in Table 6-21 and on Figures 6-3 and 6-4.

The acute and chronic AWQC for dichlorobenzene (1,120 $\mu g/\ell$, and 763 $\mu g/\ell$, respectively) are lower than the mean acute values for all organisms evaluated. The chronic AWQC (763 $\mu g/\ell$) is lower than the chronic values for the guppy, zebrafish, and fathead minnow, but is higher than the rainbow trout and water flea mean chronic values.

The maximum total dichlorobenzene concentration (sum of all three isomers) in undiluted, unfiltered groundwater at OU 8 was 10,415 $\mu g/\ell$. Total undiluted dichlorobenzene concentrations in the two wells with toxicity data (CF3-MW-13S and CF3-MW-28S) were 4,570 and 509 $\mu g/\ell$, respectively. These concentrations are within the reproductive and mortality effects range for *C. dubia* and *P. promelas*.

Figures 6-3 and 6-4 present the rank-ordered log-transformed species acute and chronic values, respectively, which graphically depict the relative sensitivities of the various test taxa to 1,4-dichlorobenzene (used as a surrogate for all three dichlorobenzene isomers). The predicted average and maximum groundwater discharge concentrations of undiluted and diluted 1,4-dichlorobenzene are plotted on each graph. Taxa, whose acute or chronic values lie to the left of these discharge concentrations, are considered to be sensitive to dichlorobenzene and may exhibit either acute or chronic effects from exposure to expected discharge concentrations. Those taxa whose acute and chronic values lie to the right of the expected discharge concentrations are not expected to experience adverse effects from exposure to dichlorobenzene.

The undiluted maximum concentration of dichlorobenzene detected in OU 8 groundwater exceeds species mean acute values for several fish species, water flea, and green algae. Acute mean values for midge larvae, fathead minnows, and a second species of green algae were greater than the maximum undiluted concentration of dichlorobenzene.

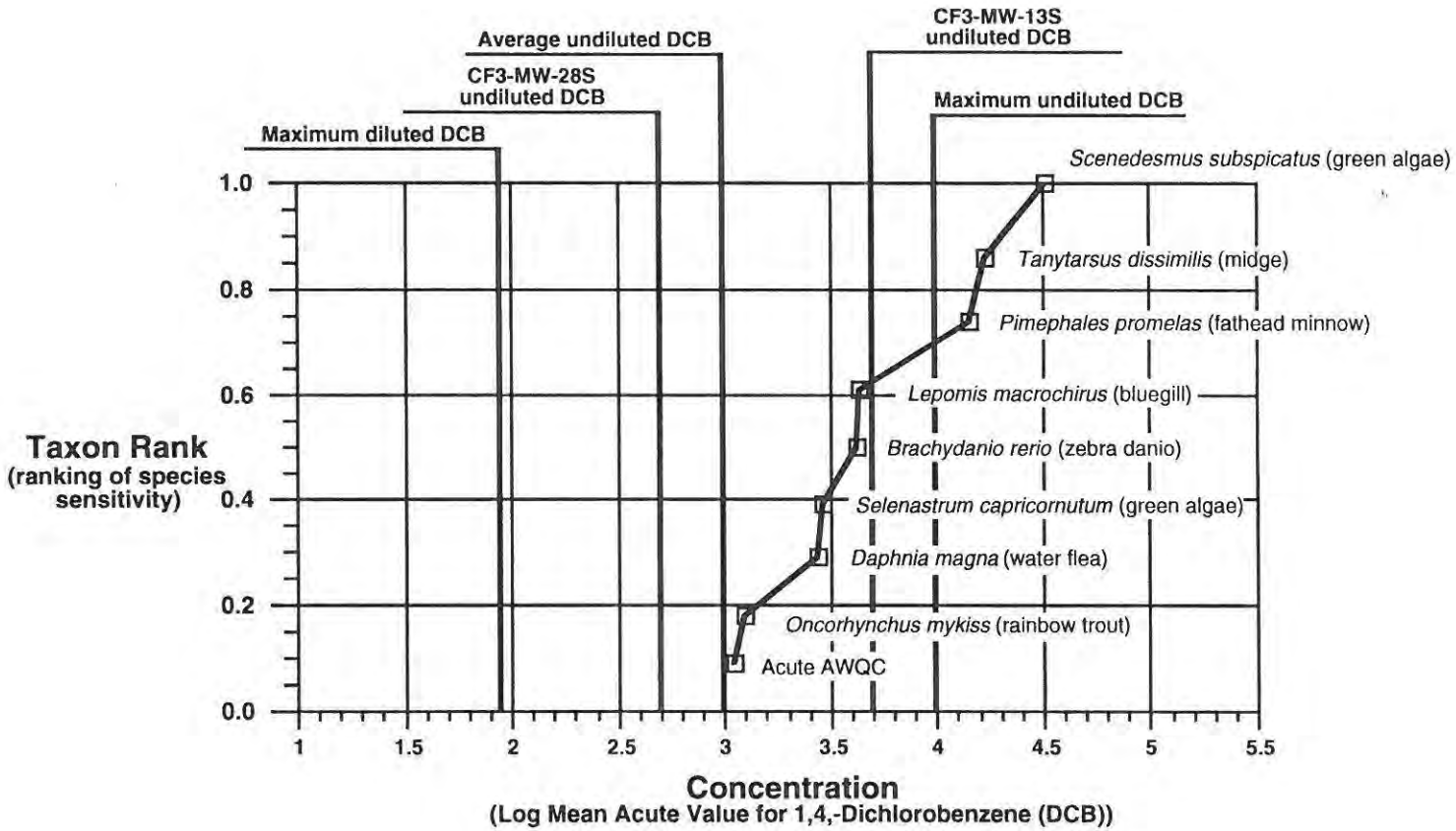
The undiluted average of all dichlorobenzene isomer concentrations, as well as the diluted average and maximum concentrations of all isomers of dichlorobenzene, are less than the species mean acute values. The maximum and average undiluted concentrations of all isomers of dichlorobenzene exceed most or all of the species mean chronic values presented in Figure 6-4; however, the maximum and average diluted concentrations of all dichlorobenzene are less than all mean chronic values, with the exception of the rainbow trout, which is not expected to be found in the warm waters of Rowell Creek.

This analysis suggests that, if aquatic organisms were exposed to undiluted groundwater, they would not be at risk from acute exposure to average concentrations, but could be adversely impacted if exposed to maximum concentrations. Further, chronic exposure to undiluted groundwater at average or maximum concentrations could in this scenario, adversely impact aquatic receptors. Although exposure to undiluted groundwater is an unlikely exposure scenario for pelagic forms, a comparison of available toxicity data to maximum concentrations of dichlorobenzenes in the more downgradient well (CF3-MW-28S) (Table 6-19) suggests there is little to no risk likely for species expected to occur in

Table 6-21
Species Mean Acute and Chronic Values for Dichlorobenzene

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Taxa	Number of Studies	Species Mean Acute Value	Rank	Log Species Mean Acute Value	Rank
Acute ambient water quality criteria (AWQC)	1	1,120	0.01	3.05	0.09
Oncorhynchus mykiss; (Rainbow trout)	6	1,223	0.03	3.09	0.18
Daphnia magna; (Water flea)	9	2,738	0.06	3.44	0.29
Selenastrum capricornutum; (Green algae)	2	2,884	0.10	3.46	0.39
Brachydanio rerio; (Zebra danio)	2	4,225	0.15	3.63	0.50
Lepomis macrochirus; (Bluegill)	2	4,399	0.21	3.64	0.61
Pimephales promelas; (Fathead minnow)	13	14,469	0.39	4.16	0.74
Tanytarsus dissimilis; (Midge)	2	16,950	0.60	4.23	0.86
Scenedesmus subspicatus; (Green algae)	2	32,619	1.00	4.51	1.00
Taxa	**Number of Studies**	**Species Mean Chronic Value**	**Rank**	**Log Species Mean Chronic Value**	**Rank**
Chronic AWQC	1	763	0.14	2.88	0.41
Oncorhynchus mykiss; (Rainbow trout)	2	38	0.00	1.58	0.09
Daphnia magna; (Water flea)	3	481	0.06	2.68	0.25
Pimephales promelas; (Fathead minnow)	5	1,766	0.33	3.25	0.60
Brachydanio rerio; (Zebra danio)	5	2,208	0.57	3.34	0.79
Poecilia reticulata; (Guppy)	1	3,960	1.00	3.60	1.00



Notes:

All site specific DCB values reported as total DCB (sum of 3 isomers)

Log species mean acute and chronic values presented in Table 6-21

AWQC = Ambient water quality criteria

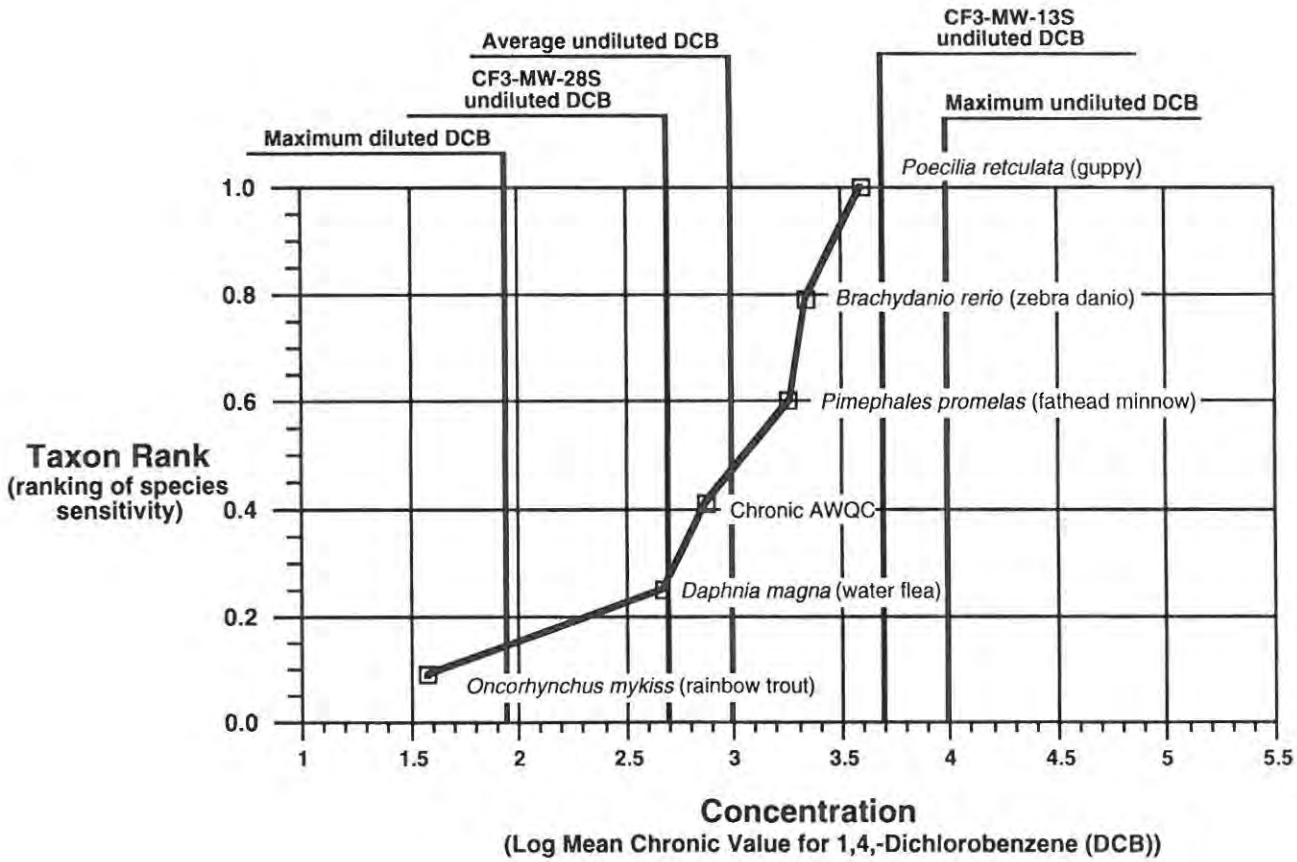
FIGURE 6-3

DICHLOROBENZENE ACUTE TOXICITY VALUES

BASELINE RISK ASSESSMENT, OPERABLE UNIT 8

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

8500-12 CF OU8 BRA 950426WEM



Notes:

All site specific DCB values reported as total DCB (sum of 3 isomers)

Log species mean acute and chronic values presented in Table 6-21

AWQC = Ambient water quality criteria

FIGURE 6-4

DICHLOROBENZENE CHRONIC TOXICITY VALUES

BASELINE RISK ASSESSMENT, OPERABLE UNIT 8

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

8500-12 CF OU8 BRA 950426WEM

Rowell Creek. Toxicity data for demersal forms exposed to dichlorobenzenes was not located in the available literature. An examination of the lowest available effect level for demersal species exposed to aluminum is 2,000 $\mu g/\ell$ (mortality in the common carp, *(Cyprinus carpio)*, and for copper, 6.6 $\mu g/\ell$ (one-fifth of the LC_{50} in the scud, *Gammarus pulex)* (Appendix T). A comparison of concentrations of inorganic ECPCs in samples from monitoring well CF3-MW-28S to these data further supports the stance that risk is minimal for aquatic species potentially exposed to OU 8 groundwater. The groundwater toxicity testing data also support this conclusion. An approximately 20-fold dilution was required to eliminate toxicity from OU 8 groundwater in the laboratory. The anticipated site-specific dilution factor (133-fold) is an order of magnitude greater than the measured 20-fold laboratory dilution.

6.6 UNCERTAINTY ANALYSES. The objective of the uncertainty analysis is to discuss the assumptions of the ERA process that may influence the risk assessment results and conclusions. General uncertainties inherent in the risk assessment process and in the OU 8 ERA are included in Table 6-22.

Use of undiluted, unfiltered groundwater for purposes of risk assessment may overestimate impacts form bioavailable concentrations of analytes in groundwater as it discharges to surface water.

Specific uncertainties associated with the assessment of risks associated with contamination at OU 8 include the following:

- The model for predicting the dilution potential of groundwater may underestimate the actual dilution. Estimates of exposure and associated risk may be overestimated.

- An assumption has been made that organisms evaluated in the laboratory bioassays are as sensitive or more sensitive than organisms at the site.

- Effects of TPH on wildlife could not be evaluated because no mode of evaluation is available (i.e., no suitable reference toxicity values for petroleum contamination are available).

- Due to the mis-labeling of groundwater samples for toxicity testing, the exposure point concentrations in the toxicity tests of samples CF3-MW-13S and CF3-MW-28S are difficult to distinguish from one another.

- The site-specific control sample used for toxicity testing exhibited toxicity to lettuce seed. This result confounded interpretation of the surface soil toxicity data.

6.7 SUMMARY OF ASSESSMENT FOR OU 8. Potential risks for ecological receptors were evaluated for ECPCs in surface soil, surface water, sediment, and groundwater at OU 8.

Risks associated with exposures to ECPCs in OU 8 surface soil and Rowell Creek surface water and sediment were evaluated for wildlife based on a model that estimates the amount of contaminant exposure obtained via the diet and incidental ingestion of these media. Comparison of estimated doses for wildlife species

Table 6-22
Potential Sources of Uncertainty in Ecological Risk Assessment

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Potential source	Direction of Effect	Justification
Uncertainties Associated with ECPC Selection Process		
Degradation of chemicals not considered	Overestimate	Risk estimates are based on recent chemical concentrations. Concentrations will tend to decrease over time from degradation and the formation of daughter products.
No evaluation of TIC data	Underestimate	Risk was not calculated for potential exposure to these compounds.
Screening of sediment ECPCs	Underestimate	Several of the USEPA Region IV sediment screening values are based on laboratory CRQLs, not sediment toxicity data. Because some ECPCs may have been screened out of the risk assessment because their concentrations are less than the sediment screening value, this may result in an underestimate of risk.
Uncertainties Associated with Exposure Assessment		
Food chain assumed to occur at site	Unknown	Occurrence of the food chain used in the models at the sites is unknown.
Food-chain model exposure parameter assumptions	Unknown	Some exposure parameters are from the literature and some are estimated. Efforts were made to select exposure parameters representative of a variety of species or feeding guilds, so that exposure estimates would be representative of more than a single species.
Uncertain occurrence of receptors at sites	Unknown	Actual occurrence at the sites by receptors considered in the food-chain models is uncertain.
Assumption that receptor species will spend equal time at all habitats within home range	Unknown	Organisms will spend varying amounts of time in different habitats, thus affecting their overall exposures.
Extrapolation from test species to representative wildlife species	Unknown	Species differ with respect to absorption, metabolism, distribution, and excretion of chemicals. The magnitude and direction of the difference will vary with each chemical.
Consumption of contaminated prey	Unknown	Toxicity to prey receptors may result in sickness or mortality. Fewer prey items would be available for predators. Predators may stop foraging in areas with reduced prey populations, or discriminate against, or, conversely, select contaminated prey.
Limited evaluation of dermal or inhalation exposure pathways	Underestimate	The dermal and inhalation exposure pathways are generally considered insignificant due to protective fur, feathers, chitinous exoskeleton, and the low concentration of chemicals under natural atmospheric conditions. However, under certain conditions, these exposure pathways may occur.

See notes at end of table.

Table 6-22 (Continued)
Potential Sources of Uncertainty in Ecological Risk Assessment

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Potential source	Direction of Effect	Justification
Maximum exposure scenarios	Overestimate	It is unlikely any receptor would be exposed concurrently to maximum concentrations of all ECPCs.
Missing BAF or RTV values	Underestimate	BAFs and RTVs were not available in the literature for many compounds and receptor classes (i.e., small birds); therefore, these gaps result in an underestimate of the total risk represented by the summary HI.
BAF estimation	Unknown	As many literature values were not available for some species and analytes, alternate BAFs were derived using other assumptions or regressions (Table 6-4 lists the rationale for the generation of alternate BAFs). There is additional uncertainty related to the averaging of log K_{ow} values for certain classes of semivolatile organic compounds prior to calculating BAFs using the Travis and Arms (1988) regression equations, resulting in an overestimate of risk for some compounds and an underestimate of risk for other compounds.
Continuous uptake and bioaccumulation of ECPCs by soil biota	Unknown	Tissue and organ responses to ECPC uptake were represented by a linear functions; that is an oversimplification of a more complex system (i.e., trophic states and lipid concentrations may affect bioaccumulation).
Bioaccumulation of ECPCs in leafy portions of plants	Overestimate	Ryan and others (1988) state that compounds with log K_{ow}s >5 are unavailable to plants due to soil sorption. Compounds with log K_{ow}s >5 will be taken into the roots of plants, but are not easily transported into the leafy parts of plants (Briggs and others, 1982; 1983). The surface soil and ingestion exposure model overestimates ECPC exposure via plant ingestion to those receptors that only eat the leafy portions of plants.
Bioconcentration of surface water ECPCs	Underestimate	The surface water and sediment exposure model may slightly underestimate the prediction of risk to aquatic receptors by not evaluating the bioconcentration of surface water ECPCs for compounds with BCFs <300.
Use of unfiltered surface water samples	Overestimate	Measurement of ECPC concentrations in unfiltered samples includes both dissolved and particulate fractions. The dissolved fraction is considered to be the biologically available component.
Relative uptake of inorganics by different plant species	Unknown	Estimated plant BAFs for certain inorganics were based on BAF data for leafy produce grown in sewage sludge. Variability in type of plant and substrate may make the chosen BAF values an overestimate or underestimate of actual uptake.

See notes at end of table.

Table 6-22 (Continued)
Potential Sources of Uncertainty in Ecological Risk Assessment

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Potential source	Direction of Effect	Justification
Uncertainties Associated with Effects		
Lack of toxicity information for reptile species	Unknown	Information is not available on the toxicity of chemicals to reptilian species resulting from dietary or oral exposures. It is assumed that if mammals and birds are protected then reptiles should be protected also; therefore, reptiles were not evaluated in the risk assessment. However, reptiles may not be protected if they are more sensitive than mammals or birds.
Use of measurement endpoints	Overestimate	Although an attempt was made to have measurement endpoints reflect assessment endpoints, limited available ecotoxicological literature resulted in the selection of certain measurement endpoints that may overestimate assessment endpoints.
Lack of toxicity information for mammals or birds	Underestimate	Reference toxicity values for certain compounds and receptor groups were not available thereby underestimating the risk predicted by the summary HI.
Uncertainties Associated with Risk Characterization		
Risk evaluated for individual terrestrial receptors only	Overestimate	Effects on individual terrestrial organisms may occur with little population or community level effects. However, as the number of affected individuals increases, the likelihood of population-level effects increases.
Effect of decreased prey item populations on predatory receptors	Unknown	Adverse population effects to prey items may reduce the foraging population for predatory receptors, but may not necessarily adversely impact the population of predatory species.
Multiple conservative assumptions	Overestimate	Cumulative impact of multiple conservative assumptions yields high risk to ecological receptors, and may result in risk at background concentrations or the prediction of risks when there is no potential for adverse effects.
Summation of effects (HIs)	Unknown	The assumption that effects are additive ignores potential synergistic or antagonistic effects. It assumes similarity in mechanism of action, which is not the case for many substances. Compounds may induce toxic effects in different organs or systems.

Notes: ECPC = ecological chemical of potential concern.
TIC = tentatively identified compounds.
USEPA = U.S. Environmental Protection Agency.
CRQLs = contract-required quantitation limits.
BAF = bioaccumulation factor.
RTVs = reference toxicity values.
HI = hazard index.
> = greater than.
BCF = bioconcentration factor.
< = less than.

with reference toxicity doses representing thresholds for both lethal and sublethal effects is the basis of the wildlife risk evaluation. No risks were estimated for wildlife exposed to OU 8 surface soil, surface water, or sediment.

Risks for soil invertebrates and plants were evaluated based on the results of laboratory toxicity testing of surface soil samples from OU 8 with earthworms and lettuce seeds. No adverse impacts to earthworms were detected in the laboratory toxicity tests. Although a reduction in lettuce seed germination was observed in two of the surface soil samples from OU 8, there was no correlation between any ECPC concentrations and observed responses. It is likely that a non-ECPC stressor (i.e., another physical, chemical, or biological stressor) is responsible for the observed adverse response.

The potential for adverse effects to aquatic receptors from exposure to Rowell Creek surface water and sediment was evaluated through comparison of site-specific contaminant concentrations to surface water and sediment criteria, guidelines, and benchmark values. In addition, a macroinvertebrate sampling station was located in Rowell Creek in the vicinity of the OU 8 groundwater plume discharge. No substantial exceedances of available surface water or sediment quality guidelines were identified for aquatic receptors in Rowell Creek in the vicinity of OU 8. A review of the macroinvertebrate habitat quality parameter data in relation to the regional reference station (Five-Mile Creek) suggests that habitat quality conditions at Rowell Creek in the vicinity of OU 8 represent a poor environment for many types of aquatic organisms. Community metric data from the macroinvertebrate study support this conclusion. Differences in habitat structure between Rowell Creek at OU 8 and the regional reference may be sufficient to explain the decreased biological condition. The upgradient sewage treatment plant discharge may also contribute to the differences in community structure at this sampling location.

Future risks for aquatic receptors were evaluated through characterization of risks from exposure to ECPCs in groundwater. Comparison of the exposure concentrations of each ECPC in filtered and unfiltered groundwater with available aquatic toxicity benchmarks indicates that several constituents in groundwater may result in risk to aquatic organisms. When a dilution factor was applied to estimate the dilution of groundwater prior to discharge to Rowell Creek, estimated concentrations of chemicals in groundwater were below available aquatic toxicity benchmarks and criteria.

Results of groundwater laboratory toxicity testing indicate that exposure to undiluted groundwater from OU 8 may result in reduced survival and reproduction for the water flea and the fathead minnow. In general, the water flea was more sensitive to OU 8 groundwater than the fathead minnow. Although several groundwater risk contributors were identified, three dichlorobenzene isomers appear to be the primary risk contributor from OU 8 groundwater. When groundwater was diluted approximately 20-fold, little toxicity was observed. Analyses of the toxicity testing data support the contention that diluted groundwater discharging to Rowell Creek poses little risk to aquatic receptors.

In summary, the results of this ERA suggest that ecological receptors are not likely to be at risk from exposure to OU 8 surface soil, surface water, or sediment. exposure of aquatic receptors to undiluted, unfiltered groundwater could result in adverse effects; however, adverse effects to demersal species from exposure to undiluted OU 8 groundwater is unlikely. With the exception of

aluminum, concentrations of ECPCs in undiluted groundwater collected from the most downgradient well (CF3-MW-31S) do not exceed available State and Federal surface water standards. Further, the expected dilution of groundwater as it discharges to surface water sufficiently reduces analyte concentrations to levels that pose little risk to aquatic receptors.

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APPENDIX E

USEPA REGION III RISK-BASED CONCENTRATION TABLE

Sources: I=IRIS H=HEAST A=HEAST alternate W=Withdrawn from IRIS or HEAST
E=EPA-NCEA Regional Support provisional value O=Other EPA documents.

Basis : C=carcinogenic effects N=noncarcinogenic effects
S=soil saturation concentration M=EPA MCL.
E=EPA draft Soil Screening Level

Contaminant	CAS	RfDo mg/kg/d		RfDi mg/kg/d		CPSo kg·d/mg		CPSi kg·d/mg		V O C	Risk-Based Concentrations: Tap Water µg/L		Ambient Air µg/m3		Fish mg/kg		Soil Ingestion: Industrial mg/kg		Soil Screening Levels- Transfers from Soil to: Residential mg/kg		Air mg/kg		Groundwater mg/kg	
Acephate	30560191	4.00E-03	I			8.70E-03	I				7.70E+00	C	7.20E-01	C	3.60E-01	C	6.60E+02	C	7.30E+01	C	0.00E+00		0.00E+00	
Acetaldehyde	75070			2.57E-03	I			7.70E-03	I		9.40E+01	N	8.10E-01	C	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Acetochlor	34256821	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00	
Acetone	67641	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	6.20E+04	E	8.00E+00	E
Acetone cyanohydrin	75865	7.00E-02	H	4.00E-02	A						2.60E+03	N	1.50E+02	N	9.50E+01	N	1.40E+05	N	5.50E+03	N	0.00E+00		0.00E+00	
Acetonitrile	75078	6.00E-03	I	1.43E-02	A						2.20E+02	N	5.20E+01	N	8.10E+00	N	1.20E+04	N	4.70E+02	N	0.00E+00		0.00E+00	
Acetophenone	98862	1.00E-01	I	5.71E-06	W					x	4.20E-02	N	2.10E-02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	0.00E+00		0.00E+00	
Acifluorfen	62476599	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N	0.00E+00		0.00E+00	
Acrolein	107028	2.00E-02	H	5.71E-06	I						7.30E+02	N	2.10E-02	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00	
Acrylamide	79061	2.00E-04	I			4.50E+00	I	4.55E+00	I		1.50E-02	C	1.40E-03	C	7.00E-04	C	1.30E+00	C	1.40E-01	C	0.00E+00		0.00E+00	
Acrylic acid	79107	5.00E-01	I	2.86E-04	I						1.80E+04	N	1.00E+00	N	6.80E+02	N	1.00E+06	N	3.90E+04	N	0.00E+00		0.00E+00	
Acrylonitrile	107131	1.00E-03	H	5.71E-04	I	5.40E-01	I	2.38E-01	I		1.20E-01	C	2.60E-02	C	5.80E-03	C	1.10E+01	C	1.20E+00	C	0.00E+00		0.00E+00	
Alachlor	15972608	1.00E-02	I			8.00E-02	H				8.40E-01	C	7.80E-02	C	3.90E-02	C	7.20E+01	C	8.00E+00	C	0.00E+00		0.00E+00	
Alar	1596845	1.50E-01	I								5.50E+03	N	5.50E+02	N	2.00E+02	N	3.10E+05	N	1.20E+04	N	0.00E+00		0.00E+00	
Aldicarb	116063	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N	5.70E+02	S	3.60E-02	M
Aldicarb sulfone	1646884	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N	0.00E+00		0.00E+00	
Aldrin	309002	3.00E-05	I			1.70E+01	I	1.71E+01	I		4.00E-03	C	3.70E-04	C	1.90E-04	C	3.40E-01	C	3.80E-02	C	5.00E-01	E	5.00E-03	E
Ally	74223646	2.50E-01	I								9.10E+03	N	9.10E+02	N	3.40E+02	N	5.10E+05	N	2.00E+04	N	0.00E+00		0.00E+00	
Allyl alcohol	107186	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00	
Allyl chloride	107051	5.00E-02	W	2.86E-04	I						1.80E+03	N	1.00E+00	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00	
Aluminum	7429905	1.00E+00	E								3.70E+04	N	3.70E+03	N	1.40E+03	N	1.00E+06	N	7.80E+04	N	0.00E+00		0.00E+00	
Aluminum phosphide	20859738	4.00E-04	I								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N	3.10E+01	N	0.00E+00		0.00E+00	
Amdro	67485294	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N	0.00E+00		0.00E+00	
Ametryn	834128	9.00E-03	I								3.30E+02	N	3.30E+01	N	1.20E+01	N	1.80E+04	N	7.00E+02	N	0.00E+00		0.00E+00	
m-Aminophenol	591275	7.00E-02	H								2.60E+03	N	2.60E+02	N	9.50E+01	N	1.40E+05	N	5.50E+03	N	0.00E+00		0.00E+00	
4-Aminopyridine	504245	2.00E-05	H								7.30E-01	N	7.30E-02	N	2.70E-02	N	4.10E+01	N	1.60E+00	N	0.00E+00		0.00E+00	
Amitraz	33089611	2.50E-03	I								9.10E+01	N	9.10E+00	N	3.40E+00	N	5.10E+03	N	2.00E+02	N	0.00E+00		0.00E+00	
Ammonia	7664417			2.86E-02	I						1.00E+03	N	1.00E+02	N	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Ammonium sulfamate	7773060	2.00E-01	I								7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N	0.00E+00		0.00E+00	
Aniline	62533			2.86E-04	I	5.70E-03	I				1.00E+01	N	1.00E+00	N	5.50E-01	C	1.00E+03	C	1.10E+02	C	4.50E+01	N	3.10E-02	N
Antimony and compounds	7440360	4.00E-04	I								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N	3.10E+01	N	0.00E+00		0.00E+00	
Antimony pentoxide	1314609	5.00E-04	H								1.80E+01	N	1.80E+00	N	6.80E-01	N	1.00E+03	N	3.90E+01	N	0.00E+00		0.00E+00	
Antimony potassium tartrate	304610	9.00E-04	H								3.30E+01	N	3.30E+00	N	1.20E+00	N	1.80E+03	N	7.00E+01	N	0.00E+00		0.00E+00	
Antimony tetroxide	1332316	4.00E-04	H								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N	3.10E+01	N	0.00E+00		0.00E+00	
Antimony trioxide	1309644	4.00E-04	H								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N	3.10E+01	N	0.00E+00		0.00E+00	
Apollo	74115245	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N	0.00E+00		0.00E+00	
Aramite	140578	5.00E-02	H			2.50E-02	I	2.49E-02	I		2.70E+00	C	2.50E-01	C	1.30E-01	C	2.30E+02	C	2.60E+01	C	0.00E+00		0.00E+00	
Arsenic	7440382	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N	3.80E+02	E	1.50E+01	E
Arsenic (as carcinogen)	7440382					1.50E+00	I	1.51E+01	I		4.50E-02	C	4.10E-04	C	2.10E-03	C	3.80E+00	C	4.30E-01	C	3.80E+02	E	1.50E+01	E
Arsine	7784421			1.43E-05	I						5.20E-01	N	5.20E-02	N	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Assure	76578148	9.00E-03	I								3.30E+02	N	3.30E+01	N	1.20E+01	N	1.80E+04	N	7.00E+02	N	0.00E+00		0.00E+00	
Asulam	3337711	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00	
Atrazine	1912249	3.50E-02	I			2.22E-01	H				3.00E-01	C	2.80E-02	C	1.40E-02	C	2.60E+01	C	2.90E+00	C	0.00E+00		0.00E+00	
Avermectin B1	65195553	4.00E-04	I								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N	3.10E+01	N	0.00E+00		0.00E+00	
Azobenzene	103333					1.10E-01	I	1.08E-01	I		6.10E-01	C	5.80E-02	C	2.90E-02	C	5.20E+01	C	5.80E+00	C	0.00E+00		0.00E+00	
Barium and compounds	7440393	7.00E-02	I	1.43E-04	A						2.60E+03	N	5.20E-01	N	9.50E+01	N	1.40E+05	N	5.50E+03	N	3.50E+05	E	3.20E+01	E
Baygon	114261	4.00E-03	I								1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N	3.10E+02	N	0.00E+00		0.00E+00	
Bayleton	43121433	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N	0.00E+00		0.00E+00	
Baythroid	68359375	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N	0.00E+00		0.00E+00	
Benefin	1861401	3.00E-01	I								1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N	2.30E+04	N	0.00E+00		0.00E+00	
Benomyl	17804352	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00	

										Risk-Based Concentrations										Soil Screening Levels-					
											V	Tap		Ambient				Soil Ingestion		Transfers from Soil to:					
		RfDo		RfDi		CPSo		CPSi			O	Water		Air		Fish		Industrial		Residential		Air		Groundwater	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg			C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
Bentazon	25057890	2.50E-03	I									9.10E+01	N	9.10E+00	N	3.40E+00	N	5.10E+03	N	2.00E+02	N	0.00E+00		0.00E+00	
Benzaldehyde	100527	1.00E-01	I								x	6.10E+02	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	0.00E+00		0.00E+00	
Benzene	71432			1.71E-03	E	2.90E-02	I	2.90E-02	I		x	3.60E-01	C	2.20E-01	C	1.10E-01	C	2.00E+02	C	2.20E+01	C	5.00E-01	E	2.00E-02	E
Benzenethiol	108985	1.00E-05	H									3.70E-01	N	3.70E-02	N	1.40E-02	N	2.00E+01	N	7.80E-01	N	0.00E+00		0.00E+00	
Benzidine	92875	3.00E-03	I			2.30E+02	I	2.35E+02	I			2.90E-04	C	2.70E-05	C	1.40E-05	C	2.50E-02	C	2.80E-03	C	1.30E+00	C	1.10E-06	C
Benzoic acid	65850	4.00E+00	I									1.50E+05	N	1.50E+04	N	5.40E+03	N	1.00E+06	N	3.10E+05	N	3.20E+02	S	2.80E+02	E
Benzotrichloride	98077					1.30E+01	I					5.20E-03	C	4.80E-04	C	2.40E-04	C	4.40E-01	C	4.90E-02	C	1.20E-02	C	7.30E-05	C
Benzyl alcohol	100516	3.00E-01	H									1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N	2.30E+04	N	0.00E+00		0.00E+00	
Benzyl chloride	100447					1.70E-01	I				x	6.20E-02	C	3.70E-02	C	1.90E-02	C	3.40E+01	C	3.80E+00	C	5.00E-01	C	3.60E-04	C
Beryllium and compounds	7440417	5.00E-03	I			4.30E+00	I	8.40E+00	I			1.60E-02	C	7.50E-04	C	7.30E-04	C	1.30E+00	C	1.50E-01	C	6.90E+02	E	1.80E+02	E
Bidrin	141662	1.00E-04	I									3.70E+00	N	3.70E-01	N	1.40E-01	N	2.00E+02	N	7.80E+00	N	0.00E+00		0.00E+00	
Biphenthrin (Talstar)	82657043	1.50E-02	I									5.50E+02	N	5.50E+01	N	2.00E+01	N	3.10E+04	N	1.20E+03	N	0.00E+00		0.00E+00	
1,1-Biphenyl	92524	5.00E-02	I									1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	9.00E+03	S	1.10E+02	N
Bis(2-chloroethyl)ether	111444					1.10E+00	I	1.16E+00	I		x	9.20E-03	C	5.40E-03	C	2.90E-03	C	5.20E+00	C	5.80E-01	C	3.00E-01	E	3.00E-04	E
Bis(2-chloroisopropyl)ether	39638329	4.00E-02	I			7.00E-02	H	3.50E-02	H		x	2.60E-01	C	1.80E-01	C	4.50E-02	C	8.20E+01	C	9.10E+00	C	0.00E+00		0.00E+00	
Bis(chloromethyl)ether	542881					2.20E+02	I	2.17E+02	I		x	4.90E-05	C	2.90E-05	C	1.40E-05	C	2.60E-02	C	2.90E-03	C	3.70E-05	C	1.00E-07	C
Bis(2-chloro-1-methylethyl)ether	0					7.00E-02	W	7.00E-02	W			9.60E-01	C	8.90E-02	C	4.50E-02	C	8.20E+01	C	9.10E+00	C	0.00E+00		0.00E+00	
Bis(2-ethylhexyl)phthalate (DEHP)	117817	2.00E-02	I			1.40E-02	I					4.80E+00	C	4.50E-01	C	2.30E-01	C	4.10E+02	C	4.60E+01	C	2.10E+02	E	1.10E+01	E
Bisphenol A	80057	5.00E-02	I									1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00	
Boron (and borates)	7440428	9.00E-02	I	5.71E-03	H							3.30E+03	N	2.10E+01	N	1.20E+02	N	1.80E+05	N	7.00E+03	N	0.00E+00		0.00E+00	
Boron trifluoride	7637072			2.00E-04	H							7.30E+00	N	7.30E-01	N	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Bromodichloromethane	75274	2.00E-02	I			6.20E-02	I				x	1.70E-01	C	1.00E-01	C	5.10E-02	C	9.20E+01	C	1.00E+01	C	1.80E+03	E	3.00E-01	E
Bromoethene	593602							1.10E-01	H		x	9.60E-02	C	5.70E-02	C	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Bromoform (tribromomethane)	75252	2.00E-02	I			7.90E-03	I	3.85E-03	I		x	2.40E+00	C	1.60E+00	C	4.00E-01	C	7.20E+02	C	8.10E+01	C	4.60E+01	E	5.00E-01	E
Bromomethane	74839	1.40E-03	I	1.43E-03	I						x	8.70E+00	N	5.20E+00	N	1.90E+00	N	2.90E+03	N	1.10E+02	N	2.00E+00	E	1.00E-01	E
4-Bromophenyl phenyl ether	101553	5.80E-02	O									2.10E+03	N	2.10E+02	N	7.80E+01	N	1.20E+05	N	4.50E+03	N	0.00E+00		0.00E+00	
Bromophos	2104963	5.00E-03	H									1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00	
Bromoxynil	1689845	2.00E-02	I									7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00	
Bromoxynil octanoate	1689992	2.00E-02	I									7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00	
1,3-Butadiene	106990							9.80E-01	I		x	1.10E-02	C	6.40E-03	C	0.00E+00		0.00E+00		0.00E+00		1.30E-03	C	7.20E-05	C
1-Butanol	71363	1.00E-01	I									3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	9.70E+03	E	8.00E+00	E
Butyl benzyl phthalate	85687	2.00E-01	I									7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N	5.30E+02	E	6.80E+01	E
Butylate	2008415	5.00E-02	I									1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00	
sec-Butylbenzene	135988	1.00E-02	E								x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	8.00E+01	S	2.70E-01	M
tert-Butylbenzene	104518	1.00E-02	E								x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	0.00E+00		2.70E-01	M
Butylphthalyl butylglycolate	85701	1.00E+00	I									3.70E+04	N	3.70E+03	N	1.40E+03	N	1.00E+06	N	7.80E+04	N	0.00E+00		0.00E+00	
Cacodylic acid	75605	3.00E-03	H									1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N	0.00E+00		0.00E+00	
Cadmium and compounds	7440439	5.00E-04	I	5.71E-05	W			6.30E+00	I			1.80E+01	N	9.90E-04	C	6.80E-01	N	1.00E+03	N	3.90E+01	N	9.20E+02	E	6.00E+00	E
Caprolactam	105602	5.00E-01	I									1.80E+04	N	1.80E+03	N	6.80E+02	N	1.00E+06	N	3.90E+04	N	0.00E+00		0.00E+00	
Captafol	2425061	2.00E-03	I			8.60E-03	H					7.80E+00	C	7.30E-01	C	3.70E-01	C	6.70E+02	C	7.40E+01	C	0.00E+00		0.00E+00	
Captan	133062	1.30E-01	I			3.50E-03	H					1.90E+01	C	1.80E+00	C	9.00E-01	C	1.60E+03	C	1.80E+02	C	0.00E+00		0.00E+00	
Carbaryl	63252	1.00E-01	I									3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	3.40E-01	S	2.30E+01	N
Carbofuran	1563662	5.00E-03	I									1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00	
Carbon disulfide	75150	1.00E-01	I	2.00E-01	I						x	1.00E+03	N	7.30E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	1.10E+01	E	1.40E+01	E
Carbon tetrachloride	56235	7.00E-04	I	5.71E-04	E	1.30E-01	I	5.25E-02	I		x	1.60E-01	C	1.20E-01	C	2.40E-02	C	4.40E+01	C	4.90E+00	C	2.00E-01	E	3.00E-02	E
Carbosulfan	55285148	1.00E-02	I									3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	0.00E+00		0.00E+00	
Carboxin	5234684	1.00E-01	I									3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	0.00E+00		0.00E+00	
Chloral	75876	2.00E-03	I									7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N	0.00E+00		0.00E+00	
Chloramben	133904	1.50E-02	I									5.50E+02	N	5.50E+01	N	2.00E+01	N	3.10E+04	N	1.20E+03	N	0.00E+00		0.00E+00	
Chloranil	118752					4.03E-01	H					1.70E-01	C	1.60E-02	C	7.80E-03	C	1.40E+01	C	1.60E+00	C	0.00E+00		0.00E+00	
Chlordane	57749	6.00E-05	I			1.30E+00	I	1.29E+00	I			5.20E-02	C	4.90E-03	C	2.40E-03	C	4.40E+00	C	4.90E-01	C	1.00E+01	E	2.00E+00	E
Chlorimuron-ethyl	90982324	2.00E-02	I									7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00	
Chlorine	7782505	1.00E-01	I									3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	0.00E+00		0.00E+00	
Chlorine dioxide	10049044			5.71E-05	I							2.10E+00	N	2.10E-01	N	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	

										Risk-Based Concentrations										Soil Screening Levels-					
											V	Tap		Ambient				Soil Ingestion		Transfers from Soil to:					
		RfDo		RfDi		CPSo		CPSi			O	Water		Air		Fish		Industrial		Residential		Air		Groundwater	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg			C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
Chloroacetaldehyde	107200	6.90E-03	O									2.50E+02	N	2.50E+01	N	9.30E+00	N	1.40E+04	N	5.40E+02	N	0.00E+00		0.00E+00	
Chloroacetic acid	79118	2.00E-03	H									7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N	0.00E+00		0.00E+00	
2-Chloroacetophenone	532274			8.57E-06	I							3.10E-01	N	3.10E-02	N	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
4-Chloroaniline	106478	4.00E-03	I									1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N	3.10E+02	N	1.20E+03	S	3.00E-01	E
Chlorobenzene	108907	2.00E-02	I	5.71E-03	A						x	3.90E+01	N	2.10E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	9.40E+01	E	6.00E-01	E
Chlorobenzilate	510156	2.00E-02	I			2.70E-01	H	2.70E-01	H			2.50E-01	C	2.30E-02	C	1.20E-02	C	2.10E+01	C	2.40E+00	C	0.00E+00		0.00E+00	
p-Chlorobenzoic acid	74113	2.00E-01	H									7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N	0.00E+00		0.00E+00	
4-Chlorobenzotrifluoride	98566	2.00E-02	H									7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	8.60E+01	N	7.50E+00	N
2-Chloro-1,3-butadiene	126998	2.00E-02	A	2.00E-03	H						x	1.40E+01	N	7.30E+00	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00	
1-Chlorobutane	109693	4.00E-01	H								x	2.40E+03	N	1.50E+03	N	5.40E+02	N	8.20E+05	N	3.10E+04	N	0.00E+00		0.00E+00	
Chlorodibromomethane	124481	2.00E-02	I			8.40E-02	I				x	1.30E-01	C	7.50E-02	C	3.80E-02	C	6.80E+01	C	7.60E+00	C	1.90E+03	E	2.00E-01	E
1-Chloro-1,1-difluoroethane	75683			1.43E+01	I						x	8.70E+04	N	5.20E+04	N	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Chlorodifluoromethane	75456			1.43e+01	I						x	8.70E+04	N	5.20E+04	N	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Chloroethane	75003	4.00E-01	E	2.86E+00	I						x	8.60E+03	N	1.00E+04	N	5.40E+02	N	8.20E+05	N	3.10E+04	N	2.60E+03	S	3.30E+01	N
2-Chloroethyl vinyl ether	110758	2.50E-02	O								x	1.50E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N	0.00E+00		0.00E+00	
Chloroform	67663	1.00E-02	I			6.10E-03	I	8.05E-02	I		x	1.50E-01	C	7.80E-02	C	5.20E-01	C	9.40E+02	C	1.00E+02	C	2.00E-01	E	3.00E-01	E
Chloromethane	74873					1.30E-02	H	6.30E-03	H		x	1.40E+00	C	9.90E-01	C	2.40E-01	C	4.40E+02	C	4.90E+01	C	6.30E-02	C	6.60E-03	C
4-Chloro-2,2-methylaniline hydrochloride	3165933					4.60E-01	H					1.50E-01	C	1.40E-02	C	6.90E-03	C	1.20E+01	C	1.40E+00	C	0.00E+00		0.00E+00	
4-Chloro-2-methylaniline	95692					5.80E-01	H					1.20E-01	C	1.10E-02	C	5.40E-03	C	9.90E+00	C	1.10E+00	C	0.00E+00		0.00E+00	
beta-Chloronaphthalene	91587	8.00E-02	I									2.90E+03	N	2.90E+02	N	1.10E+02	N	1.60E+05	N	6.30E+03	N	2.80E+00	S	1.40E+02	N
o-Chloronitrobenzene	88733					2.50E-02	H				x	4.20E-01	C	2.50E-01	C	1.30E-01	C	2.30E+02	C	2.60E+01	C	0.00E+00		0.00E+00	
p-Chloronitrobenzene	100005					1.80E-02	H				x	5.90E-01	C	3.50E-01	C	1.80E-01	C	3.20E+02	C	3.50E+01	C	0.00E+00		0.00E+00	
2-Chlorophenol	95578	5.00E-03	I									1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	5.30E+04	E	2.00E+00	E
2-Chloropropane	75296			2.86E-02	H						x	1.70E+02	N	1.00E+02	N	0.00E+00		0.00E+00		0.00E+00		2.20E+01	N	6.40E-01	N
Chlorothalonil	1897456	1.50E-02	I			1.10E-02	H					6.10E+00	C	5.70E-01	C	2.90E-01	C	5.20E+02	C	5.80E+01	C	0.00E+00		0.00E+00	
o-Chlorotoluene	95498	2.00E-02	I								x	1.20E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	1.20E+03	N	5.60E+00	N
Chlorpropham	101213	2.00E-01	I									7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N	0.00E+00		0.00E+00	
Chlorpyrifos	2921882	3.00E-03	I									1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N	0.00E+00		0.00E+00	
Chlorpyrifos-methyl	5598130	1.00E-02	H									3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	0.00E+00		0.00E+00	
Chlorsulfuron	64902723	5.00E-02	I									1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00	
Chlorthiophos	60238564	8.00E-04	H									2.90E+01	N	2.90E+00	N	1.10E+00	N	1.60E+03	N	6.30E+01	N	0.00E+00		0.00E+00	
Chromium III and compounds	16065831	1.00E+00	I	5.71E-07	W							3.70E+04	N	2.10E-03	N	1.40E+03	N	1.00E+06	N	7.80E+04	N	0.00E+00		0.00E+00	
Chromium VI and compounds	18540299	5.00E-03	I					4.20E+01	I			1.80E+02	N	1.50E-04	C	6.80E+00	N	1.00E+04	N	3.90E+02	N	1.40E+02	E	1.90E+01	E
Coal tar	8001589							2.20E+00	W			0.00E+00		2.80E-03	C	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Cobalt	7440484	6.00E-02	E									2.20E+03	N	2.20E+02	N	8.10E+01	N	1.20E+05	N	4.70E+03	N	0.00E+00		0.00E+00	
Coke Oven Emissions	8007452							2.17E+00	I			0.00E+00		2.90E-03	C	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Copper and compounds	7440508	4.00E-02	E									1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N	0.00E+00		0.00E+00	
Crotonaldehyde	123739	1.00E-02	W			1.90E+00	H	1.90E+00	W			3.50E-02	C	3.30E-03	C	1.70E-03	C	3.00E+00	C	3.40E-01	C	0.00E+00		0.00E+00	
Cumene	98828	4.00E-02	I	2.57E-03	H							1.50E+03	N	9.40E+00	N	5.40E+01	N	8.20E+04	N	3.10E+03	N	8.10E+01	N	6.50E+01	N
Cyanides:	0											0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Barium cyanide	542621	1.00E-01	W									3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	0.00E+00		0.00E+00	
Calcium cyanide	592018	4.00E-02	I									1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N	0.00E+00		0.00E+00	
**Chlorine cyanide	506774	5.00E-02	I									1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00	
Copper cyanide	544923	5.00E-03	I									1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00	
Cyanazine	21725462	2.00E-03	H			8.40E-01	H					8.00E-02	C	7.50E-03	C	3.80E-03	C	6.80E+00	C	7.60E-01	C	0.00E+00		0.00E+00	
Cyanogen	460195	4.00E-02	I									1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N	0.00E+00		0.00E+00	
Cyanogen bromide	506683	9.00E-02	I									3.30E+03	N	3.30E+02	N	1.20E+02	N	1.80E+05	N	7.00E+03	N	0.00E+00		0.00E+00	
Cyanogen chloride	506774	5.00E-02	I									1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00	
Free cyanide	57125	2.00E-02	I									7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00	
Hydrogen cyanide	74908	2.00E-02	I	8.57E-04	I							7.30E+02	N	3.10E+00	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00	
Potassium cyanide	151508	5.00E-02	I									1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00	
Potassium silver cyanide	506616	2.00E-01	I									7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N	0.00E+00		0.00E+00	
Silver cyanide	506649	1.00E-01	I									3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	0.00E+00		0.00E+00	
Sodium cyanide	143339	4.00E-02	I									1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N	0.00E+00		0.00E+00	

											Risk-Based Concentrations								Soil Screening Levels-					
										V	Tap		Ambient				Soil Ingestion		Transfers from Soil to:					
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential		Air		Groundwater	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
Thiocyanate	0	2.00E-02	E								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00	
Zinc cyanide	557211	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00	
Cyclohexanone	108941	5.00E+00	I							x	3.00E+04	N	1.80E+04	N	6.80E+03	N	1.00E+06	N	3.90E+05	N	0.00E+00		0.00E+00	
Cyclohexlamine	108918	2.00E-01	I								7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N	0.00E+00		0.00E+00	
Cyhalothrin/Karate	68085858	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00	
Cypermethrin	52315078	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	0.00E+00		0.00E+00	
Cyromazine	66215278	7.50E-03	I								2.70E+02	N	2.70E+01	N	1.00E+01	N	1.50E+04	N	5.90E+02	N	0.00E+00		0.00E+00	
Dacthal	1861321	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	0.00E+00		0.00E+00	
Dalapon	75990	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N	0.00E+00		0.00E+00	
Danitol	39515418	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N	0.00E+00		0.00E+00	
DDD	72548					2.40E-01	I				2.80E-01	C	2.60E-02	C	1.30E-02	C	2.40E+01	C	2.70E+00	C	3.70E+01	S	7.00E-01	E
DDE	72559					3.40E-01	I				2.00E-01	C	1.80E-02	C	9.30E-03	C	1.70E+01	C	1.90E+00	C	1.00E+01	S	5.00E-01	E
DDT	50293	5.00E-04	I			3.40E-01	I	3.40E-01	I		2.00E-01	C	1.80E-02	C	9.30E-03	C	1.70E+01	C	1.90E+00	C	8.00E+01	E	1.00E+00	E
Decabromodiphenyl ether	1163195	1.00E-02	I							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	0.00E+00		0.00E+00	
Demeton	8065483	4.00E-05	I								1.50E+00	N	1.50E-01	N	5.40E-02	N	8.20E+01	N	3.10E+00	N	0.00E+00		0.00E+00	
Diallate	2303164					6.10E-02	H			x	1.70E-01	C	1.00E-01	C	5.20E-02	C	9.40E+01	C	1.00E+01	C	0.00E+00		0.00E+00	
Diazinon	333415	9.00E-04	H								3.30E+01	N	3.30E+00	N	1.20E+00	N	1.80E+03	N	7.00E+01	N	5.40E+03	S	2.80E+00	N
Dibenzofuran	132649	4.00E-03	E								1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N	3.10E+02	N	1.20E+02	S	1.20E+02	N
1,4-Dibromobenzene	106376	1.00E-02	I							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	0.00E+00		0.00E+00	
1,2-Dibromo-3-chloropropane	96128			5.71E-05	I	1.40E+00	H	2.42E-03	H	x	4.80E-02	C	2.10E-01	N	2.30E-03	C	4.10E+00	C	4.60E-01	C	1.90E+00	N	6.10E-04	M
1,2-Dibromoethane	106934			5.71E-05	H	8.50E+01	I	7.70E-01	I	x	7.50E-04	C	8.10E-03	C	3.70E-05	C	6.70E-02	C	7.50E-03	C	5.80E-03	C	1.80E-04	M
Dibutyl phthalate	84742	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	1.00E+02	E	1.20E+02	E
Dicamba	1918009	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N	0.00E+00		0.00E+00	
1,2-Dichlorobenzene	95501	9.00E-02	I	4.00E-02	A					x	2.70E+02	N	1.50E+02	N	1.20E+02	N	1.80E+05	N	7.00E+03	N	3.00E+02	E	6.00E+00	E
1,3-Dichlorobenzene	541731	8.90E-02	O							x	5.40E+02	N	3.20E+02	N	1.20E+02	N	1.80E+05	N	7.00E+03	N	0.00E+00		0.00E+00	
1,4-Dichlorobenzene	106467			2.29E-01	I	2.40E-02	H			x	4.40E-01	C	2.60E-01	C	1.30E-01	C	2.40E+02	C	2.70E+01	C	7.70E+03	E	1.00E+00	E
3,3'-Dichlorobenzidine	91941					4.50E-01	I				1.50E-01	C	1.40E-02	C	7.00E-03	C	1.30E+01	C	1.40E+00	C	5.20E+01	S	1.00E-02	E
1,4-Dichloro-2-butene	764410							9.30E+00	H	x	1.10E-03	C	6.70E-04	C	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Dichlorodifluoromethane	75718	2.00E-01	I	5.71E-02	A					x	3.90E+02	N	2.10E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N	3.70E+01	N	7.50E+00	N
1,1-Dichloroethane	75343	1.00E-01	H	1.43E-01	A					x	8.10E+02	N	5.20E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	9.80E+02	E	1.10E+01	E
1,2-Dichloroethane (EDC)	107062			2.86E-03	E	9.10E-02	I	9.10E-02	I	x	1.20E-01	C	6.90E-02	C	3.50E-02	C	6.30E+01	C	7.00E+00	C	3.00E-01	E	1.00E-02	E
1,1-Dichloroethylene	75354	9.00E-03	I			6.00E-01	I	1.75E-01	I	x	4.40E-02	C	3.60E-02	C	5.30E-03	C	9.50E+00	C	1.10E+00	C	4.00E-02	E	3.00E-02	E
1,2-Dichloroethylene (cis)	156592	1.00E-02	H							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	1.50E+03	E	2.00E-01	E
1,2-Dichloroethylene (trans)	156605	2.00E-02	I							x	1.20E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	3.60E+03	E	3.00E-01	E
1,2-Dichloroethylene (mixture)	540590	9.00E-03	H							x	5.50E+01	N	3.30E+01	N	1.20E+01	N	1.80E+04	N	7.00E+02	N	0.00E+00		0.00E+00	
2,4-Dichlorophenol	120832	3.00E-03	I								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N	4.80E+03	S	5.00E-01	E
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	1.00E-02	I							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	7.00E+03	S	1.70E+00	M
4-(2,4-Dichlorophenoxy)butyric Acid	94826	8.00E-03	I								2.90E+02	N	2.90E+01	N	1.10E+01	N	1.60E+04	N	6.30E+02	N	0.00E+00		0.00E+00	
1,2-Dichloropropane	78875			1.14E-03	I	6.80E-02	H			x	1.60E-01	C	9.20E-02	C	4.60E-02	C	8.40E+01	C	9.40E+00	C	1.10E+01	E	2.00E-02	E
2,3-Dichloropropanol	616239	3.00E-03	I								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N	0.00E+00		0.00E+00	
1,3-Dichloropropene	542756	3.00E-04	I	5.71E-03	I	1.75E-01	H	1.30E-01	H	x	7.70E-02	C	4.80E-02	C	1.80E-02	C	3.30E+01	C	3.70E+00	C	1.00E-01	E	1.00E-03	E
Dichlorvos	62737	5.00e-04	I	1.43E-04	I	2.90E-01	I				2.30E-01	C	2.20E-02	C	1.10E-02	C	2.00E+01	C	2.20E+00	C	3.50E+00	C	7.20E-04	C
Dicofol	115322					4.40E-01	W				1.50E-01	C	1.40E-02	C	7.20E-03	C	1.30E+01	C	1.50E+00	C	0.00E+00		0.00E+00	
Dicyclopentadiene	77736	3.00E-02	H	5.71E-05	A					x	4.20E-01	N	2.10E-01	N	4.10E+01	N	6.10E+04	N	2.30E+03	N	0.00E+00		0.00E+00	
Dieldrin	60571	5.00E-05	I			1.60E+01	I	1.61E+01	I		4.20E-03	C	3.90E-04	C	2.00E-04	C	3.60E-01	C	4.00E-02	C	2.00E+00	E	1.00E-03	E
Diesel emissions	0			1.43E-03	I						5.20E+01	N	5.20E+00	N	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Diethyl phthalate	84662	8.00E-01	I								2.90E+04	N	2.90E+03	N	1.10E+03	N	1.00E+06	N	6.30E+04	N	5.20E+02	E	1.10E+02	E
Diethylene glycol, monobutyl ether	112345			5.71E-03	H						2.10E+02	N	2.10E+01	N	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Diethylene glycol, monoethyl ether	111900	2.00E+00	H								7.30E+04	N	7.30E+03	N	2.70E+03	N	1.00E+06	N	1.60E+05	N	0.00E+00		0.00E+00	
Diethylforamide	617845	1.10E-02	H								4.00E+02	N	4.00E+01	N	1.50E+01	N	2.20E+04	N	8.60E+02	N	0.00E+00		0.00E+00	
Di(2-ethylhexyl)adipate	103231	6.00E-01	I			1.20E-03	I				5.60E+01	C	5.20E+00	C	2.60E+00	C	4.80E+03	C	5.30E+02	C	0.00E+00		0.00E+00	
Diethylstilbestrol	56531					4.70E+03	H				1.40E-05	C	1.30E-06	C	7.00E-07	C	1.20E-03	C	1.40E-04	C	0.00E+00		0.00E+00	
Difenzoquat (Avenge)	43222486	8.00E-02	I								2.90E+03	N	2.90E+02	N	1.10E+02	N	1.60E+05	N	6.30E+03	N	0.00E+00		0.00E+00	
Diflubenzuron	35367385	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00	

										Risk-Based Concentrations										Soil Screening Levels-					
										V	Tap		Ambient				Soil Ingestion			Transfers from Soil to:					
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial			Residential		Air		Groundwater	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg			mg/kg		mg/kg		mg/kg	
1,1-Difluoroethane	75376			1.14E+01	I					x	6.90E+04	N	4.20E+04	N	0.00E+00		0.00E+00			0.00E+00		0.00E+00		0.00E+00	
Diisopropyl methylphosphonate (DIMP)	1445756	8.00E-02	I								2.90E+03	N	2.90E+02	N	1.10E+02	N	1.60E+05	N		6.30E+03	N	0.00E+00		0.00E+00	
Dimethipin	55290647	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N		1.60E+03	N	0.00E+00		0.00E+00	
Dimethoate	60515	2.00E-04	I								7.30E+00	N	7.30E-01	N	2.70E-01	N	4.10E+02	N		1.60E+01	N	0.00E+00		0.00E+00	
3,3'-Dimethoxybenzidine	119904					1.40E-02	H				4.80E+00	C	4.50E-01	C	2.30E-01	C	4.10E+02	C		4.60E+01	C	0.00E+00		0.00E+00	
Dimethylamine	124403			5.71E-06	W						2.10E-01	N	2.10E-02	N	0.00E+00		0.00E+00			0.00E+00		0.00E+00		0.00E+00	
2,4-Dimethylaniline hydrochloride	21436964					5.80E-01	H				1.20E-01	C	1.10E-02	C	5.40E-03	C	9.90E+00	C		1.10E+00	C	0.00E+00		0.00E+00	
2,4-Dimethylaniline	95681					7.50E-01	H				9.00E-02	C	8.30E-03	C	4.20E-03	C	7.60E+00	C		8.50E-01	C	0.00E+00		0.00E+00	
N-N-Dimethylaniline	121697	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N		1.60E+02	N	0.00E+00		0.00E+00	
3,3'-Dimethylbenzidine	119937					9.20E+00	H				7.30E-03	C	6.80E-04	C	3.40E-04	C	6.20E-01	C		6.90E-02	C	2.90E+01	C	3.90E-04	C
N,N-Dimethylformamide	68122	1.00E-01	H	8.57E-03	I						3.70E+03	N	3.10E+01	N	1.40E+02	N	2.00E+05	N		7.80E+03	N	0.00E+00		0.00E+00	
1,1-Dimethylhydrazine	57147					2.60E+00	W	3.50E+00	W		2.60E-02	C	1.80E-03	C	1.20E-03	C	2.20E+00	C		2.50E-01	C	0.00E+00		0.00E+00	
1,2-Dimethylhydrazine	540738					3.70E+01	W	3.70E+01	W		1.80E-03	C	1.70E-04	C	8.50E-05	C	1.50E-01	C		1.70E-02	C	0.00E+00		0.00E+00	
2,4-Dimethylphenol	105679	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N		1.60E+03	N	5.40E+03	S	3.00E+00	E
2,6-Dimethylphenol	576261	6.00E-04	I								2.20E+01	N	2.20E+00	N	8.10E-01	N	1.20E+03	N		4.70E+01	N	0.00E+00		0.00E+00	
3,4-Dimethylphenol	95658	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N		7.80E+01	N	0.00E+00		0.00E+00	
Dimethyl phthalate	131113	1.00E+01	H								3.70E+05	N	3.70E+04	N	1.40E+04	N	1.00E+06	N		7.80E+05	N	1.60E+03	E	1.20E+03	E
Dimethyl terephthalate	120616	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N		7.80E+03	N	0.00E+00		0.00E+00	
1,2-Dinitrobenzene	528290	4.00E-04	H								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N		3.10E+01	N	0.00E+00		0.00E+00	
1,3-Dinitrobenzene	99650	1.00E-04	I								3.70E+00	N	3.70E-01	N	1.40E-01	N	2.00E+02	N		7.80E+00	N	0.00E+00		0.00E+00	
1,4-Dinitrobenzene	100254	4.00E-04	H								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N		3.10E+01	N	0.00E+00		0.00E+00	
4,6-Dinitro-o-cyclohexyl phenol	131895	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N		1.60E+02	N	0.00E+00		0.00E+00	
2,4-Dinitrophenol	51285	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N		1.60E+02	N	3.60E+02	N	1.00E-01	E
Dinitrotoluene mixture	0					6.80E-01	I				9.90E-02	C	9.20E-03	C	4.60E-03	C	8.40E+00	C		9.40E-01	C	0.00E+00		0.00E+00	
2,4-Dinitrotoluene	121142	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N		1.60E+02	N	1.20E+02	S	2.00E-01	E
2,6-Dinitrotoluene	606202	1.00E-03	H								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N		7.80E+01	N	3.70E+02	S	1.00E-01	E
Dinoseb	88857	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N		7.80E+01	N	0.00E+00		0.00E+00	
di-n-Octyl phthalate	117840	2.00E-02	H								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N		1.60E+03	N	1.00E+06	S	1.00E+06	E
1,4-Dioxane	123911					1.10E-02	I				6.10E+00	C	5.70E-01	C	2.90E-01	C	5.20E+02	C		5.80E+01	C	0.00E+00		0.00E+00	
Diphenamid	957517	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N		2.30E+03	N	0.00E+00		0.00E+00	
Diphenylamine	122394	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N		2.00E+03	N	0.00E+00		0.00E+00	
1,2-Diphenylhydrazine	122667					8.00E-01	I	7.70E-01	I		8.40E-02	C	8.10E-03	C	3.90E-03	C	7.20E+00	C		8.00E-01	C	0.00E+00		0.00E+00	
Diquat	85007	2.20E-03	I								8.00E+01	N	8.00E+00	N	3.00E+00	N	4.50E+03	N		1.70E+02	N	0.00E+00		0.00E+00	
Direct black 38	1937377					8.60E+00	H				7.80E-03	C	7.30E-04	C	3.70E-04	C	6.70E-01	C		7.40E-02	C	0.00E+00		0.00E+00	
Direct blue 6	2602462					8.10E+00	H				8.30E-03	C	7.70E-04	C	3.90E-04	C	7.10E-01	C		7.90E-02	C	0.00E+00		0.00E+00	
Direct brown 95	16071866					9.30E+00	H				7.20E-03	C	6.70E-04	C	3.40E-04	C	6.20E-01	C		6.90E-02	C	0.00E+00		0.00E+00	
Disulfoton	298044	4.00E-05	I								1.50E+00	N	1.50E-01	N	5.40E-02	N	8.20E+01	N		3.10E+00	N	0.00E+00		0.00E+00	
1,4-Dithiane	505293	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N		7.80E+02	N	0.00E+00		0.00E+00	
Diuron	330541	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N		1.60E+02	N	0.00E+00		0.00E+00	
Dodine	2439103	4.00E-03	I								1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N		3.10E+02	N	0.00E+00		0.00E+00	
Endosulfan	115297	6.00E-03	I								2.20E+02	N	2.20E+01	N	8.10E+00	N	1.20E+04	N		4.70E+02	N	1.00E+00	S	3.00E+00	E
Endothall	145733	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N		1.60E+03	N	0.00E+00		0.00E+00	
Endrin	72208	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N		2.30E+01	N	1.60E+01	S	4.00E-01	E
Epichlorohydrin	106898	2.00E-03	H	2.86E-04	I	9.90E-03	I	4.20E-03	I		6.80E+00	C	1.00E+00	N	3.20E-01	C	5.80E+02	C		6.50E+01	C	0.00E+00		0.00E+00	
1,2-Epoxybutane	106887			5.71E-03	I						2.10E+02	N	2.10E+01	N	0.00E+00		0.00E+00			0.00E+00		0.00E+00		0.00E+00	
Ethephon (2-chloroethyl phosphonic acid)	16672870	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N		3.90E+02	N	0.00E+00		0.00E+00	
Ethion	563122	5.00E-04	I								1.80E+01	N	1.80E+00	N	6.80E-01	N	1.00E+03	N		3.90E+01	N	0.00E+00		0.00E+00	
2-Ethoxyethanol acetate	111159	3.00E-01	A								1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N		2.30E+04	N	0.00E+00		0.00E+00	
2-Ethoxyethanol	110805	4.00E-01	H	5.71E-02	I						1.50E+04	N	2.10E+02	N	5.40E+02	N	8.20E+05	N		3.10E+04	N	0.00E+00		0.00E+00	
Ethyl acrylate	140885					4.80E-02	H				1.40E+00	C	1.30E-01	C	6.60E-02	C	1.20E+02	C		1.30E+01	C	0.00E+00		0.00E+00	
EPTC (S-Ethyl dipropylthiocarbamate)	759944	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N		2.00E+03	N	0.00E+00		0.00E+00	
Ethyl acetate	141786	9.00E-01	I								3.30E+04	N	3.30E+03	N	1.20E+03	N	1.00E+06	N		7.00E+04	N	0.00E+00		0.00E+00	
Ethylbenzene	100414	1.00E-01	I	2.86E-01	I					x	1.30E+03	N	1.00E+03	N	1.40E+02	N	2.00E+05	N		7.80E+03	N	2.60E+02	E	5.00E+00	E
Ethylene cyanohydrin	109784	3.00E-01	H								1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N		2.30E+04	N	0.00E+00		0.00E+00	

								Risk-Based Concentrations												Soil Screening Levels-							
										V	Tap		Ambient				Soil Ingestion			Transfers from Soil to:							
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial			Residential		Air		Groundwater		
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg			mg/kg		mg/kg		mg/kg		
Ethylene diamine	107153	2.00E-02	H								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N		1.60E+03	N	0.00E+00		0.00E+00		
Ethylene glycol	107211	2.00E+00	I								7.30E+04	N	7.30E+03	N	2.70E+03	N	1.00E+06	N		1.60E+05	N	0.00E+00		0.00E+00		
Ethylene glycol, monobutyl ether	111762			5.71E-03	H						2.10E+02	N	2.10E+01	N	0.00E+00		0.00E+00			0.00E+00		0.00E+00		0.00E+00		
Ethylene oxide	75218					1.02E+00	H	3.50E-01	H		6.60E-02	C	1.80E-02	C	3.10E-03	C	5.60E+00	C		6.30E-01	C	0.00E+00		0.00E+00		
Ethylene thiourea (ETU)	96457	8.00E-05	I			1.19E-01	H				5.70E-01	C	5.30E-02	C	2.70E-02	C	4.80E+01	C		5.40E+00	C	0.00E+00		0.00E+00		
Ethyl ether	60297	2.00E-01	I							x	1.20E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N		1.60E+04	N	0.00E+00		0.00E+00		
Ethyl methacrylate	97632	9.00E-02	H								3.30E+03	N	3.30E+02	N	1.20E+02	N	1.80E+05	N		7.00E+03	N	0.00E+00		0.00E+00		
Ethyl p-nitrophenyl phenylphosphorothioate	2104645	1.00E-05	I								3.70E-01	N	3.70E-02	N	1.40E-02	N	2.00E+01	N		7.80E-01	N	0.00E+00		0.00E+00		
Ethylnitrosourea	759739					1.40E+02	W				4.80E-04	C	4.50E-05	C	2.30E-05	C	4.10E-02	C		4.60E-03	C	0.00E+00		0.00E+00		
Ethylphthalyl ethyl glycolate	84720	3.00E+00	I								1.10E+05	N	1.10E+04	N	4.10E+03	N	1.00E+06	N		2.30E+05	N	0.00E+00		0.00E+00		
Express	10120	8.00E-03	I								2.90E+02	N	2.90E+01	N	1.10E+01	N	1.60E+04	N		6.30E+02	N	0.00E+00		0.00E+00		
Fenamiphos	22224926	2.50E-04	I								9.10E+00	N	9.10E-01	N	3.40E-01	N	5.10E+02	N		2.00E+01	N	0.00E+00		0.00E+00		
Fluometuron	2164172	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N		1.00E+03	N	0.00E+00		0.00E+00		
Fluoride	7782414	6.00E-02	I								2.20E+03	N	2.20E+02	N	8.10E+01	N	1.20E+05	N		4.70E+03	N	0.00E+00		0.00E+00		
Fluoridone	59756604	8.00E-02	I								2.90E+03	N	2.90E+02	N	1.10E+02	N	1.60E+05	N		6.30E+03	N	0.00E+00		0.00E+00		
Flurprimidol	56425913	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N		1.60E+03	N	0.00E+00		0.00E+00		
Flutolanil	66332965	6.00E-02	I								2.20E+03	N	2.20E+02	N	8.10E+01	N	1.20E+05	N		4.70E+03	N	0.00E+00		0.00E+00		
Fluvalinate	69409945	1.00E-02	I								3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N		7.80E+02	N	0.00E+00		0.00E+00		
Folpet	133073	1.00E-01	I			3.50E-03	I				1.90E+01	C	1.80E+00	C	9.00E-01	C	1.60E+03	C		1.80E+02	C	0.00E+00		0.00E+00		
Fomesafen	72178020					1.90E-01	I				3.50E-01	C	3.30E-02	C	1.70E-02	C	3.00E+01	C		3.40E+00	C	0.00E+00		0.00E+00		
Fonofos	944229	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N		1.60E+02	N	0.00E+00		0.00E+00		
Formaldehyde	50000	2.00E-01	I					4.55E-02	I		7.30E+03	N	1.40E-01	C	2.70E+02	N	4.10E+05	N		1.60E+04	N	0.00E+00		0.00E+00		
Formic Acid	64186	2.00E+00	H								7.30E+04	N	7.30E+03	N	2.70E+03	N	1.00E+06	N		1.60E+05	N	0.00E+00		0.00E+00		
Fosetyl-al	39148248	3.00E+00	I								1.10E+05	N	1.10E+04	N	4.10E+03	N	1.00E+06	N		2.30E+05	N	0.00E+00		0.00E+00		
Furan	110009	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N		7.80E+01	N	0.00E+00		0.00E+00		
Furazolidone	67458					3.80E+00	H				1.80E-02	C	1.60E-03	C	8.30E-04	C	1.50E+00	C		1.70E-01	C	0.00E+00		0.00E+00		
Furfural	98011	3.00E-03	I	1.43E-02	A						1.10E+02	N	5.20E+01	N	4.10E+00	N	6.10E+03	N		2.30E+02	N	0.00E+00		0.00E+00		
Furium	531828					5.00E+01	H				1.30E-03	C	1.30E-04	C	6.30E-05	C	1.10E-01	C		1.30E-02	C	0.00E+00		0.00E+00		
Furmecyclox	60568050					3.00E-02	I				2.20E+00	C	2.10E-01	C	1.10E-01	C	1.90E+02	C		2.10E+01	C	0.00E+00		0.00E+00		
Glufosinate-ammonium	77182822	4.00E-04	I								1.50E+01	N	1.50E+00	N	5.40E-01	N	8.20E+02	N		3.10E+01	N	0.00E+00		0.00E+00		
Glycidaldehyde	765344	4.00E-04	I	2.86E-04	H						1.50E+01	N	1.00E+00	N	5.40E-01	N	8.20E+02	N		3.10E+01	N	0.00E+00		0.00E+00		
Glyphosate	1071836	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N		7.80E+03	N	0.00E+00		0.00E+00		
Haloxyfop-methyl	69806402	5.00E-05	I								1.80E+00	N	1.80E-01	N	6.80E-02	N	1.00E+02	N		3.90E+00	N	0.00E+00		0.00E+00		
Harmony	79277273	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N		1.00E+03	N	0.00E+00		0.00E+00		
HCH (alpha)	319846					6.30E+00	I	6.30E+00	I		1.10E-02	C	9.90E-04	C	5.00E-04	C	9.10E-01	C		1.00E-01	C	9.00E-01	E	4.00E-04	E	
HCH (beta)	319857					1.80E+00	I	1.80E+00	I		3.70E-02	C	3.50E-03	C	1.80E-03	C	3.20E+00	C		3.50E-01	C	1.60E+01	E	2.00E-03	E	
HCH (gamma) Lindane	58899	3.00E-04	I			1.30E+00	H				5.20E-02	C	4.80E-03	C	2.40E-03	C	4.40E+00	C		4.90E-01	C	4.20E+00	C	6.00E-03	E	
HCH-technical	608731					1.80E+00	I	1.79E+00	I		3.70E-02	C	3.50E-03	C	1.80E-03	C	3.20E+00	C		3.50E-01	C	0.00E+00		0.00E+00		
Heptachlor	76448	5.00E-04	I			4.50E+00	I	4.55E+00	I	x	2.30E-03	C	1.40E-03	C	7.00E-04	C	1.30E+00	C		1.40E-01	C	3.00E-01	E	6.00E-02	E	
Heptachlor epoxide	1024573	1.30E-05	I			9.10E+00	I	9.10E+00	I	x	1.20E-03	C	6.90E-04	C	3.50E-04	C	6.30E-01	C		7.00E-02	C	1.00E+00	E	3.00E-02	E	
Hexabromobenzene	87821	2.00E-03	I							x	1.20E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N		1.60E+02	N	0.00E+00		0.00E+00		
Hexachlorobenzene	118741	8.00E-04	I			1.60E+00	I	1.61E+00	I	x	6.60E-03	C	3.90E-03	C	2.00E-03	C	3.60E+00	C		4.00E-01	C	1.00E+00	E	8.00E-01	E	
Hexachlorobutadiene	87683	2.00E-04	H			7.80E-02	I	7.70E-02	I	x	1.40E-01	C	8.10E-02	C	4.00E-02	C	7.30E+01	C		8.20E+00	C	1.00E+00	E	1.00E-01	E	
Hexachlorocyclopentadiene	77474	7.00E-03	I	2.00E-05	H					x	1.50E-01	N	7.30E-02	N	9.50E+00	N	1.40E+04	N		5.50E+02	N	2.00E+00	E	1.00E+01	E	
Hexachlorodibenzo-p-dioxin mixture	19408743					6.20E+03	I	4.55E+03	I		1.10E-05	C	1.40E-06	C	5.00E-07	C	9.20E-04	C		1.00E-04	C	0.00E+00		0.00E+00		
Hexachloroethane	67721	1.00E-03	I			1.40E-02	I	1.40E-02	I	x	7.50E-01	C	4.50E-01	C	2.30E-01	C	4.10E+02	C		4.60E+01	C	4.90E+01	E	2.00E-01	E	
Hexachlorophene	70304	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N		2.30E+01	N	0.00E+00		0.00E+00		
Hexahydro-1,3,5-trinitro-1,3,5-triazine	121824	3.00E-03	I			1.10E-01	I				6.10E-01	C	5.70E-02	C	2.90E-02	C	5.20E+01	C		5.80E+00	C	0.00E+00		0.00E+00		
1,6-Hexamethylene diisocyanate	822060			2.86E-06	I						1.00E-01	N	1.00E-02	N	0.00E+00		0.00E+00			0.00E+00		0.00E+00		0.00E+00		
n-Hexane	110543	6.00E-02	H	5.71E-02	I					x	3.50E+02	N	2.10E+02	N	8.10E+01	N	1.20E+05	N		4.70E+03	N	3.20E+01	N	1.30E+01	N	
Hexazinone	51235042	3.30E-02	I								1.20E+03	N	1.20E+02	N	4.50E+01	N	6.70E+04	N		2.60E+03	N	0.00E+00		0.00E+00		
Hydrazine, hydrazine sulfate	302012					3.00E+00	I	1.71E+01	I		2.20E-02	C	3.70E-04	C	1.10E-03	C	1.90E+00	C		2.10E-01	C	0.00E+00		0.00E+00		
Hydrogen chloride	7647010			5.71E-03	I						2.10E+02	N	2.10E+01	N	0.00E+00		0.00E+00			0.00E+00		0.00E+00		0.00E+00		
Hydrogen sulfide	7783064	3.00E-03	I	2.85E-04	I						1.10E+02	N	1.00E+00	N	4.10E+00	N	6.10E+03	N		2.30E+02	N	0.00E+00		0.00E+00		

										Risk-Based Concentrations										Soil Screening Levels-					
									V	Tap		Ambient				Soil Ingestion				Transfers from Soil to:					
		RfDo		RfDi		CPSo		CPSi	O	Water		Air		Fish		Industrial				Residential		Air		Groundwater	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg	C	µg/L		µg/m3		mg/kg		mg/kg				mg/kg		mg/kg		mg/kg	
Hydroquinone	123319	4.00E-02	H							1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N			3.10E+03	N	0.00E+00		0.00E+00	
Imazalil	35554440	1.30E-02	I							4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N			1.00E+03	N	0.00E+00		0.00E+00	
Imazaquin	81335377	2.50E-01	I							9.10E+03	N	9.10E+02	N	3.40E+02	N	5.10E+05	N			2.00E+04	N	0.00E+00		0.00E+00	
Iprodione	36734197	4.00E-02	I							1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N			3.10E+03	N	0.00E+00		0.00E+00	
Iron	7439896	3.00E-01	E							1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N			2.30E+04	N	0.00E+00		0.00E+00	
Isobutanol	78831	3.00E-01	I						x	1.80E+03	N	1.10E+03	N	4.10E+02	N	6.10E+05	N			2.30E+04	N	0.00E+00		0.00E+00	
Isophorone	78591	2.00E-01	I			9.50E-04	I			7.10E+01	C	6.60E+00	C	3.30E+00	C	6.00E+03	C			6.70E+02	C	3.40E+03	E	2.00E-01	E
Isopropalin	33820530	1.50E-02	I							5.50E+02	N	5.50E+01	N	2.00E+01	N	3.10E+04	N			1.20E+03	N	0.00E+00		0.00E+00	
Isopropyl methyl phosphonic acid	1832548	1.00E-01	I							3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N			7.80E+03	N	0.00E+00		0.00E+00	
Isoxaben	82558507	5.00E-02	I							1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N			3.90E+03	N	0.00E+00		0.00E+00	
Kepone	143500					1.80E+01	E			3.70E-03	C	3.50E-04	C	1.80E-04	C	3.20E-01	C			3.50E-02	C	0.00E+00		0.00E+00	
Lactofen	77501634	2.00E-03	I							7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N			1.60E+02	N	0.00E+00		0.00E+00	
Linuron	330552	2.00E-03	I							7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N			1.60E+02	N	0.00E+00		0.00E+00	
Lithium	7439932	2.00E-02	E							7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N			1.60E+03	N	0.00E+00		0.00E+00	
Londax	83056996	2.00E-01	I							7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N			1.60E+04	N	0.00E+00		0.00E+00	
Malathion	121755	2.00E-02	I							7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N			1.60E+03	N	0.00E+00		0.00E+00	
Maleic anhydride	108316	1.00E-01	I							3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N			7.80E+03	N	0.00E+00		0.00E+00	
Maleic hydrazide	123331	5.00E-01	I							1.80E+04	N	1.80E+03	N	6.80E+02	N	1.00E+06	N			3.90E+04	N	0.00E+00		0.00E+00	
Malononitrile	109773	2.00E-05	H							7.30E-01	N	7.30E-02	N	2.70E-02	N	4.10E+01	N			1.60E+00	N	0.00E+00		0.00E+00	
Mancozeb	8018017	3.00E-02	H							1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N			2.30E+03	N	0.00E+00		0.00E+00	
Maneb	12427382	5.00E-03	I							1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N			3.90E+02	N	0.00E+00		0.00E+00	
**Manganese and compounds	7439965	2.30E-02	I	1.43e-05	I					8.40E+02	N	5.20E-02	N	3.10E+01	N	4.70E+04	N			1.80E+03	N	0.00E+00		0.00E+00	
Mephosfolan	950107	9.00E-05	H							3.30E+00	N	3.30E-01	N	1.20E-01	N	1.80E+02	N			7.00E+00	N	0.00E+00		0.00E+00	
Mepiquat chloride	24307264	3.00E-02	I							1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N			2.30E+03	N	0.00E+00		0.00E+00	
Mercuric chloride	7487947	3.00E-04	I							1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N			2.30E+01	N	0.00E+00		0.00E+00	
Mercury (inorganic)	7439976	3.00E-04	H	8.57E-05	H					1.10E+01	N	3.10E-01	N	4.10E-01	N	6.10E+02	N			2.30E+01	N	7.00E+00	E	3.00E+00	E
Mercury (methyl)	22967926	1.00E-04	I							3.70E+00	N	3.70E-01	N	1.40E-01	N	2.00E+02	N			7.80E+00	N	0.00E+00		0.00E+00	
Merphos	150505	3.00E-05	I							1.10E+00	N	1.10E-01	N	4.10E-02	N	6.10E+01	N			2.30E+00	N	0.00E+00		0.00E+00	
Merphos oxide	78488	3.00E-05	I							1.10E+00	N	1.10E-01	N	4.10E-02	N	6.10E+01	N			2.30E+00	N	0.00E+00		0.00E+00	
Metalaxyl	57837191	6.00E-02	I							2.20E+03	N	2.20E+02	N	8.10E+01	N	1.20E+05	N			4.70E+03	N	0.00E+00		0.00E+00	
Methacrylonitrile	126987	1.00E-04	I	2.00E-04	A					3.70E+00	N	7.30E-01	N	1.40E-01	N	2.00E+02	N			7.80E+00	N	0.00E+00		0.00E+00	
Methamidophos	10265926	5.00E-05	I							1.80E+00	N	1.80E-01	N	6.80E-02	N	1.00E+02	N			3.90E+00	N	0.00E+00		0.00E+00	
Methanol	67561	5.00E-01	I							1.80E+04	N	1.80E+03	N	6.80E+02	N	1.00E+06	N			3.90E+04	N	0.00E+00		0.00E+00	
Methidathion	950378	1.00E-03	I							3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N			7.80E+01	N	0.00E+00		0.00E+00	
Methomyl	16752775	2.50E-02	I							9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N			2.00E+03	N	0.00E+00		0.00E+00	
Methoxychlor	72435	5.00E-03	I							1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N			3.90E+02	N	4.10E+01	S	6.20E+01	E
2-Methoxyethanol acetate	110496	2.00E-03	A							7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N			1.60E+02	N	0.00E+00		0.00E+00	
2-Methoxyethanol	109864	1.00E-03	H	5.71E-03	I					3.70E+01	N	2.10E+01	N	1.40E+00	N	2.00E+03	N			7.80E+01	N	0.00E+00		0.00E+00	
2-Methoxy-5-nitroaniline	99592					4.60E-02	H			1.50E+00	C	1.40E-01	C	6.90E-02	C	1.20E+02	C			1.40E+01	C	0.00E+00		0.00E+00	
Methyl acetate	79209	1.00E+00	H							3.70E+04	N	3.70E+03	N	1.40E+03	N	1.00E+06	N			7.80E+04	N	0.00E+00		0.00E+00	
Methyl acrylate	96333	3.00E-02	A							1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N			2.30E+03	N	0.00E+00		0.00E+00	
2-Methylaniline hydrochloride	636215					1.80E-01	H			3.70E-01	C	3.50E-02	C	1.80E-02	C	3.20E+01	C			3.50E+00	C	0.00E+00		0.00E+00	
2-Methylaniline	95534					2.40E-01	H			2.80E-01	C	2.60E-02	C	1.30E-02	C	2.40E+01	C			2.70E+00	C	0.00E+00		0.00E+00	
Methyl chlorocarbonate	79221	1.00E+00	W							3.70E+04	N	3.70E+03	N	1.40E+03	N	1.00E+06	N			7.80E+04	N	0.00E+00		0.00E+00	
4-(2-Methyl-4-chlorophenoxy) butyric acid	94815	1.00E-02	I							3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N			7.80E+02	N	0.00E+00		0.00E+00	
2-Methyl-4-chlorophenoxyacetic acid	94746	5.00E-04	I							1.80E+01	N	1.80E+00	N	6.80E-01	N	1.00E+03	N			3.90E+01	N	0.00E+00		0.00E+00	
2-(2-Methyl-14-chlorophenoxy)propionic aci	93652	1.00E-03	I							3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N			7.80E+01	N	0.00E+00		0.00E+00	
Methylcyclohexane	108872			8.57E-01	H					3.10E+04	N	3.10E+03	N	0.00E+00		0.00E+00				0.00E+00		6.00E+01	S	1.50E+03	N
Methylene bromide	74953	1.00E-02	A						x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N			7.80E+02	N	0.00E+00		0.00E+00	
Methylene chloride	75092	6.00E-02	I	8.57E-01	H	7.50E-03	I	1.64E-03	I	x	4.10E+00	C	3.80E+00	C	4.20E-01	C	7.60E+02	C			8.50E+01	C	7.00E+00	E	1.00E-02	E
4,4'-Methylene bis(2-chloroaniline)	101144	7.00E-04	H			1.30E-01	H	1.30E-01	H		5.20E-01	C	4.80E-02	C	2.40E-02	C	4.40E+01	C			4.90E+00	C	0.00E+00		0.00E+00	
4,4'-Methylenebisbenzeneamine	101779					2.50E-01	W				2.70E-01	C	2.50E-02	C	1.30E-02	C	2.30E+01	C			2.60E+00	C	0.00E+00		0.00E+00	
4,4'-Methylene bis(N,N'-dimethyl)aniline	101611					4.60E-02	I				1.50E+00	C	1.40E-01	C	6.90E-02	C	1.20E+02	C			1.40E+01	C	0.00E+00		0.00E+00	
4,4'-Methylenediphenyl isocyanate	101688			5.71E-06	I					x	3.50E-02	N	2.10E-02	N	0.00E+00		0.00E+00				0.00E+00		0.00E+00		0.00E+00	

										Risk-Based Concentrations										Soil Screening Levels-					
										V	Tap		Ambient				Soil Ingestion			Transfers from Soil to:					
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential		Air		Groundwater	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
Methyl ethyl ketone	78933	6.00E-01	I	2.86E-01	I					x	1.90E+03	N	1.00E+03	N	8.10E+02	N	1.00E+06	N	4.70E+04	N	0.00E+00		0.00E+00	
Methyl hydrazine	60344					1.10E+00	W				6.10E-02	C	5.70E-03	C	2.90E-03	C	5.20E+00	C	5.80E-01	C	0.00E+00		0.00E+00	
Methyl isobutyl ketone	108101	8.00E-02	H	2.29E-02	A						2.90E+03	N	8.40E+01	N	1.10E+02	N	1.60E+05	N	6.30E+03	N	0.00E+00		0.00E+00	
Methyl methacrylate	80626	8.00E-02	H								2.90E+03	N	2.90E+02	N	1.10E+02	N	1.60E+05	N	6.30E+03	N	0.00E+00		0.00E+00	
2-Methyl-5-nitroaniline	99558					3.30E-02	H				2.00E+00	C	1.90E-01	C	9.60E-02	C	1.70E+02	C	1.90E+01	C	0.00E+00		0.00E+00	
Methyl parathion	298000	2.50E-04	I								9.10E+00	N	9.10E-01	N	3.40E-01	N	5.10E+02	N	2.00E+01	N	2.80E+01	S	4.10E-02	N
2-Methylphenol (o-cresol)	95487	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	1.20E+04	S	6.00E+00	E
3-Methylphenol (m-cresol)	103394	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00	
4-Methylphenol (p-cresol)	106445	5.00E-03	H								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00	
Methyl styrene (mixture)	25013154	6.00E-03	A	1.14E-02	A					x	6.00E+01	N	4.20E+01	N	8.10E+00	N	1.20E+04	N	4.70E+02	N	1.00E+02	N	1.00E+00	N
Methyl styrene (alpha)	98839	7.00E-02	A							x	4.30E+02	N	2.60E+02	N	9.50E+01	N	1.40E+05	N	5.50E+03	N	8.80E+00	S	7.50E+00	N
Methyl tertbutyl ether (MTBE)	1634044	5.00E-03	E	8.57E-01	I					x	1.80E+02	N	3.10E+03	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00	
Metolaclor (Dual)	51218452	1.50E-01	H								5.50E+03	N	5.50E+02	N	2.00E+02	N	3.10E+05	N	1.20E+04	N	0.00E+00		0.00E+00	
Metribuzin	21087649	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N	0.00E+00		0.00E+00	
Mirex	2385855	2.00E-04	I			1.80E+00	W				3.70E-02	C	3.50E-03	C	1.80E-03	C	3.20E+00	C	3.50E-01	C	0.00E+00		0.00E+00	
Molinate	2212671	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N	0.00E+00		0.00E+00	
Molybdenum	7439987	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00	
Monochloramine	10599903	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	0.00E+00		0.00E+00	
Naled	300765	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N	0.00E+00		0.00E+00	
2-Naphthylamine	91598					1.30e+02	E				5.20E-04	C	4.80E-05	C	2.40E-05	C	4.40E-02	C	4.90E-03	C	0.00E+00		0.00E+00	
Napropamide	15299997	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	0.00E+00		0.00E+00	
Nickel refinery dust	0							8.40E-01	I		0.00E+00		7.50E-03	C	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Nickel and compounds	7440020	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	6.90E+03	E	2.10E+01	E
Nickel subsulfide	12035722							1.70E+00	I		0.00E+00		3.70E-03	C	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Nitrapyrin	1929824	1.50E-03	W								5.50E+01	N	5.50E+00	N	2.00E+00	N	3.10E+03	N	1.20E+02	N	0.00E+00		0.00E+00	
Nitrate	14797558	1.60E+00	I								5.80E+04	N	5.80E+03	N	2.20E+03	N	1.00E+06	N	1.30E+05	N	0.00E+00		0.00E+00	
Nitric oxide	10102439	1.00E-01	W								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	0.00E+00		0.00E+00	
Nitrite	14797650	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	0.00E+00		0.00E+00	
2-Nitroaniline	88744	6.00E-05	W	5.71E-05	H						2.20E+00	N	2.10E-01	N	8.10E-02	N	1.20E+02	N	4.70E+00	N	0.00E+00		0.00E+00	
3-Nitroaniline	99092	3.00E-03	O								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N	0.00E+00		0.00E+00	
4-Nitroaniline	100016	3.00E-03	O								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N	0.00E+00		0.00E+00	
Nitrobenzene	98953	5.00E-04	I	5.71E-04	A					x	3.40E+00	N	2.10E+00	N	6.80E-01	N	1.00E+03	N	3.90E+01	N	1.10E+02	E	9.00E-02	E
Nitrofurantoin	67209	7.00E-02	H								2.60E+03	N	2.60E+02	N	9.50E+01	N	1.40E+05	N	5.50E+03	N	0.00E+00		0.00E+00	
Nitrofurazone	59870					1.50E+00	H	9.40E+00	H		4.50E-02	C	6.70E-04	C	2.10E-03	C	3.80E+00	C	4.30E-01	C	0.00E+00		0.00E+00	
Nitrogen dioxide	10102440	1.00E+00	W								3.70E+04	N	3.70E+03	N	1.40E+03	N	1.00E+06	N	7.80E+04	N	0.00E+00		0.00E+00	
Nitroguanidine	556887	1.00E-01	I								3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	0.00E+00		0.00E+00	
4-Nitrophenol	100027	6.20E-02	O								2.30E+03	N	2.30E+02	N	8.40E+01	N	1.30E+05	N	4.80E+03	N	0.00E+00		0.00E+00	
2-Nitropropane	79469			5.71E-03	I			9.40E+00	H		2.10E+02	N	6.70E-04	C	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
N-Nitrosodi-n-butylamine	924163					5.40E+00	I	5.60E+00	I		1.20E-02	C	1.10E-03	C	5.80E-04	C	1.10E+00	C	1.20E-01	C	0.00E+00		0.00E+00	
N-Nitrosodiethanolamine	1116547					2.80E+00	I				2.40E-02	C	2.20E-03	C	1.10E-03	C	2.00E+00	C	2.30E-01	C	0.00E+00		0.00E+00	
N-Nitrosodiethylamine	55185					1.50E+02	I	1.51E+02	I		4.50E-04	C	4.10E-05	C	2.10E-05	C	3.80E-02	C	4.30E-03	C	0.00E+00		0.00E+00	
N-Nitrosodimethylamine	62759					5.10E+01	I	4.90E+01	I		1.30E-03	C	1.30E-04	C	6.20E-05	C	1.10E-01	C	1.30E-02	C	0.00E+00		0.00E+00	
N-Nitrosodiphenylamine	86306					4.90E-03	I				1.40E+01	C	1.30E+00	C	6.40E-01	C	1.20E+03	C	1.30E+02	C	2.90E+01	C	2.00E-01	E
N-Nitroso di-n-propylamine	621647					7.00E+00	I				9.60E-03	C	8.90E-04	C	4.50E-04	C	8.20E-01	C	9.10E-02	C	1.40E-02	C	2.00E-05	E
N-Nitroso-N-methylethylamine	10595956					2.20E+01	I				3.10E-03	C	2.80E-04	C	1.40E-04	C	2.60E-01	C	2.90E-02	C	0.00E+00		0.00E+00	
N-Nitrosopyrrolidine	930552					2.10E+00	I	2.13E+00	I		3.20E-02	C	2.90E-03	C	1.50E-03	C	2.70E+00	C	3.00E-01	C	0.00E+00		0.00E+00	
m-Nitrotoluene	99081	1.00E-02	H							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	4.60E+02	S	4.20E-01	N
o-Nitrotoluene	88722	1.00E-02	H							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	4.60E+02	S	4.20E-01	N
p-Nitrotoluene	99990	1.00E-02	H							x	6.10E+01	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	4.60E+02	S	4.20E-01	N
Norflurazon	27314132	4.00E-02	I								1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N	0.00E+00		0.00E+00	
NuStar	85509199	7.00E-04	I								2.60E+01	N	2.60E+00	N	9.50E-01	N	1.40E+03	N	5.50E+01	N	0.00E+00		0.00E+00	
Octabromodiphenyl ether	32536520	3.00E-03	I								1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N	0.00E+00		0.00E+00	
Octahydro-1357-tetranitro-1357-tetrazocine	2691410	5.00E-02	I								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00	
Octamethylpyrophosphoramide	152169	2.00E-03	H								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N	0.00E+00		0.00E+00	

										Risk-Based Concentrations										Soil Screening Levels-					
									V	Tap		Ambient				Soil Ingestion		Transfers from Soil to:							
		RfDo		RfDi		CPSo		CPSi	O	Water		Air		Fish		Industrial		Residential		Air		Groundwater		
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg	C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		
Oryzalin	19044883	5.00E-02	I							1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00		
Oxadiazon	19666309	5.00E-03	I							1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00		
Oxamyl	23135220	2.50E-02	I							9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N	0.00E+00		0.00E+00		
Oxyfluorfen	42874033	3.00E-03	I							1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N	0.00E+00		0.00E+00		
Paclobutrazol	76738620	1.30E-02	I							4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N	0.00E+00		0.00E+00		
Paraquat	1910425	4.50E-03	I							1.60E+02	N	1.60E+01	N	6.10E+00	N	9.20E+03	N	3.50E+02	N	0.00E+00		0.00E+00		
Parathion	56382	6.00E-03	H							2.20E+02	N	2.20E+01	N	8.10E+00	N	1.20E+04	N	4.70E+02	N	1.10E+02	S	3.90E+00	N	
Pebulate	1114712	5.00E-02	H							1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00		
Pendimethalin	40487421	4.00E-02	I							1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N	0.00E+00		0.00E+00		
Pentabromo-6-chloro cyclohexane	87843					2.30E-02	H			2.90E+00	C	2.70E-01	C	1.40E-01	C	2.50E+02	C	2.80E+01	C	0.00E+00		0.00E+00		
Pentabromodiphenyl ether	32534819	2.00E-03	I							7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N	0.00E+00		0.00E+00		
Pentachlorobenzene	608935	8.00E-04	I						x	4.90E+00	N	2.90E+00	N	1.10E+00	N	1.60E+03	N	6.30E+01	N	5.70E+02	N	4.80E+01	N	
Pentachloronitrobenzene	82688	3.00E-03	I			2.60E-01	H		x	4.10E-02	C	2.40E-02	C	1.20E-02	C	2.20E+01	C	2.50E+00	C	0.00E+00		0.00E+00		
Pentachlorophenol	87865	3.00E-02	I			1.20E-01	I			5.60E-01	C	5.20E-02	C	2.60E-02	C	4.80E+01	C	5.30E+00	C	7.90E+00	C	2.00E-01	E	
Permethrin	52645531	5.00E-02	I							1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00		
Phenmedipham	13684634	2.50E-01	I							9.10E+03	N	9.10E+02	N	3.40E+02	N	5.10E+05	N	2.00E+04	N	0.00E+00		0.00E+00		
Phenol	108952	6.00E-01	I							2.20E+04	N	2.20E+03	N	8.10E+02	N	1.00E+06	N	4.70E+04	N	2.10E+04	S	4.90E+01	E	
m-Phenylenediamine	108452	6.00E-03	I							2.20E+02	N	2.20E+01	N	8.10E+00	N	1.20E+04	N	4.70E+02	N	0.00E+00		0.00E+00		
p-Phenylenediamine	106503	1.90E-01	H							6.90E+03	N	6.90E+02	N	2.60E+02	N	3.90E+05	N	1.50E+04	N	0.00E+00		0.00E+00		
Phenylmercuric acetate	62384	8.00E-05	I							2.90E+00	N	2.90E-01	N	1.10E-01	N	1.60E+02	N	6.30E+00	N	0.00E+00		0.00E+00		
2-Phenylphenol	90437					1.94E-03	H			3.50E+01	C	3.20E+00	C	1.60E+00	C	3.00E+03	C	3.30E+02	C	0.00E+00		0.00E+00		
Phorate	298022	2.00E-04	H							7.30E+00	N	7.30E-01	N	2.70E-01	N	4.10E+02	N	1.60E+01	N	0.00E+00		0.00E+00		
Phosmet	732116	2.00E-02	I							7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00		
Phosphine	7803512	3.00E-04	I	8.57E-05	I					1.10E+01	N	3.10E-01	N	4.10E-01	N	6.10E+02	N	2.30E+01	N	0.00E+00		0.00E+00		
Phosphoric acid	7664382			2.86E-03	I					1.00E+02	N	1.00E+01	N	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		
Phosphorus (white)	7723140	2.00E-05	I							7.30E-01	N	7.30E-02	N	2.70E-02	N	4.10E+01	N	1.60E+00	N	0.00E+00		0.00E+00		
p-Phthalic acid	100210	1.00E+00	H							3.70E+04	N	3.70E+03	N	1.40E+03	N	1.00E+06	N	7.80E+04	N	0.00E+00		0.00E+00		
Phthalic anhydride	85449	2.00E+00	I	3.43E-02	H					7.30E+04	N	1.30E+02	N	2.70E+03	N	1.00E+06	N	1.60E+05	N	0.00E+00		0.00E+00		
Picloram	1918021	7.00E-02	I							2.60E+03	N	2.60E+02	N	9.50E+01	N	1.40E+05	N	5.50E+03	N	0.00E+00		0.00E+00		
Pirimiphos-methyl	29232937	1.00E-02	I							3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	0.00E+00		0.00E+00		
Polybrominated biphenyls	0	7.00E-06	H			8.90E+00	H			7.60E-03	C	7.00E-04	C	3.50E-04	C	6.40E-01	C	7.20E-02	C	0.00E+00		0.00E+00		
Polychlorinated biphenyls (PCBs)	1336363					7.70E+00	I			8.70E-03	C	8.10E-04	C	4.10E-04	C	7.40E-01	C	8.30E-02	C	0.00E+00		0.00E+00		
Aroclor 1016	12674112	7.00E-05	I							2.60E+00	N	2.60E-01	N	9.50E-02	N	1.40E+02	N	5.50E+00	N	0.00E+00		0.00E+00		
Aroclor 1254	11097691	2.00E-05	I							7.30E-01	N	7.30E-02	N	2.70E-02	N	4.10E+01	N	1.60E+00	N	0.00E+00		0.00E+00		
Polychlorinated terphenyls (PCTs)	0					4.50E+00	E			1.50E-02	C	1.40E-03	C	7.00E-04	C	1.30E+00	C	1.40E-01	C	0.00E+00		0.00E+00		
Polynuclear aromatic hydrocarbons	0									0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		1.10E+05	S	0.00E+00		
Acenaphthene	83329	6.00E-02	I							2.20E+03	N	2.20E+02	N	8.10E+01	N	1.20E+05	N	4.70E+03	N	1.20E+02	S	2.00E+02	E	
Anthracene	120127	3.00E-01	I							1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N	2.30E+04	N	6.80E+00	S	4.30E+03	E	
Benz[a]anthracene	56553					7.30E-01	E	6.10E-01	E	9.20E-02	C	1.00E-02	C	4.30E-03	C	7.80E+00	C	8.80E-01	C	2.70E+01	S	7.00E-01	E	
Benzo[b]fluoranthene	205992					7.30E-01	E	6.10E-01	E	9.20E-02	C	1.00E-02	C	4.30E-03	C	7.80E+00	C	8.80E-01	C	2.30E+01	S	4.00E+00	E	
Benzo[k]fluoranthene	207089					7.30E-02	E	6.10E-02	E	9.20E-01	C	1.00E-01	C	4.30E-02	C	7.80E+01	C	8.80E+00	C	0.00E+00		4.00E+00	E	
Benzo[a]pyrene	50328					7.30E+00	I	6.10E+00	W	9.20E-03	C	1.00E-03	C	4.30E-04	C	7.80E-01	C	8.80E-02	C	1.10E+01	S	4.00E+00	E	
Carbazole	86748					2.00E-02	H			3.40E+00	C	3.10E-01	C	1.60E-01	C	2.90E+02	C	3.20E+01	C	1.10E+01	S	5.00E-01	E	
Chrysene	218019					7.30E-03	E	6.10E-03	E	9.20E+00	C	1.00E+00	C	4.30E-01	C	7.80E+02	C	8.80E+01	C	3.60E+00	S	1.00E+00	E	
Dibenz[ah]anthracene	53703					7.30E+00	E	6.10E+00	E	9.20E-03	C	1.00E-03	C	4.30E-04	C	7.80E-01	C	8.80E-02	C	7.20E+00	S	1.10E+01	E	
Fluoranthene	206440	4.00E-02	I							1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N	6.80E+01	S	9.80E+02	E	
Fluorene	86737	4.00E-02	I							1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N	8.90E+01	S	1.60E+02	E	
Indeno[1,2,3-cd]pyrene	193395					7.30E-01	E	6.10E-01	E	9.20E-02	C	1.00E-02	C	4.30E-03	C	7.80E+00	C	8.80E-01	C	2.80E+02	S	3.50E+01	E	
Naphthalene	91203	4.00E-02	W							1.50E+03	N	1.50E+02	N	5.40E+01	N	8.20E+04	N	3.10E+03	N	1.80E+02	S	3.00E+01	E	
Pyrene	129000	3.00E-02	I							1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N	5.60E+01	S	1.40E+03	E	
Prochloraz	67747095	9.00E-03	I			1.50E-01	I			4.50E-01	C	4.20E-02	C	2.10E-02	C	3.80E+01	C	4.30E+00	C	0.00E+00		0.00E+00		
Profluralin	26399360	6.00E-03	H							2.20E+02	N	2.20E+01	N	8.10E+00	N	1.20E+04	N	4.70E+02	N	0.00E+00		0.00E+00		
Prometon	1610180	1.50E-02	I							5.50E+02	N	5.50E+01	N	2.00E+01	N	3.10E+04	N	1.20E+03	N	0.00E+00		0.00E+00		
Prometryn	7287196	4.00E-03	I							1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N	3.10E+02	N	0.00E+00		0.00E+00		

								Risk-Based Concentrations												Soil Screening Levels-					
										V	Tap		Ambient				Soil Ingestion			Transfers from Soil to:					
		RfDo		RfDi		CPSo		CPSi		O	Water		Air		Fish		Industrial		Residential		Air		Groundwater		
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg		C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		
Pronamide	23950585	7.50E-02	I								2.70E+03	N	2.70E+02	N	1.00E+02	N	1.50E+05	N	5.90E+03	N	0.00E+00		0.00E+00		
Propachlor	1918167	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N	0.00E+00		0.00E+00		
Propanil	709988	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00		
Propargite	2312358	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00		
Propargyl alcohol	107197	2.00E-03	I								7.30E+01	N	7.30E+00	N	2.70E+00	N	4.10E+03	N	1.60E+02	N	0.00E+00		0.00E+00		
Propazine	139402	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00		
Propham	122429	2.00E-02	I								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00		
Propiconazole	60207901	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N	0.00E+00		0.00E+00		
Propylene glycol	57556	2.00E+01	H								7.30E+05	N	7.30E+04	N	2.70E+04	N	1.00E+06	N	1.00E+06	N	0.00E+00		0.00E+00		
Propylene glycol, monoethyl ether	52125538	7.00E-01	H								2.60E+04	N	2.60E+03	N	9.50E+02	N	1.00E+06	N	5.50E+04	N	0.00E+00		0.00E+00		
Propylene glycol, monomethyl ether	107982	7.00E-01	H	5.71E-01	I						2.60E+04	N	2.10E+03	N	9.50E+02	N	1.00E+06	N	5.50E+04	N	0.00E+00		0.00E+00		
Propylene oxide	75569			8.57E-03	I	2.40E-01	I	1.29E-02	I		2.80E-01	C	4.90E-01	C	1.30E-02	C	2.40E+01	C	2.70E+00	C	0.00E+00		0.00E+00		
Pursuit	81335775	2.50E-01	I								9.10E+03	N	9.10E+02	N	3.40E+02	N	5.10E+05	N	2.00E+04	N	0.00E+00		0.00E+00		
Pydrin	51630581	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N	0.00E+00		0.00E+00		
Pyridine	110861	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N	0.00E+00		0.00E+00		
Quinalphos	13593038	5.00E-04	I								1.80E+01	N	1.80E+00	N	6.80E-01	N	1.00E+03	N	3.90E+01	N	0.00E+00		0.00E+00		
Quinoline	91225					1.20E+01	H				5.60E-03	C	5.20E-04	C	2.60E-04	C	4.80E-01	C	5.30E-02	C	0.00E+00		0.00E+00		
Resmethrin	10463868	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N	0.00E+00		0.00E+00		
Ronnel	299843	5.00E-02	H								1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00		
Rotenone	83794	4.00E-03	I								1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N	3.10E+02	N	0.00E+00		0.00E+00		
Savey	78587050	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N	0.00E+00		0.00E+00		
Selenious Acid	7783008	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00		
Selenium	7782492	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		3.00E+00	E	
Selenourea	630104	5.00E-03	H								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00		
Sethoxydim	74051802	9.00E-02	I								3.30E+03	N	3.30E+02	N	1.20E+02	N	1.80E+05	N	7.00E+03	N	0.00E+00		0.00E+00		
Silver and compounds	7440224	5.00E-03	I								1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00		
Simazine	122349	5.00E-03	I			1.20E-01	H				5.60E-01	C	5.20E-02	C	2.60E-02	C	4.80E+01	C	5.30E+00	C	0.00E+00		0.00E+00		
Sodium azide	26628228	4.00E-03	I								1.50E+02	N	1.50E+01	N	5.40E+00	N	8.20E+03	N	3.10E+02	N	0.00E+00		0.00E+00		
Sodium diethyldithiocarbamate	148185	3.00E-02	I			2.70E-01	H				2.50E-01	C	2.30E-02	C	1.20E-02	C	2.10E+01	C	2.40E+00	C	0.00E+00		0.00E+00		
Sodium fluoroacetate	62748	2.00E-05	I								7.30E-01	N	7.30E-02	N	2.70E-02	N	4.10E+01	N	1.60E+00	N	0.00E+00		0.00E+00		
Sodium metavanadate	13718268	1.00E-03	H								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N	0.00E+00		0.00E+00		
Strontium, stable	7440246	6.00E-01	I								2.20E+04	N	2.20E+03	N	8.10E+02	N	1.00E+06	N	4.70E+04	N	0.00E+00		0.00E+00		
Strychnine	57249	3.00E-04	I								1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N	0.00E+00		0.00E+00		
Styrene	100425	2.00E-01	I	2.86E-01	I					x	1.60E+03	N	1.00E+03	N	2.70E+02	N	4.10E+05	N	1.60E+04	N	1.40E+03	E	2.00E+00	E	
Systhane	88671890	2.50E-02	I								9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N	0.00E+00		0.00E+00		
2,3,7,8-TCDD (dioxin)	1746016					1.56E+05	H	1.16E+05	H		4.30E-07	C	5.40E-08	C	0.00E+00	C	3.70E-05	C	4.10E-06	C	0.00E+00		0.00E+00		
Tebuthiuron	34014181	7.00E-02	I								2.60E+03	N	2.60E+02	N	9.50E+01	N	1.40E+05	N	5.50E+03	N	0.00E+00		0.00E+00		
Temephos	3383968	2.00E-02	H								7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00		
Terbacil	5902512	1.30E-02	I								4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N	0.00E+00		0.00E+00		
Terbufos	13071799	2.50E-05	H								9.10E-01	N	9.10E-02	N	3.40E-02	N	5.10E+01	N	2.00E+00	N	0.00E+00		0.00E+00		
Terbutryn	886500	1.00E-03	I								3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N	0.00E+00		0.00E+00		
1,2,4,5-Tetrachlorobenzene	95943	3.00E-04	I							x	1.80E+00	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N	9.10E+01	N	6.90E-01	N	
1,1,1,2-Tetrachloroethane	630206	3.00E-02	I			2.60E-02	I	2.59E-02	I	x	4.10E-01	C	2.40E-01	C	1.20E-01	C	2.20E+02	C	2.50E+01	C	0.00E+00		0.00E+00		
1,1,2,2-Tetrachloroethane	79345					2.00E-01	I	2.03E-01	I	x	5.20E-02	C	3.10E-02	C	1.60E-02	C	2.90E+01	C	3.20E+00	C	4.00E-01	E	1.00E-03	E	
Tetrachloroethylene (PCE)	127184	1.00E-02	I			5.20E-02	E	2.03E-03	E	x	1.10E+00	C	3.10E+00	C	6.10E-02	C	1.10E+02	C	1.20E+01	C	1.10E+01	E	4.00E-02	E	
2,3,4,6-Tetrachlorophenol	58902	3.00E-02	I								1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N	0.00E+00		0.00E+00		
p,a,a,a-Tetrachlorotoluene	5216251					2.00E+01	H			x	5.30E-04	C	3.10E-04	C	1.60E-04	C	2.90E-01	C	3.20E-02	C	0.00E+00		0.00E+00		
Tetrachlorovinphos	961115	3.00E-02	I			2.40E-02	H				2.80E+00	C	2.60E-01	C	1.30E-01	C	2.40E+02	C	2.70E+01	C	0.00E+00		0.00E+00		
Tetraethyldithiopyrophosphate	3689245	5.00E-04	I								1.80E+01	N	1.80E+00	N	6.80E-01	N	1.00E+03	N	3.90E+01	N	0.00E+00		0.00E+00		
Tetraethyl lead	78002	1.00E-07	I								3.70E-03	N	3.70E-04	N	1.40E-04	N	2.00E-01	N	7.80E-03	N	6.80E-04	N	3.40E-05	N	
1,1,1,2-Tetrafluoroethane	811972		I	2.29E+01						x	1.40E+05	N	8.40E+04	N	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		
Thallic oxide	1314325	7.00E-05	W								2.60E+00	N	2.60E-01	N	9.50E-02	N	1.40E+02	N	5.50E+00	N	0.00E+00		0.00E+00		
Thallium	0										0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00		4.00E-01	E	
Thallium acetate	563688	9.00E-05	I								3.30E+00	N	3.30E-01	N	1.20E-01	N	1.80E+02	N	7.00E+00	N	0.00E+00		0.00E+00		

										Risk-Based Concentrations										Soil Screening Levels-					
									V	Tap		Ambient				Soil Ingestion				Transfers from Soil to:					
		RfDo		RfDi		CPSo		CPSi	O	Water		Air		Fish		Industrial		Residential		Air		Groundwater	
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg	C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
Thallium carbonate	6533739	8.00E-05	I							2.90E+00	N	2.90E-01	N	1.10E-01	N	1.60E+02	N	6.30E+00	N	0.00E+00		0.00E+00	
Thallium chloride	7791120	8.00E-05	I							2.90E+00	N	2.90E-01	N	1.10E-01	N	1.60E+02	N	6.30E+00	N	0.00E+00		0.00E+00	
Thallium nitrate	10102451	9.00E-05	I							3.30E+00	N	3.30E-01	N	1.20E-01	N	1.80E+02	N	7.00E+00	N	0.00E+00		0.00E+00	
Thallium selenite	12039520	9.00E-05	W							3.30E+00	N	3.30E-01	N	1.20E-01	N	1.80E+02	N	7.00E+00	N	0.00E+00		0.00E+00	
Thallium sulfate	7446186	8.00E-05	I							2.90E+00	N	2.90E-01	N	1.10E-01	N	1.60E+02	N	6.30E+00	N	0.00E+00		0.00E+00	
Thiobencarb	28249776	1.00E-02	I							3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	0.00E+00		0.00E+00	
2-(Thiocyanomethylthio)-benzothiazole	21564170	3.00E-02	H							1.10E+03	N	1.10E+02	N	4.10E+01	N	6.10E+04	N	2.30E+03	N	0.00E+00		0.00E+00	
Thiofanox	39196184	3.00E-04	H							1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N	0.00E+00		0.00E+00	
Thiophanate-methyl	23564058	8.00E-02	I							2.90E+03	N	2.90E+02	N	1.10E+02	N	1.60E+05	N	6.30E+03	N	0.00E+00		0.00E+00	
Thiram	137268	5.00E-03	I							1.80E+02	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00	
Tin and compounds	0	6.00E-01	H							2.20E+04	N	2.20E+03	N	8.10E+02	N	1.00E+06	N	4.70E+04	N	0.00E+00		0.00E+00	
Toluene	108883	2.00E-01	I	1.14E-01	I				x	7.50E+02	N	4.20E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N	5.20E+02	E	5.00E+00	E
Toluene-2,4-diamine	95807					3.20E+00	H			2.10E-02	C	2.00E-03	C	9.90E-04	C	1.80E+00	C	2.00E-01	C	0.00E+00		0.00E+00	
Toluene-2,5-diamine	95705	6.00E-01	H							2.20E+04	N	2.20E+03	N	8.10E+02	N	1.00E+06	N	4.70E+04	N	0.00E+00		0.00E+00	
Toluene-2,6-diamine	823405	2.00E-01	H							7.30E+03	N	7.30E+02	N	2.70E+02	N	4.10E+05	N	1.60E+04	N	0.00E+00		0.00E+00	
p-Toluidine	106490					1.90E-01	H			3.50E-01	C	3.30E-02	C	1.70E-02	C	3.00E+01	C	3.40E+00	C	0.00E+00		0.00E+00	
Toxaphene	8001352					1.10E+00	I	1.12E+00	I	6.10E-02	C	5.60E-03	C	2.90E-03	C	5.20E+00	C	5.80E-01	C	5.00E+00	E	4.00E-02	E
Tralomethrin	66841256	7.50E-03	I							2.70E+02	N	2.70E+01	N	1.00E+01	N	1.50E+04	N	5.90E+02	N	0.00E+00		0.00E+00	
Triallate	2303175	1.30E-02	I							4.70E+02	N	4.70E+01	N	1.80E+01	N	2.70E+04	N	1.00E+03	N	0.00E+00		0.00E+00	
Triasulfuron	82097505	1.00E-02	I							3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	0.00E+00		0.00E+00	
1,2,4-Tribromobenzene	615543	5.00E-03	I						x	3.00E+01	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00	
Tributyltin oxide (TBTO)	56359	3.00E-05	I							1.10E+00	N	1.10E-01	N	4.10E-02	N	6.10E+01	N	2.30E+00	N	0.00E+00		0.00E+00	
2,4,6-Trichloroaniline hydrochloride	33663502					2.90E-02	H			2.30E+00	C	2.20E-01	C	1.10E-01	C	2.00E+02	C	2.20E+01	C	0.00E+00		0.00E+00	
2,4,6-Trichloroaniline	634935					3.40E-02	H			2.00E+00	C	1.80E-01	C	9.30E-02	C	1.70E+02	C	1.90E+01	C	0.00E+00		0.00E+00	
1,2,4-Trichlorobenzene	120821	1.00E-02	I	5.71e-02	H				x	1.90E+02	N	2.10E+02	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	2.40E+02	E	2.00E+00	E
**1,1,1-Trichloroethane	71556	3.50E-02	E	2.86E-01	W				x	7.90E+02	N	1.00E+03	N	4.70E+01	N	7.20E+04	N	2.70E+03	N	9.80E+02	E	9.00E-01	E
1,1,2-Trichloroethane	79005	4.00E-03	I			5.70E-02	I	5.60E-02	I	x	1.90E-01	C	1.10E-01	C	5.50E-02	C	1.00E+02	C	1.10E+01	C	8.00E-01	E	1.00E-02	E
Trichloroethylene (TCE)	79016	6.00E-03	E			1.10E-02	W	6.00E-03	E	x	1.60E+00	C	1.00E+00	C	2.90E-01	C	5.20E+02	C	5.80E+01	C	3.00E+00	E	2.00E-02	E
Trichlorofluoromethane	75694	3.00E-01	I	2.00E-01	A				x	1.30E+03	N	7.30E+02	N	4.10E+02	N	6.10E+05	N	2.30E+04	N	7.90E+02	N	1.30E+01	N
2,4,5-Trichlorophenol	95954	1.00E-01	I							3.70E+03	N	3.70E+02	N	1.40E+02	N	2.00E+05	N	7.80E+03	N	8.20E+03	S	1.20E+02	E
2,4,6-Trichlorophenol	88062					1.10E-02	I	1.09E-02	I	6.10E+00	C	5.70E-01	C	2.90E-01	C	5.20E+02	C	5.80E+01	C	1.50E+02	C	6.00E-02	E
2,4,5-Trichlorophenoxyacetic acid	93765	1.00E-02	I							3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	0.00E+00		0.00E+00	
2-(2,4,5-Trichlorophenoxy)propionic acid	93721	8.00E-03	I							2.90E+02	N	2.90E+01	N	1.10E+01	N	1.60E+04	N	6.30E+02	N	0.00E+00		0.00E+00	
1,1,2-Trichloropropane	598776	5.00E-03	I						x	3.00E+01	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	1.30E+01	N	1.40E-01	N
1,2,3-Trichloropropane	96184	6.00E-03	I			7.00e+00	I		x	1.50E-03	C	8.90E-04	C	4.50E-04	C	8.20E-01	C	9.10E-02	C	2.70E-05	C	6.00E-06	C
1,2,3-Trichloropropene	96195	5.00E-03	H						x	3.00E+01	N	1.80E+01	N	6.80E+00	N	1.00E+04	N	3.90E+02	N	0.00E+00		0.00E+00	
1,1,2-Trichloro-1,2,2- trifluoroethane	76131	3.00E+01	I	8.57E+00	H				x	5.90E+04	N	3.10E+04	N	4.10E+04	N	1.00E+06	N	1.00E+06	N	2.40E+03	S	3.10E+03	N
Tridiphane	58138082	3.00E-03	I							1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N	0.00E+00		0.00E+00	
Triethylamine	121448			2.00E-03	I					7.30E+01	N	7.30E+00	N	0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00	
Trifluralin	1582098	7.50E-03	I			7.70E-03	I			8.70E+00	C	8.10E-01	C	4.10E-01	C	7.40E+02	C	8.30E+01	C	0.00E+00		0.00E+00	
1,2,4-Trimethylbenzene	95636	5.00e-02	E						x	3.00E+02	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00	
1,3,5-Trimethylbenzene	108678	5.00e-02	E						x	3.00E+02	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	9.80E+01	S	2.60E-01	M
Trimethyl phosphate	512561					3.70E-02	H			1.80E+00	C	1.70E-01	C	8.50E-02	C	1.50E+02	C	1.70E+01	C	0.00E+00		0.00E+00	
1,3,5-Trinitrobenzene	99354	5.00E-05	I							1.80E+00	N	1.80E-01	N	6.80E-02	N	1.00E+02	N	3.90E+00	N	0.00E+00		0.00E+00	
Trinitrophenylmethylnitramine	479458	1.00E-02	H							3.70E+02	N	3.70E+01	N	1.40E+01	N	2.00E+04	N	7.80E+02	N	0.00E+00		0.00E+00	
2,4,6-Trinitrotoluene	118967	5.00E-04	I			3.00E-02	I			2.20E+00	C	2.10E-01	C	1.10E-01	C	1.90E+02	C	2.10E+01	C	0.00E+00		0.00E+00	
Uranium (soluble salts)	7440611	3.00E-03	I							1.10E+02	N	1.10E+01	N	4.10E+00	N	6.10E+03	N	2.30E+02	N	0.00E+00		0.00E+00	
Vanadium	7440622	7.00E-03	H							2.60E+02	N	2.60E+01	N	9.50E+00	N	1.40E+04	N	5.50E+02	N	0.00E+00		0.00E+00	
Vanadium pentoxide	1314621	9.00E-03	I							3.30E+02	N	3.30E+01	N	1.20E+01	N	1.80E+04	N	7.00E+02	N	0.00E+00		0.00E+00	
Vanadium sulfate	36907423	2.00E-02	H							7.30E+02	N	7.30E+01	N	2.70E+01	N	4.10E+04	N	1.60E+03	N	0.00E+00		0.00E+00	
Vernam	1929777	1.00E-03	I							3.70E+01	N	3.70E+00	N	1.40E+00	N	2.00E+03	N	7.80E+01	N	0.00E+00		0.00E+00	
Vinclozolin	50471448	2.50E-02	I							9.10E+02	N	9.10E+01	N	3.40E+01	N	5.10E+04	N	2.00E+03	N	0.00E+00		0.00E+00	
Vinyl acetate	108054	1.00E+00	H	5.71E-02	I					3.70E+04	N	2.10E+02	N	1.40E+03	N	1.00E+06	N	7.80E+04	N	3.70E+02	E	8.40E+01	E
Vinyl bromide	593602			8.57E-04	I				x	5.20E+00	N	3.10E+00	N	0.00E+00		0.00E+00		0.00E+00		2.00E+00	N	1.80E-02	N

										Risk-Based Concentrations																Soil Screening Levels-						
											V	Tap		Ambient				Soil Ingestion				Transfers from Soil to:									
		RfDo		RfDi		CPSo		CPSi			O	Water		Air		Fish		Industrial		Residential		Air		Groundwater			
Contaminant	CAS	mg/kg/d		mg/kg/d		kg·d/mg		kg·d/mg			C	µg/L		µg/m3		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg			
Vinyl chloride	75014					1.90E+00	H	3.00E-01	H	x		1.90E-02	C	2.10E-02	C	1.70E-03	C	3.00E+00	C	3.40E-01	C	2.00E-03	E	1.00E-02	E		
Warfarin	81812	3.00E-04	I									1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N	4.60E-02	N	1.80E+03	N		
m-Xylene	1.08E+05	2.00E+00	H	2.00E-01	W					x		1.40E+03	N	7.30E+02	N	2.70E+03	N	1.00E+06	N	1.60E+05	N	9.50E+02	S	2.40E+02	M		
o-Xylene	9.55E+04	2.00E+00	H	2.00E-01	W					x		1.40E+03	N	7.30E+02	N	2.70E+03	N	1.00E+06	N	1.60E+05	N	7.30E+02	S	1.50E+02	M		
p-Xylene	1.06E+05			8.57E-02	W					x		5.20E+02	N	3.10E+02	N	0.00E+00		0.00E+00		0.00E+00		1.00E+03	S	2.20E+02	M		
Xylene (mixed)	1.33E+06	2.00E+00	I							x		1.20E+04	N	7.30E+03	N	2.70E+03	N	1.00E+06	N	1.60E+05	N	3.20E+02	E	7.40E+01	E		
Zinc	7.44E+06	3.00E-01	I									1.10E+04	N	1.10E+03	N	4.10E+02	N	6.10E+05	N	2.30E+04	N	0.00E+00		4.20E+04	E		
Zinc phosphide	1.31E+06	3.00E-04	I									1.10E+01	N	1.10E+00	N	4.10E-01	N	6.10E+02	N	2.30E+01	N	0.00E+00		0.00E+00			
Zineb	1.21E+07	5.00E-02	I									1.80E+03	N	1.80E+02	N	6.80E+01	N	1.00E+05	N	3.90E+03	N	0.00E+00		0.00E+00			

APPENDIX F

SOIL CLEAN UP GOALS FOR FLORIDA

Florida Department of
Environmental Protection

Memorandum

TO: District Directors
Waste Program Administrators

FROM: John M. Ruddell, Director
Division of Waste Management

DATE: January 19, 1996

SUBJECT: Applicability of Soil Cleanup Goals for Florida

Background:

At the beginning of 1995 the Bureau of Waste Cleanup distributed to you and your staff a list of soil cleanup goals to be used when making cleanup decisions. These cleanup goals were derived following, in general, EPA's methodology since that agency was developing their own generic Site Screening Levels (SSLs) at the same time. Subsequently, EPA's approach underwent widespread review both within and outside the agency. As a result, Florida's goals were redefined throughout 1995 to parallel EPA's SSLs.

My September 29, 1995 memorandum listed the Florida Soil Cleanup Goals developed by Dr. Stephen M. Roberts (UF toxicologist under contract to FDEP). These goals are not identical to the EPA's SSLs. Inasmuch as one can "fine tune" generic goals, ours are tailored to Florida's typical soil characteristics, hydrogeology, meteorological data, average source size and state groundwater standards. The Florida Soil Cleanup Goals were also modified from EPA's SSLs to include toxicity considerations that were not available in IRIS, the Federal toxicity database.

Purpose:

The first several pages of the September 29, 1995 document explain the appropriate and intended use of the document. However, there have been some questions about it; therefore, I would like to elaborate on the applicability of these goals:

The Soil Cleanup Goals are intended to be used only as "goals" for cleanup decisions in corrective actions and should not be used by the agency as rule, standards or to deny or approve permits. The FDEP has found that most business/site owners do not normally have the money or the expertise to establish Site-specific Rehabilitation Levels (SRLs) as allowed by our cleanup Consent Order conditions. The soil cleanup goals are intended to be used for site screening purposes, for source

removal evaluations, and as guidance during evaluation of remediation alternatives and design considerations for development of the Remedial Action Plan (RAP) for a site. The soil cleanup goals can and should be used for cleanup decisions if the default assumptions fit the site-specific situation. For your information, although the default parameters used to derive these goals are conservative, they are not necessarily representative of the worst case scenario. In addition, ecological receptors were not taken into consideration when these cleanup goals were developed. A site-specific evaluation should be conducted during the Contamination Assessment phase to determine if protection of ecological receptors is needed at a particular site and, if that is the case, whether the soil goals based on human health are also protective of those ecological receptors.

Please note that the risk assessment phase occurs after the Contamination Assessment Report has been approved. The responsible party can develop site-specific soil cleanup goals utilizing site-specific parameters such as total organic carbon, soil porosity, soil moisture content and dry bulk density in combination with exposure assumptions acceptable to the Department.

The evaluation process should take into consideration the following criteria:

1) the site-specific background levels,
2) the Method Detection Limits (MDLs),
3) the soil cleanup goals, and
4) the site contaminant levels.

The site contaminant levels (criterion 4) for each Chemical of Concern (COC) should be compared to the highest value of the first three criteria. If the site contaminant levels are below the highest value, then no remediation is required for that contaminant. If the site contaminant levels are higher than the highest value, then remediation alternatives should be evaluated taking into consideration the specific nature of the site and the responsible party's ability to effectively manage the risk of a particular site contaminant level. FDEP may consider site-specific risk management alternatives that may further modify the guidance levels for the contaminant. These health-based soil goals are evaluated based on the nature and intended use of the site (e.g., residential or industrial) and usually only apply to the upper two feet of soil. If the contaminated soil can be permanently covered with more than two feet of clean soil or

otherwise have the exposure pathways restricted, the site may not need further remediation if the contaminated soil is not a source of groundwater contamination.

The second use of the soil cleanup goals is to provide a guidance level for the potential leachability of various soil contaminants. The leachability level (last column on the right) is intended to give you, site owners and consultants an indication of the soil contaminant levels that may cause groundwater contamination in excess of Florida's water quality standards and minimum criteria. The goals are applicable if a recent discharge has occurred (within the last year) or if indeed there are monitoring data showing violation of groundwater standards and minimum criteria. The leachability levels apply throughout the soil profile, when applicable.

The soil values may be used for other purposes (other media) if indeed the particular application fits the situation (e.g., sediments that upon dredging will be used as soil). Again, an analysis of the specific situation must be performed (i.e., ascertain land use, exposure duration, leachability concerns, background considerations, etc.).

From time to time, we will update the soil cleanup goals; as of today, the following changes have occurred:

Arsenic;

	Residential	Industrial	Leachability *
Old:	0.7 mg/Kg	3.1 mg/Kg	pass TCLP (mg/L)
New:	0.8 mg/Kg	3.7 mg/Kg	same as before

* In certain cases, soil may pass TCLP but still leach to groundwater and cause groundwater violations. In these cases, further evaluation will be needed to determine appropriate leachability-based goals.

Please contact Ligia Mora-Applegate at Suncom 278-3935 if further assistance is needed.

cc: Doug Jones
Bill Hinkley
Jim Crane
Satish Kastury

Table 2. Variables and Assumptions for Calculating Soil Cleanup Goals Based on Direct Exposure to Soil

Variable	Child Resident[1] (age 1-6 years)	Aggregate Resident[2] (age 1 - 30 yrs)	On-Site Worker[3]
BW (body weight)	15 kg	59 kg	70 kg
IRo (ingestion rate, oral)	200 mg/kg	120 mg/day	50 mg/day
IRi (inhalation rate)	10 m^3/day	15 m^3/day	20 m^3/day
FC (fraction from contam. source)	1.0 (100%)	1.0 (100%)	1.0 (100%)
EF (exposure frequency)	350 days/yr	350 days/yr	250 days/yr
ED (exposure duration)	6 yrs	30 yrs	25 yrs
SA (surface area of skin exposed)	1,800 cm^2/day	4,855 cm^2/day	2,300 cm^2/day
AF (adherence factor)	0.2 mg/cm^2	0.2 mg/cm^2	0.6 mg/cm2
AT (averaging time)			
• non-carcinogens	2,190 days	10,950	9,125 days
• carcinogens	25,550 days	25,550 days	25,550 days

[1] used in calculating soil cleanup goals based on non-cancer health effects for a residential scenario

[2] used in calculating soil cleanup goals based on potential carcinogenicity for a residential scenario.

[3] used in calculating soil cleanup goals based on both cancer and non-cancer health effects for commercial/industrial land use.

Variable	
TR (target risk)	1×10^{-6} for carcinogens; hazard quotient of 1.0 for non-carcinogens
DA (dermal absorption)	0.01 for organics; 0.001 for inorganics[4]
PEF (particulate emission factor)	1.24 E+09 m^3/kg
VF (volatilization factor)	compound specific[5]
SF (slope factor)	compound and route specific
RfD (reference dose)	compound and route specific

[4] based upon Region IV guidance

[5] refer to *Technical Background Document for Draft Soil Screening Level Guidance*, EPA 540/R-94/018, July 1994, for the method of calculation.

Florida Department of

Environmental Protection

Memorandum

TO: District Directors
Waste Program Administrators

FROM: John M. Ruddell, Director JMR
Division of Waste Management

DATE: September 29, 1995

SUBJECT: **Soil Cleanup Goals for Florida**

Attached, please find the soil cleanup goals that should be used when making cleanup decisions. These cleanup goals were developed by Dr. Stephen M. Roberts (UF toxicologist under contract to FDEP). The health-based cleanup goals (residential and industrial) are based on human toxicity using generalized exposure assumptions and are applicable to the upper two feet of soil. If the industrial scenario is warranted, the site should have a deed restriction for the more restrictive land use. If there is ground water contamination above Florida standards and minimum criteria or if there was a recent discharge, the leachability-based cleanup goals should also be considered using the applicable direct contact scenario (residential and industrial). The lowest of the two should be the final cleanup goal for the upper two feet of soil. For soil below two feet, the leachability-based goal should be applied if the parameters of concern are detected above the Florida criteria. In addition, until further notice and where appropriate, the metals should pass TCLP as an indication not only that the soil is not a hazardous waste, but also that the soil will not act as a source of groundwater contamination.

If any of the levels is below site-specific background or the QA acceptable Method Detection Limit (MDL), any of the latter two will suffice.

Site-specific soil characteristics such as porosity, carbon content, moisture content, and dry bulk density are needed to refine acceptable soil concentrations based on site-specific parameters.

If you have any questions, please call Ligia Mora-Applegate at SC 278-3935.

JMR/lm-a

Attachment

cc: Doug Jones
Bill Hinkley
Jim Crane
Satish Kastury

BUREAU OF WASTE CLEANUP

SEP 2 0 1995

TECHNICAL REVIEW SECTION

Soil Cleanup Goals

Based on Direct Exposure and Migration to Groundwater

September 27, 1995

The appended Table 1 contains acceptable soil concentrations for over 200 chemicals commonly found as contaminants at sites in Florida. Soil cleanup goal concentrations based on direct exposure have been calculated using exposure assumptions consistent with both residential and commercial/industrial land use, and are presented in Table 1. For situations in which there is evidence that soil may be serving as a source of contamination for groundwater, soil cleanup goal concentrations for organic chemicals based on leaching from soil to groundwater are also provided in this table.

For evaluation of direct exposure to contaminants in soils, intake from incidental ingestion, dermal contact, and inhalation is considered. Soil concentrations are calculated using the following equation:

$$Cs = \frac{TR \times BW \times AT}{EF \times ED \times FC \times [A + B + C]}$$

When calculating soil concentrations based on potential carcinogenicity:

- the ingestion component, A = $\left(SF_o \times IR_o \times 10^{-6} kg / mg\right)$
- the dermal component, B = $\left(SF_d \times SA \times AF \times DA \times 10^{-6} kg / mg\right)$
- and the inhalation component, C = $\left(SF_i \times IR_i \times \left(\frac{1}{VF} + \frac{1}{PEF}\right)\right)$

When calculating soil concentrations based on potential non-cancer health effects:

- the ingestion component, A = $\left(\frac{1}{RfD_o} \times IR_o \times 10^{-6} kg / mg\right)$
- the dermal component, B = $\left(\frac{1}{RfD_d} \times SA \times AF \times DA \times 10^{-6} kg / mg\right)$
- and the inhalation component, C = $\left(\frac{1}{RfD_i} \times IR_i \times \left(\frac{1}{VF} + \frac{1}{PEF}\right)\right)$

The equation variables and assumptions are summarized in Table 2. For most chemicals in Table 1, toxicity criteria (reference doses and slope factors) can be taken from IRIS (Integrated Risk Information System, USEPA). When toxicity criteria are unavailable from IRIS, other sources (e.g. HEAST, ECAO, OPP, and the toxicological literature) were used. Intake from all

routes should be assumed to contribute to toxic endpoints that are systemic in nature. For toxic endpoints that are route-specific (e.g. carcinogenicity from inhalation of hexavalent chromium), only the relevant intake pathway is included in the calculation of the soil cleanup goal. Dermal toxicity criteria were derived using route-to-route extrapolation from available criteria for other routes; for some chemicals, inhalation toxicity criteria can also be derived using this method. For carcinogens, soil cleanup goal concentrations should be calculated for both carcinogenic and non-carcinogenic health effects. Only the lower of the two value is shown in Table 1. These values are intended to be applicable only to soil contamination within 2 feet of land surface.

For leaching of organic contaminants from soil to groundwater, the following equation was used to calculate a soil cleanup goal:

$$Cs = Cw\left[K_d + \frac{(\theta_w + \theta_a H')}{\rho_b}\right]$$

The variables and assumed values are summarized below:

Variable	Definition	Assumed Value
Cw	target soil leachate concentration (mg/L)	chemical-specific
K_d	soil-water partition coefficient (cm^3/g)	$K_{oc} \times f_{oc}$ (organics)
q_w	water-filled soil porosity (L_{water}/L_{soil})	0.3
q_a	air-filled soil porosity (L_{air}/L_{soil})	0.13
r_b	dry soil bulk density (kg/L)	1.5
Koc	organic carbon partition coefficient (cm^3/g)	chemical-specific
f_{oc}	organic carbon content of soil (g/g)	0.002 (0.2%)
H'	dimensionless Henry's Law constant	chemical-specific

Soil concentrations based on partitioning to groundwater are not calculated in the same way for inorganics, and for some organic chemicals the necessary physical-chemical characteristics may be unavailable. Soil cleanup goals for this latter group of chemicals may become available in future updates.

Some risk-based values presented in Table 1 may be less than natural background concentrations for the chemicals in the soils. In such cases, the background concentration would represent a reasonable cleanup goal. Similarly, if the risk based value is less than the Method of Detection Limit (MDL), the MDL would become the operational cleanup goal for practical reasons.

The values in Table 1 were calculated using generic assumptions regarding exposure and soil characteristics and are intended to be broadly applicable to sites in Florida. In some situations it may be desirable to utilize site-specific assumptions in the development of cleanup goals for contaminants in soils. For example, site-specific soil characteristics might be used to refine estimates of acceptable soil concentrations based on both direct contact and leachability. The use of more limited exposure assumptions should be considered in the development of soil cleanup goals only when they can be reasonably assured to reflect both current and plausible future land use.

It is important A il concentrations for individual chemicals will
change over time in LINE HE IS QUOTING n regarding the toxicity of the chemical,
improvement in expo: gly, this list will be updated periodically to
ensure that the most cu

Table 1. SELECTED SOIL CLEAN-UP GOALS *

Current as of September 27, 1995

All values are presented in mg/kg (ppm)

Chemical Name	CAS	Residential	Industrial	Leaching **
Acenaphthene	83-32-9	2800	30000	2.0
Acenaphthylene	208-96-8	670	5600	11
Acetone	67-64-1	260	1800	1.4
Acrolein	107-02-8	0.4	2.7	0.3
Acrylonitrile	107-13-1	0.1	0.2	0.02
Alachlor	15972-60-8	14	56	NC
Aldrin	309-00-2	0.06	0.2	0.05
Aluminum	7429-90-5	75000	†	NC
Anthracene	120-12-7	20000	300000	890
Antimony	7440-36-0	26	220	NC
Arsenic	7440-38-2	0.7	3.1	NC
Atrazine	1912-24-9	4.9	20	0.02
Barium	7440-39-3	5200	84000	NC
Benzene	71-43-2	1.4	2.0	0.003
Benzo(a)anthracene	56-55-3	1.4	4.9	29
Benzo(a)pyrene	50-32-8	0.1	0.5	3.7
Benzo(b)fluoranthene	205-99-2	1.4	5.0	71
Benzo(g,h,i)perylene	191-24-2	14	50	320
Benzo(k)fluoranthene	207-08-9	14	48	44
Benzoic acid	65-85-0	130000	†	56
Beryllium	7440-41-7	0.2‡	1.0‡	NC
Bis(2-chloroethoxy)methane	111-91-1	170	3000	0.03
Bis(2-chloroethyl)ether	111-44-4	0.5	0.9	0.005
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	48	110	11
Boron	7440-42-8	7000	180000	NC
Bromodichloromethane	75-27-4	0.7	01	0.002
Bromoform	75-25-2	65	130	0.02
Butanone, 2- (MEK)	78-93-3	2200	15000	8.7
Butyl benzyl phthalate, N-	85-68-7	15000	310000	960
Cadmium	7440-43-9	37	600	NC
Carbaryl	63-25-2	7600	150000	4.6
Carbazole	86-74-8	42	120	0.4

Table 1. SELECTED SOIL CLEAN-UP GOALS *

Current as of September 27, 1995

All values are presented in mg/kg (ppm)

Chemical Name	CAS	Residential	Industrial	Leaching **
Carbofuran	1563-66-2	380	7700	0.1
Carbon disulfide	75-15-0	5.2	34	2.5
Carbon tetrachloride	56-23-5	0.6	0.8	0.02
Chlordane	57-74-9	0.8	3.0	2.1
Chloro-m-cresol, p-	59-50-7	140000	†	42
Chloroaniline, 4-	106-47-8	240	3300	0.08
Chlorobenzene	108-90-7	44	300	0.6
Chloroethylvinylether, 2-	110-75-8	100	690	0.002
Chloroform	67-66-3	0.6	0.8	0.02
Chloromethane	74-87-3	0.2	0.3	0.01
Chloronaphthalene, beta-	91-58-7	560	4000	57
Chlorophenol, 2-	95-57-8	280	3700	0.3
Chlorpyrifos	2921-88-2	190	2900	2.6
Chromium (hexavalent)	18540-29-9	290	430	NC
Chromium (trivalent)	16065-83-1	66000	540000	NC
Chrysene	218-01-9	140	500	31
Cobalt	7440-48-4	4700	110000	NC
Coumaphos	56-72-4	19	410	NC
Cyanide	57-12-5	1600	40000	NC
DDD, 4,4'-	72-54-8	4.5	17	0.2
DDE, 4,4'-	72-55-9	3.0	11	0.2
DDT, 4,4'-	50-29-3	3.1	12	0.5
Dalapon	75-99-0	1900	28000	0.4
Demeton	8065-48-3	3.1	64	NC
Di-n-Butylphthalate	84-74-2	7300	140000	23
Di-n-Octylphthalate	117-84-0	1500	32000	†
Diazinon	333-41-5	66	1300	0.04
Dibenz(a,h)anthracene	53-70-3	0.1	0.5	7.2
Dibenzofuran	132-64-9	240	3500	NC
Dibromochloromethane	124-48-1	1.2	1.7	0.004
Dibromoethane, 1,2- (EDB)	106-93-4	0.01	0.04	0.00006
Dicamba	1918-00-9	1700	23000	0.7

Note
Missing
Copper

Table 1. SELECTED SOIL CLEAN-UP GOALS *

Current as of September 27, 1995

All values are presented in mg/kg (ppm)

Chemical Name	CAS	Residential	Industrial	Leaching **
Dichlorobenzene, 1,2-	95-50-1	820	6000	5.8
Dichlorobenzene, 1,3-	541-73-1	1700	13000	0.4
Dichlorobenzene, 1,4-	106-46-7	7.5	11	0.9
Dichloroethane, 1,1-	75-34-3	310	2100	2.3
Dichloroethane, 1,2- (EDC)	107-06-2	0.7	1.0	0.008
Dichloroethene, 1,1-	75-35-4	0.1	0.1	0.03
Dichloroethene, cis-1,2-	156-59-2	26	180	0.2
Dichloroethene, trans-1,2-	156-60-5	62	430	0.3
Dichlorophenol, 2,4-	120-83-2	220	4000	0.02
Dichlorophenoxy acetic acid, 2,4-	94-75-7	110	800	0.2
Dichlorophenoxy) butyric acid, 4-(2,4-	94-82-6	610	13000	NC
Dichloroprop	120-36-5	3.8	15	NC
Dichloropropane, 1,2-	78-87-5	0.8	1.2	0.02
Dichloropropene, 1,3-	542-75-6	0.3	0.4	0.003
Dichlorvos	62-73-7	3.8	15	0.0003
Dicofol (Kelthane)	115-32-2	2.5	10	NC
Dieldrin	60-57-1	0.07	0.3	0.02
Diethylphthalate	84-66-2	56000	970000	20
Dimethylformamide, N,N-	68-12-2	1800	27000	1.5
Dimethylphenol, 2,4-	105-67-9	1200	16000	1.8
Dimethylphthalate	131-11-3	630000	†	200
Dinitrotoluene, 2,4-	121-14-2	130	2000	0.0006
Dinitrotoluene, 2,6-	606-20-2	71	1300	0.0006
Dinoseb	88-85-7	43	470	0.4
Disulfoton	298-04-4	2.8	50	0.01
Diuron	330-54-1	130	2100	0.1
Endosulfan	115-29-7	390	5900	0.7
Endrin	72-20-8	23	470	0.4
Endrin aldehyde	7421-93-4	23	480	0.05
Ethoprop	13194-48-4	1.2	25	NC
Ethyl chloride	75-00-3	8200	56000	0.6
Ethyl dipropylthiocarbamate, S- (EPTC)	759-94-4	1900	38000	NC

Table 1. SELECTED SOIL CLEAN-UP GOALS *

Current as of September 27, 1995

All values are presented in mg/kg (ppm)

Chemical Name	CAS	Residential	Industrial	Leaching **
Ethyl p-nitrophenyl phenylphosphorothioate	2104-64-5	0.8	15	0.008
Ethylbenzene	100-41-4	1400	10000	0.2
Fenamiphos	22224-92-6	19	410	0.06
Fensulfothion	115-90-2	19	410	NC
Fenthion	55-38-9	3.8	80	NC
Fluoranthene	206-44-0	2900	48000	280
Fluorene	86-73-7	2400	30000	45
Fluoride	16984-58-8	4700	120000	NC
Guthion (Azinphos-methyl)	86-50-0	120	2500	0.1
Heptachlor	76-44-8	0.2	0.5	0.06
Heptachlor epoxide	1024-57-3	0.1	0.3	0.03
Hexachlorobenzene	118-74-1	0.6	1.6	0.8
Hexachlorobutadiene	87-68-3	3.1	4.9	2.1
Hexachlorocyclohexane, alpha-	319-84-6	0.2	0.6	0.002
Hexachlorocyclohexane, beta-	319-85-7	0.6	2.3	0.005
Hexachlorocyclohexane, delta-	319-86-8	23	470	0.007
Hexachlorocyclohexane, gamma-	58-89-9	0.8	3.0	0.006
Hexachloroethane	67-72-1	27	120	0.4
Hexane, n-	110-54-3	76	510	1.0
Hexazinone	51235-04-2	2500	52000	NC
Indeno(1,2,3-cd)pyrene	193-39-5	1.4	5.0	17
Lead	7439-92-1	500	1000	NC
Linuron	330-55-2	150	3200	NC
Lithium	743-99-32	1600	40000	NC
Malathion	121-75-5	1500	23000	1.1
Manganese	7439-96-5	370	5500	NC
Mercury	7439-97-6	23	480	NC
Merphos	150-50-5	2.3	48	NC
Mesurol (Methiocarb)	2032-65-7	310	4600	NC
Methomyl	16752-77-5	1900	41000	0.5
Methoxychlor	72-43-5	380	7800	62
Methyl parathion	298-00-0	19	350	0.1

Table 1. SELECTED SOIL CLEAN-UP GOALS *

Current as of September 27, 1995

All values are presented in mg/kg (ppm)

Chemical Name	CAS	Residential	Industrial	Leaching **
Methyl tert-butyl ether	1634-04-4	3800	27000	0.1
Methyl-2-pentanone, 4- (MIBK)	108-10-1	520	3700	1.1
Methyl-4-chlorophenoxy acetic acid, 2-	94-74-6	38	800	NC
Methyl-4-chlorophenoxy propionic acid, 2-	93-65-2	77	1600	NC
Methylene chloride	75-09-2	16	23	0.01
Methylnaphthalene, 1-	90-12-0	930	8400	NC
Methylnaphthalene, 2-	91-57-6	960	8800	NC
Methylphenol, 2- (o-cresol)	95-48-7	2600	32000	1.1
Methylphenol, 3- (m-cresol)	108-39-4	3400	55000	4.2
Methylphenol, 4- (p-cresol)	106-44-5	340	5500	0.4
Metribuzin	21087-64-9	1900	42000	NC
Mevinphos	7786-34-7	19	420	NC
Mirex	2385-85-5	0.4	0.8	0.01
Molybdenum	7439-98-7	390	9600	NC
Monuron	150-68-5	9.6	190	NC
Naled	300-76-5	150	3200	NC
Naphthalene	91-20-3	1300	12000	0.1
Nickel	7440-02-0	1500	26000	NC
Nickel subsulfide	12035-72-2	7000	10000	NC
Nitrate	14797-55-8	120000	†	NC
Nitrite	14797-65-0	7800	200000	NC
Nitroaniline, o-	88-74-4	4.0	73	0.02
Nitroaniline, p-	100-01-6	230	4700	NC
Nitrobenzene	98-95-3	22	250	0.04
Nitroso-di-n-propylamine, N-	621-64-7	0.02	0.03	0.009
Nitrosodimethylamine, N-	62-75-9	0.003	0.004	0.02
Nitrosodiphenylamine, N-	86-30-6	73	130	0.06
Oxamyl	23135-22-0	1900	42000	NC
Parathion	56-38-2	450	9000	3.9
Pentachlorophenol	87-86-5	5.4	12	0.01
Phenanthrene	85-01-8	1700	21000	2.8
Phenol	108-95-2	34000	440000	0.02

Table 1. SELECTED SOIL CLEAN-UP GOALS *

Current as of September 27, 1995

All values are presented in mg/kg (ppm)

Chemical Name	CAS	Residential	Industrial	Leaching **
Phorate	298-02-2	14	240	0.05
Polychlorinated biphenyls (PCBs)	1336-36-3	0.9	3.5	44
Propazine	139-40-2	1500	32000	2.3
Pyrene	129-00-0	2200	41000	290
Pyridine	110-86-1	0.5	3.2	0.02
Ronnel	299-84-3	3700	71000	NC
Selenium	7782-49-2	390	9900	NC
Silver	7440-22-4	390	9000	NC
Sodium diethyldithiocarbamate	148-18-5	4.1	17	NC
Strontium	7440-24-6	47000	†	NC
Styrene	100-42-5	4100	34000	2.0
Tetrachloroethane, 1,1,1,2-	630-20-6	5.9	8.9	0.003
Tetrachloroethane, 1,1,2,2-	79-34-5	0.9	1.4	0.0007
Tetrachloroethene (PCE)	127-18-4	12	28	0.03
Tetrachlorvinphos (Stirophos)	961-11-5	45	180	NC
Tetraethyl dithiopyrophosphate	3689-24-5	34	590	0.06
Tetraethylpyrophosphate (TEPP)	107-49-3	2.5	51	NC
Tin	7440-31-5	44000	670000	NC
Tokuthion	34643-46-4	68	1400	NC
Toluene	108-88-3	520	3500	0.2
Toxaphene	8001-35-2	0.9	3.0	0.04
Trichlorobenzene, 1,2,4-	120-82-1	590	8200	2.3
Trichloroethane, 1,1,1-	71-55-6	610	4300	0.9
Trichloroethane, 1,1,2-	79-00-5	2.0	3.0	0.02
Trichloroethene (TCE)	79-01-6	6.5	9.3	0.01
Trichlorofluoromethane	75-69-4	6.6	44	400
Trichlorophenol, 2,4,5-	95-95-4	7100	130000	0.1
Trichlorophenol, 2,4,6-	88-06-2	87	280	0.08
Trichlorophenoxy acetic acid, 2,4,5-	93-76-5	760	15000	NC
Trichlorophenoxy propionic acid, 2,4,5	93-72-1	610	13000	2.7
Trimethylbenzene, 1,2,3-	526-73-8	6.7	51	0.2
Trimethylbenzene, 1,2,4-	95-63-6	6.2	47	0.2

Table 1. SELECTED SOIL CLEAN-UP GOALS *

Current as of September 27, 1995

All values are presented in mg/kg (ppm)

Chemical Name	CAS	Residential	Industrial	Leaching **
Trimethylbenzene, 1,3,5-	108-67-8	3.7	27	0.1
Uranium, natural	7440-61-1	120	410	NC
Vanadium	7440-62-2	490	4800	NC
Vinyl acetate	108-05-4	180	1200	0.5
Vinyl chloride	75-01-4	0.005	0.007	0.005
Xylene, total	1330-20-7	13000	92000	0.1
Zinc	7440-66-6	23000	560000	NC

* Soil cleanup goals in these tables are based on human toxicity using generalized exposure assumptions. Some tabulated soil cleanup goals may be less than the minimum detection limit (MDL) for that chemical in soils; in such cases the MDL would be the applicable cleanup goal.

** TCLP for metals applies as appropriate.

NC = No Value Calculated

TCLP = Toxicity Leaching Characteristic Leaching Procedure.

† = Number exceeds 1E+06.

‡ = Based on dermal absorption of 0.0001

APPENDIX H

DERIVATION OF SCREENING CONCENTRATIONS

Certain inorganics (calcium, iron, magnesium, potassium, and sodium) that are present as naturally occurring constituents in soil and groundwater are required in limited intakes to maintain normal human physiological functions and are, therefore, considered essential nutrients. The Risk Assessment Guidance for Superfund (RAGS), Volume I, Part A, regarding the treatment of essential nutrients in selection of Contaminants of Potential Concern (CPC), states that essential nutrients need not be quantitatively evaluated in a public health risk assessment if they are (1) present at low concentrations (only slightly above background) and (2) toxic only at doses much higher than those which might be related to exposure at the site (USEPA, 1989). In this report, "only slightly above background" is interpreted to mean that the arithmetic mean of the site concentrations is less than two times the arithmetic mean of the background concentrations. The focus of this section of the document is the technical approach for determining that an analyte is "toxic only at doses higher than those associated with exposures at the site" and a mechanism for making that determination by employing soil and groundwater screening concentrations. The screening concentrations are used to streamline the process and to eliminate the need to calculate essential nutrient doses as part of CPC selection at every site. If the maximum concentration of an essential nutrient does not exceed the appropriate screening concentration shown below, the essential nutrient is considered nontoxic. Essential nutrients are not retained as CPCs if they are detected at concentrations that are either consistent with background or do not exceed the screening concentrations.

Currently, no published essential nutrient screening concentrations for use in risk assessment CPC selection are available. Therefore, ABB-ES has derived surface soil and groundwater screening concentrations of essential nutrients that, when contacted in accordance with the exposure assumptions described below, are not expected to result in adverse health effects. The screening concentrations for groundwater and surface soil are presented in Table H-1. The essential nutrient concentrations in surface soil and groundwater are to be compared directly to the nutrient screening concentrations for the purposes of CPC selection.

Table H-1
Essential Nutrient Screening Concentrations for Surface Soil and Groundwater

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Essential Nutrient	Surface Soil Screening Concentration (mg/kg)	Groundwater Screening Concentration (μg/ℓ)
Calcium	[1]1,000,000	1,055,398
Iron	47,824	13,267
Magnesium	460,468	118,807
Potassium	[1]1,000,000	297,016
Sodium	[1]1,000,000	396,022

[1] Actual calculated screening concentration is greater than 1,000,000 mg/kg (Table 5), indicating that this essential nutrient would not be present at toxic levels in surface soil.

Notes: mg/kg = milligrams per kilogram.
μg/ℓ = micrograms per liter.

As described below, screening concentrations for surface soil and groundwater represent conservative screening concentrations for other media. These surface soil and groundwater screening concentrations are used to screen sediment, subsurface soil, sludge, and surface water, respectively.

Documentation of Surface Soil and Groundwater Screening Concentrations

The essential nutrient toxicity screening concentrations were derived in two steps: first, a "nontoxic" dose was identified for each essential nutrient; second, the soil and groundwater concentrations associated with the "nontoxic" doses were calculated using standard residential exposure assumptions. The details of the derivation of the screening values are presented below.

Identification of Nontoxic Doses

The identification of doses which are not toxic is often accomplished by identifying Reference Doses (RfDs) which are published by USEPA. These RfDs represent doses, including a margin of safety, to which even sensitive subpopulations could be exposed for a lifetime without adverse noncarcinogenic effects. Because no RfDs for calcium, iron, magnesium, potassium, or sodium are available in the Integrated Risk Information System (IRIS) (USEPA, 1994a) or the Health Effects Assessment Summary Tables (HEAST) (USEPA, 1994b), other published nontoxic doses were sought. Recommended Dietary Allowances (RDAs) prepared by the Food and Nutrition Board (FNB) of the National Research Council (NRC, 1989) have been selected here to represent nontoxic doses.

RDAs are defined by the FNB as "the levels of intake of essential nutrients that, on the basis of scientific knowledge, are judged by the Food and Nutrition Board to be adequate to meet the known nutrient needs of practically all healthy persons." It is assumed here that, since the RDA represents a requirement for good nutrition, it also represents a dose which is nontoxic. Although some essential nutrients (arsenic for example) have been classified as carcinogens, none of the five nutrients discussed here have been classified as such. The available RDA data for calcium, iron, magnesium, potassium, and sodium are presented in Table H-2. From this data set, RDAs for children were preferentially selected to coincide with the child exposure scenario. RDAs were converted from units of mg/day to units of mg/kg/day by dividing the RDA by the child resident body weight of 15 kg (USEPA, 1991). Dermal RDAs were developed by adjusting the oral RDA to compensate for the oral absorption efficiency in a manner similar to that presented in Appendix A of RAGS, Volume I, Part A (USEPA, 1989).

Calculation of Screening Concentrations

Risk-based screening concentrations for essential nutrients are derived by estimating concentrations in soil and groundwater that correspond to the RDAs for a residential exposure scenario. When the dose is equal to the RDA, the hazard quotient for the situation equals one. Risk calculation spreadsheets have been used to assist in the calculation of the screening concentrations. When the concentration of an essential nutrient and the associated hazard quotient are known, only a simple calculation is needed to identify the concentration associated with a hazard quotient of one. An arbitrary nutrient concentration has been entered into risk spreadsheets to derive associated hazard quotient values as shown in Tables H-3 and H-4. Once that information is available, the

Table H-2
Recommended Dietary Allowances[1]

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Nutrient	RDA	Age (years)	Oral Absorption (%)	Typical dietary intake (mg/day)	Toxicity Threshold (mg/day)	Oral RDA (mg/kg/day) [2]	Dermal RDA (mg/kg/day) [3]
Calcium	800 (mg/day)	1 to 10	40	743 (average of all ages)	NA	53.3	21.2
	1,200 (mg/day)	11 to 24		1,179	NA		
	800 (mg/day)	>24		743 (average of all ages); 530 (women ages 35-50)	>2,500		
Iron	10 (mg/day)	1 to 20	10 to 15	10 to 15	25 to 75 (NOAEL); 3,000 (lethal)	0.67	0.067
	15 (mg/day)	>20		10 to 15	25 to 75 (NOAEL); 14,000 (lethal)		
Magnesium	6 (mg/kg/day)	1 to 15	50	193 (age 1-5)	NA	6	3
	4.5 (mg/kg/day)	>15		207-329	NA		
Potassium	15 to 20 (mg/kg/day)	1 to 10	90	1,500	NA	15	13.5
	1,600 to 2,000 (mg/day)	>20		2,500	18,000 (hyperkalemia)		
Sodium	300 (mg/day)	2 to 5	[4]90	NA	NA	20	18
	500 (mg/day)	Adult		1,800 to 5,000	2400 (intake not to be exceeded)		

[1] All data from National Research Council (NRC, 1989).
[2] Adjusted oral RDA calculated by dividing the recommended dietary allowance (RDA) (milligrams per kilogram [mg/kg]) by the bodyweight of a child ages 1-6 (15 kg) (U.S. Environmental Protection Agency [USEPA], 1991); RDAs provided in mg/kg/day were not modified.
[3] Adjusted dermal RDA calculated by multiplying the oral RDA by the oral absorption efficiency (USEPA, 1989).
[4] Oral absorption data not available; value for potassium used as a surrogate based on physio-chemical similarities.

equality shown below is used to calculate screening soil concentration with the target hazard quotient equal to one.

$$\frac{\textit{Baseline Soil Concentration}}{\textit{BaselineHazardQuotient}} = \frac{\textit{ScreeningSoilConcnetration}}{\textit{Target Hazard Quotient}} \qquad (17)$$

Screening groundwater concentrations were calculated in a similar manner. The surface soil and groundwater risk assessment spreadsheets used to calculate the hazard quotients for each essential nutrient are taken from this report. The baseline soil concentration is arbitrary and is used only to establish a baseline hazard quotient to solve the equality.

To derive screening concentrations that would be protective to the majority of the exposed population, the exposure assumptions for the most sensitive receptor evaluated (ABB-ES, 1993) (e.g., a child resident) were used. For groundwater, screening concentrations were based on ingestion of groundwater as drinking water. For surface soil, screening concentrations were based on ingestion of surface soil and dermal contact with surface soil. Child resident exposure to surface soil and groundwater used as drinking water is usually greater than or equal to oral and dermal exposure to media treated as soil and groundwater, respectively, for exposure assessment. Therefore, screening values for surface soil represent conservative screening values for sediment, subsurface soil, and sludge, and screening values for groundwater used as drinking water represent conservative screening values for surface water.

The calculated essential nutrient screening concentrations for surface soil and groundwater are presented in Table H-5. These values represent the concentrations of individual essential nutrients in media that, if contacted in accordance with the exposure parameters used to derive the screening concentration, would theoretically result in the receptor receiving their recommended dietary allowance of an essential nutrient solely from the contacted media. For some nutrients, the calculated screening concentrations exceed one million mg/kg (i.e., 100%). Such concentrations indicate that no concentration of nutrient in the particular media would result in an intake that exceeds the RDA, given the exposure assumptions on which the screening value is based. Because these screening concentrations do not take into account the additivity of exposures between media (and other dietary intakes, including food), a receptor exposed to essential nutrients that are present in multiple media at the screening concentrations would, in essence, be receiving more than their recommended dietary allowance of nutrient. However, data provided in Table H-2 indicate that the toxicity threshold for most essential nutrients is several times greater than the RDA; the RDA is not a toxicity threshold value. Therefore, these screening concentrations do not represent concentrations which, if exceeded, would necessarily result in deleterious effects.

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL - ESSENTIAL NUTRIENTS
CHILD RESIDENT
NAS CECIL FIELD OPERABLE UNIT 8
SITE 3
TABLE II-3
NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL RDA (mg/kg-day)	HAZARD QUOTIENT INGESTION	DERMAL ABS [1]	INTAKE DERMAL (mg/kg-day)	DERMAL RDA [2] (mg/kg-day)	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Calcium	I	5000	mg/kg	6.4E-02	5.3E+01	1.2E-03	0.001	6.1E-04	2.1E+01	2.9E-05	1.2E-03
Iron	I	5000	mg/kg	6.4E-02	6.7E-01	9.5E-02	0.001	6.1E-04	6.7E-02	9.1E-03	1.0E-01
Magnesium	I	5000	mg/kg	6.4E-02	6.0E+00	1.1E-02	0.001	6.1E-04	3.0E+00	2.0E-04	1.1E-02
Potassium	I	5000	mg/kg	6.4E-02	1.5E+01	4.3E-03	0.001	6.1E-04	1.4E+01	4.5E-05	4.3E-03
Sodium	I	5000	mg/kg	6.4E-02	2.0E+01	3.2E-03	0.001	6.1E-04	1.8E+01	3.4E-05	3.2E-03
					SUMMARY HAZARD INDEX	1.1E-01				9E-03	1E-01

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from Oral RDAs.

INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - ESSENTIAL NUTRIENTS
CHILD RESIDENT
NAS CECIL FIELD OPERABLE UNIT 8
SITE 3
TABLE II-4

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION WATER	CW	chemical specific	ug/liter	
INGESTION RATE	IR	0.79	liters/day	USEPA, 1989
BODY WEIGHT	BW	15	kg	USEPA, 1991
CONVERSION FACTOR	CR	0.001	mg/ug	
EXPOSURE FREQUENCY	EF	350	days/year	USEPA, 1991
EXPOSURE DURATION	ED	6	years	USEPA, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	6	years	USEPA, 1991

USEPA, 1989. Exposure Factors Handbook, Final Report, EPA/600/8-89/043, May 1989.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)$^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / RECOMMENDED DIETARY ALLOWANCE (mg/kg-day)

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

NOTE:
For noncarcinogenic effects AT = ED

Table H-5
Theoretical Essential Nutrient Screening Concentrations for Surface Soil and Groundwater

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

	Surface Soil Screening Concentration (mg/kg)[1]	Groundwater Screening Concentration (μg/ℓ)[2]
Calcium	[3]4,070,824	1,055,398
Iron	47,824	13,267
Magnesium	460,468	118,807
Potassium	[3]1,160,864	297,016
Sodium	[3]1,547,819	396,022

[1] Surface soil screening concentrations calculated as described in text, using RDAs presented in Table 3 and the exposure parameters and risk calculations presented in Table 1.
[2] Surface soil screening concentrations calculated as described in text, using RDAs presented in Table 3 and the exposure parameters and risk calculations presented in Table 2.
[3] The calculation of a screening concentration larger than 1,000,000 mg/kg indicates that no concentration results in an intake greater than the RDA, given the standard exposure parameters.

Notes: mg/kg = milligrams per kilogram.
μg/ℓ = micrograms per liter.

References

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USEPA. 1994b. "Health Effects Assessment Summary Tables: FY-1994 Annual." U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C., March, 1994. EPA 540-R-94-020.

APPENDIX M

HUMAN HEALTH EXPOSURE PARAMETERS

Table M-1
Exposure Parameters for Surface Soil Ingestion, Inhalation, and Dermal Contact Resident (Adult and Child)

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

$$INTAKE_{ing} = \frac{CS \times IR_{soil} \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$DA_{event} = CS \times AF \times ABS_d \times CF$$

$$INTAKE_{dermal} = \frac{DA_{event} \times SA \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$INTAKE_{inh} = \frac{CA \times IR_{air} \times ET \times EF \times ED}{BW \times AT \times 356\ days/year}$$

Parameter	Symbol	Child Value (Age 1-6)	Adult Value	Units	Source
Concentration in Soil	CS	Chemical Specific		Chemical Specific	
Soil Ingestion Rate	IR_{soil}	200	100	mg/day	[2]
Fraction Ingested	FI	100%	100%	unitless	Assumption
Conversion Factor			1×10^{-6}		
Inorganics	CF	1×10^{-6}	1×10^{-9}	kg/mg	
Organics	CF	1×10^{-9}		kg/ug	
Exposure Frequency	EF	350	350	days/year	[2]
Exposure Duration	ED	6	24	years	[2]
Exposure Time [1]	ET	16	16	hours/day	Assumption
Averaging Time	AT				
Cancer		70	70	years	[2]
Non-cancer		6	24	years	[2]
Surface Area	SA	See Appendix K	5750	cm^2	[3]
Inhalation Rate	IR_{air}	0.833	0.833	m^3/hour	[2]
Body Weight	BW	15	70	kg	[2]
Adherence Factor	AF	1	1	mg/cm^2-event	[3]
Absorption Fraction	ABS_d	Chemical Specific		unitless	[4]
Concentration in Air	CA	Chemical Specific		mg/m^3	See Appendix I

See notes at end of table.

Table M-1 (Continued)
Exposure Parameters for Surface Soil Ingestion, Inhalation, and Dermal Contact
Resident (Adult and Child)

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

References:
[1] Exposure Time is a parameter used only in Inhalation of Particulate Dust Scenario; See Appendix I.
[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03; march 25, 1991.
[3] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992. See Appendix K.
[4] USEPA, 1992. USEPA Region IV Guidance Memo February 10, 1992.

Table M-2
Exposure Parameters for Surface Soil Ingestion, Inhalation, and Dermal Contact Transient (Adult and Child)

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

$$INTAKE_{ing} = \frac{CS \times IR_{soil} \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$DA_{event} = CS \times AF \times ABS_d \times CF$$

$$INTAKE_{dermal} = \frac{DA_{event} \times SA \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$INTAKE_{inh} = \frac{CA \times IR_{air} \times ET \times EF \times ED}{BW \times AT \times 356\ days/year}$$

Parameter	Symbol	Child Value (Age 7-16)	Adult Value	Units	Source
Concentration in Soil	CS	Chemical Specific		Chemical Specific	
Soil Ingestion Rate	IR_{soil}	100	100	mg/day	[2]
Fraction Ingested	FI	100%	100%	unitless	Assumption
Conversion Factor	CF	1×10^{-6}	1×10^{-6}	kg/mg	
Inorganics	CF	1×10^{-9}	1×10^{-9}	kg/ug	
Organics					
Exposure Frequency	EF	30	24	days/year	Assumption
Exposure Duration	ED	10	19	years	[2]
Exposure Time [1]	ET	4	4	hours/day	Assumption
Averaging Time	AT				
Cancer		70	70	years	[2]
Non-cancer		10	19	years	[2]
Surface Area	SA	See Appendix K	5750	cm^2	[3]
Inhalation Rate	IR_{air}	0.833	0.833	m^3/hour	[2]
Body Weight	BW	45	70	kg	[2,5]
Adherence Factor	AF	1	1	mg/cm^2-event	[3]
Absorption Fraction	ABS_d	Chemical Specific		unitless	[4]
Concentration in Air	CA	Chemical Specific		mg/m^3	See Appendix I

See notes at end of table.

Table M-2 (Continued)
Exposure Parameters for Surface Soil Ingestion, Inhalation, and Dermal Contact
Transient (Adult and Child)

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

References:
[1] Exposure Time is a parameter used only in Inhalation of Particulate Dust Scenario; See Appendix I.
[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03; March 25, 1991.
[3] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992. See Appendix K.
[4] USEPA, 1992. USEPA Region IV Guidance Memo February 10, 1992.
[5] USEPA, 1989. Exposure Factors Handbook; EPA/600/8-89/043; July 1989.

Table M-3
Exposure Parameters for Surface Soil Ingestion, Inhalation, and Dermal Contact
Site Worker (Adult)

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

$$INTAKE_{ing} = \frac{CS \times IR_{soil} \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$INTAKE_{dermal} = \frac{DA_{event} \times SA \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$DA_{event} = CS \times AF \times ABS_d \times CF$$

$$INTAKE_{inh} = \frac{CA \times IR_{air} \times ET \times EF \times ED}{BW \times AT \times 356\ days/year}$$

Parameter	Symbol	Adult Value	Units	Source
Concentration in Soil	CS	Chemical Specific	Chemical Specific	
Soil Ingestion Rate	IR_{soil}	100	mg/day	[2]
Fraction Ingested	FI	100%	unitless	Assumption
Conversion Factor				
Inorganics	CF	1×10^{-6}	kg/mg	
Organics	CF	1×10^{-9}	kg/ug	
Exposure Frequency	EF	12	days/year	Assumption
Exposure Duration	ED	25	years	[2]
Exposure Time [1]	ET	8	hours/day	Assumption
Averaging Time	AT			
Cancer		70	years	[2]
Non-cancer		25	years	[2]
Surface Area	SA	5750	cm^2	[3]
Inhalation Rate	IR_{air}	0.833	m^3/hour	[2]
Body Weight	BW	70	kg	[2]
Adherence Factor	AF	1	mg/cm^2-event	[3]
Absorption Fraction	ABS_d	Chemical Specific	unitless	[4]
Concentration in Air	CA	Chemical Specific	mg/m^3	See Appendix I

See notes at end of table.

Table M-3 (Continued)
Exposure Parameters for Surface Soil Ingestion, Inhalation, and Dermal Contact
Site Worker (Adult)

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

References:
[1] Exposure Time is a parameter used only in Inhalation of Particulate Dust Scenario;See Appendix I.
[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03; March 25, 1991.
[3] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992. See Appendix K.
[4] USEPA, 1992. USEPA Region IV Guidance Memo February 10, 1992.

Note: The site worker represents an infrequent worker on the site, such as a lawn maintenance worker. This worker would be expected to visit the site for one day a month (total of 12 days a year). Because his job is physically demanding, his ingestion rate would be higher than the occupational workers.

Table M-4
Exposure Parameters for Surface and Subsurface Soil Ingestion, Inhalation, and Dermal Contact
Excavation Worker (Adult)

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

$$INTAKE_{ing} = \frac{CS \times IR_{soil} \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$INTAKE_{dermal} = \frac{DA_{event} \times SA \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$DA_{event} = CS \times AF \times ABS_d \times CF$$

$$INTAKE_{inh} = \frac{CA \times IR_{air} \times ET \times EF \times ED}{BW \times AT \times 356\ days/year}$$

Parameter	Symbol	Adult Value	Units	Source
Concentration in Soil	CS	Chemical Specific	Chemical Specific	
Soil Ingestion Rate	IR_{soil}	480 [2]	mg/day	[2]
Fraction Ingested	FI	100%	unitless	Assumption
Conversion Factor				
Inorganics	CF	1×10^{-6}	kg/mg	
Organics	CF	1×10^{-9}	kg/ug	
Exposure Frequency	EF	30	days/year	Assumption
Exposure Duration	ED	1	years	[2]
Exposure Time [1]	ET	8	hours/day	Assumption
Averaging Time	AT			
Cancer		70	years	[2]
Non-cancer		1	years	[2]
Surface Area	SA	5,750	cm^2	[3]
Inhalation Rate	IR_{air}	2.5	m^3/hour	[2]
Body Weight	BW	70	kg	[2]
Adherence Factor	AF	1	mg/cm^2-event	[3]
Absorption Fraction	ABS_d	Chemical Specific	unitless	[4]
Concentration in Air	CA	Chemical Specific	mg/m^3	See Appendix I

References:
[1] Exposure Time is a parameter used only in Inhalation of Particulate Dust Scenario; See Appendix I.
[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03; March 25, 1991.
[3] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992. See Appendix K.
[4] USEPA, 1992. USEPA Region IV Guidance Memo February 10, 1992.

Table M-5
Exposure Parameters for Surface Soil Ingestion, Inhalation, and Dermal Contact
Occupational Worker (Adult)

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

$$INTAKE_{ing} = \frac{CS \times IR_{soil} \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$INTAKE_{dermal} = \frac{DA_{event} \times SA \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$DA_{event} = CS \times AF \times ABS_d \times CF$$

$$INTAKE_{inh} = \frac{CA \times IR_{air} \times ET \times EF \times ED}{BW \times AT \times 356\ days/year}$$

Parameter	Symbol	Adult Value	Units	Source
Concentration in Soil	CS	Chemical Specific	Chemical Specific	
Soil Ingestion Rate	IR_{soil}	50	mg/day	[2]
Fraction Ingested	FI	100%	unitless	Assumption
Conversion Factor				
Inorganics	CF	1×10^{-6}	kg/mg	
Organics	CF	1×10^{-9}	kg/ug	
Exposure Frequency	EF	250	days/year	[2]
Exposure Duration	ED	25	years	[2]
Exposure Time [1]	ET	8	hours/day	Assumption
Averaging Time	AT			
Cancer		70	years	[2]
Non-cancer		25	years	[2]
Surface Area	SA	2300	cm^2	[3]
Inhalation Rate	IR_{air}	0.833	m^3/hour	[2]
Body Weight	BW	70	kg	[2]
Concentration in Air	CA	Chemical Specific	mg/m^3	See Appendix I
Adherence Factor	AF	1	mg/cm^2-event	[3]
Absorption Fraction	ABS_d	Chemical Specific	unitless	[4]

References:
[1] Exposure Time is a parameter used only in Inhalation of Particulate Dust Scenario; See Appendix I.
[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03; March 25, 1991.
[3] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992. Represents surface area of the head and forearms (See Appendix K).
[4] USEPA, 1992. USEPA Region IV Guidance Memo February 10, 1992.

Table M-6
Exposure Parameters for Sediment Ingestion and Dermal Contact
Resident (Adult and Child)

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

$$INTAKE_{ing} = \frac{CS \times IR_{sediment} \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$DA_{event} = CS \times AF \times ABS_d \times CF$$

$$INTAKE_{dermal} = \frac{DA_{event} \times SA \times EF \times ED}{BW \times AT \times 365\ days/year}$$

Parameter	Symbol	Child Value (Age 1-6)	Adult Value	Units	Source
Concentration in Sediment	CS	Chemical Specific		Chemical Specific	
Sediment Ingestion Rate	$IR_{sediment}$	200	100	mg/day	[1]
Fraction Ingested	FI	100%	100%	unitless	Assumption
Conversion Factor					
Inorganics	CF	1×10^{-6}	1×10^{-6}	kg/mg	
Organics	CF	1×10^{-9}	1×10^{-9}	kg/ug	
Exposure Frequency	EF	100	100	days/year	Assumption
Exposure Duration	ED	6	24	years	[1]
Averaging Time	AT				
Cancer		70	70	years	[1]
Non-cancer		6	24	years	[1]
Surface Area	SA	See Appendix K	5750	cm^2	[2]
Body Weight	BW	15	70	kg	[2]
Adherence Factor	AF	1	1	mg/cm^2-event	[2]
Absorption Fraction	ABS_d	Chemical Specific		unitless	[3]

References:
[1] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03; March 25, 1991.
[2] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992. See Appendix K.
[3] USEPA, 1992. USEPA Region IV Guidance Memo February 10, 1992.

Table M-7
Exposure Parameters for Sediment Ingestion and Dermal Contact Transient (Adult and Child)

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

$$INTAKE_{ing} = \frac{CS \times IR_{sediment} \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$DA_{event} = CS \times AF \times ABS_d \times CF$$

$$INTAKE_{dermal} = \frac{DA_{event} \times SA \times EF \times ED}{BW \times AT \times 365\ days/year}$$

Parameter	Symbol	Child Value (Age 7-16)	Adult Value	Units	Source
Concentration in Sediment	CS	Chemical Specific		Chemical Specific	
Sediment Ingestion Rate	$IR_{sediment}$	100	100	mg/day	[1]
Fraction Ingested	FI	100%	100%	unitless	Assumption
Conversion Factor					
Inorganics	CF	1×10^{-6}	1×10^{-6}	kg/mg	
Organics	CF	1×10^{-9}	1×10^{-9}	kg/ug	
Exposure Frequency	EF	45	45	days/year	Assumption
Exposure Duration	ED	10	19	years	[1]
Averaging Time	AT				
Cancer		70	70	years	[1]
Non-cancer		10	19	years	[1]
Surface Area	SA	See Appendix K	5,750	cm^2	[2]
Body Weight	BW	45	70	kg	[1,4]
Adherence Factor	AF	1	1	mg/cm^2-event	[2]
Absorption Fraction	ABS_d	Chemical Specific		unitless	[3]

References:
[1] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03; march 25, 1991.
[2] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992. See Appendix K.
[3] USEPA, 1992. USEPA Region IV Guidance Memo February 10, 1992.
[4] USEPA, 1989. Exposure Factors Handbook; EPA/600/8-89/043; July 1989.

Table M-8
Exposure Parameters for Surface Water Ingestion and Dermal Contact
Resident (Adult and Child)

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

$$INTAKE_{ing} = \frac{CW \times IR_{surface\ water} \times CF1 \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$DA_{event} = PC_{event} \times CW \times CF1 \times CF2$$

$$INTAKE_{dermal} = \frac{DA_{event} \times SA \times EF \times ED \times EV}{BW \times AT \times 365\ days/year}$$

Parameter	Symbol	Child Value (Age 1-6)	Adult Value	Units	Source
Concentration in Surface Water	CW	Chemical Specific		Chemical Specific	
Surface Water Ingestion Rate	$IR_{surface\ water}$	0.13	0.13	liters/day	[1]
Conversion Factor				mg/μg	
	CF1	0.001	0.001	liters/cm^3	
	CF2	0.001	0.001		
Exposure Frequency	EF	100	100	days/year	Assumption
Exposure Duration	ED	6	24	years	Assumption
Event Frequency	EV	1	1	events/day	Assumption
Averaging Time	AT				
Cancer		70	70	years	[2]
Non-cancer		6	24	years	[2]
Surface Area	SA	See Appendix K	5,750	cm^2	[3]
Body Weight	BW	15	70	kg	[2]
Diffusion Depth per Event	PC_{event}	Chemical Specific		cm/event	[4]
Exposure Time	ET		2.6	hours/day	Assumption

References:
[1] USEPA, 1988. Superfund Exposure Assessment Manual; EPA/540//1-88/001; April 1989.
[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03; March 25, 1991.
[3] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992. See Appendix K.
[4] Calculated per USEPA, 1992 [3]; See Appendix N (Table N-21).

Table M-9
Exposure Parameters for Surface Water Ingestion and Dermal Contact Transient (Adult and Child)

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

$$INTAKE_{ing} = \frac{CW \times IR_{surface\ water} \times CF1 \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$DA_{event} = PC_{event} \times CW \times CF1 \times CF2$$

$$INTAKE_{dermal} = \frac{DA_{event} \times SA \times EF \times ED \times EV}{BW \times AT \times 365\ days/year}$$

Parameter	Symbol	Child Value (Age 7-16)	Adult Value	Units	Source
Concentration in Surface Water	CS	Chemical Specific		Chemical Specific	
Surface Water Ingestion Rate	$IR_{surface\ water}$	0.13	0.13	liters/day	[1]
Fraction Ingested	FI	100%	100%	unitless	Assumption
Conversion Factor	CF1	0.001	0.001		
	CF2	0.001	0.001	mg/ug liters/cm^3	
Exposure Frequency	EF	45	45	days/year	Assumption
Exposure Duration	ED	10	19	years	[2]
Event Frequency	EV	1	1	events/day	Assumption
Averaging Time	AT				
Cancer		70	70	years	[2]
Non-cancer		10	19	years	[2]
Surface Area	SA	See Appendix K	5,750	cm^2	[3]
Body Weight	BW	45	70	kg	[2,5]
Diffusion Depth per Event	PC_{event}	Chemical Specific		cm/event	[4]

References:
[1] USEPA, 1988. Superfund Exposure Assessment Manual; EPA/540/1-88/001; April 1988.
[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03; March 25, 1991.
[3] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992. See Appendix K.
[4] Calculated per USEPA, 1992 [3]; See Appendix N (Table N-21).
[5] USEPA, 1989, Exposure Factors Handbook; EPA/600/8-89/043; May 1989.

Table M-10
Exposure Parameters for Groundwater Ingestion and Inhalation
Adult Residents

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

$$Intake_{ing} = \frac{CW \times IR_{groundwater} \times CF1 \times EF \times ED}{BW \times AT \times 365\ days/year}$$

$$INTAKE_{inh} = \frac{CA_{air} \times ET \times EF \times ED}{CF2 \times AT \times 356\ days/year}$$

Parameter	Symbol	Adult Value	Units	Source
Concentration in Groundwater	CW	Chemical Specific	µg/liter	
Water Ingestion Rate	IR_{water}	2	liters/day	[2]
Conversion Factor	CF1	0.001	mg/ug	
	CF2	24	hours/day	
Exposure Frequency	EF	350	days/year	[2]
Exposure Duration	ED	30	years	[2]
Averaging Time	AT			
Cancer		70	years	[2]
Non-cancer		30	years	[2]
Body Weight	BW	70	kg	[2]
Concentration Shower Air	CA_{air}	See Appendix J	$\mu g/m^3$	[3]
Exposure Time [1]	ET	0.2	hours/day	[4]

References:
[1] Exposure Time is a parameter used only in inhalation of volatiles while showering; See Appendix J .
[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03; March 25, 1991.
[3] This parameter is modeled; See Appendix J.
[4] USEPA, 1989. Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part A) EPA/540/1-89/002; December, 1989.

APPENDIX N

HUMAN HEALTH RISK ASSESSMENT SPREADSHEETS

TABLE N-1

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
CHILD TRANSIENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

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/cm²-event	USEPA, 1992a
AGE-SPECIFIC SURFACE AREA	SAi	age-specific	cm²	USEPA, 1989
ABSORPTION FRACTION	ABSd	chemical-specific	unitless	USEPA, 1992b
CONVERSION FACTOR	CF	1.00E-06	kg/mg	Inorganics
	CF	1.00E-09	kg/mg	Organics
BODY WEIGHT	BW	45	kg	USEPA, 1989
AGE-SPECIFIC BODY WEIGHT	BWi	age-specific	kg	USEPA, 1989
EXPOSURE FREQUENCY	EF	30	days/year [1]	Assumption
EXPOSURE DURATION	ED	10	years	Assumption
AGE-SPECIFIC EXPOSURE DURATION	EDi	age-specific	years	Assumption
AGE-WEIGHTED SURFACE AREA [2]	$SA_{wt/adj}$	1136	cm²-year/kg	Per USEPA, 1992a
DOSE ABSORBED PER EVENT	DA_{event}	chemical-specific	mg/cm²-event	Per USEPA, 1992a
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	10	years	Assumption

[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, 1992a. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992 and Appendix K to this report.
USEPA, 1992b. USEPA Region IV Guidance Memorandum, February 10, 1992.

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)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = (DA_{event} \times EF / AT \times 365\ \text{days/year}) \times SA_{wt/adj}$$

Where:

$SA_{wt/adj}$ = SUM (SAi x EDi / BWi)
DA_{event} = CS x AF x ABSd x CF

Note: For noncarcinogenic effects: AT = ED.

TABLE N-1

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
CHILD TRANSIENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF [1] (mg/kg-day)^-1	CANCER RISK INGESTION	DERMAL ABS [2]	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [1,3] (mg/kg-day)^-1	CANCER RISK DERMAL	TOTAL CANCER RISK
Benzo(a)anthracene	O	620	ug/kg	1.6E-08	0.73	1.2E-08	0.01	8.3E-09	0.8	6.6E-09	1.8E-08
Benzo(a)pyrene	O	273	ug/kg	7.1E-09	7.3	5.2E-08	0.01	3.6E-09	8	2.9E-08	8.1E-08
Benzo(b)fluoranthene	O	287	ug/kg	7.5E-09	0.73	5.5E-09	0.01	3.8E-09	0.8	3.1E-09	8.5E-09
Benzo(k)fluoranthene	O	280	ug/kg	7.3E-09	0.073	5.3E-10	0.01	3.7E-09	0.08	3.0E-10	8.3E-10
Chrysene	O	290	ug/kg	7.6E-09	0.0073	5.5E-11	0.01	3.9E-09	0.008	3.1E-11	8.6E-11
Dibenzo(a,h)anthracene	O	100	ug/kg	2.6E-09	7.3	1.9E-08	0.01	1.3E-09	8	1.1E-08	3.0E-08
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	8.6E-09	0.73	6.3E-09	0.01	4.4E-09	0.8	3.5E-09	9.8E-09
					SUMMARY CANCER RISK	1E-07				5E-08	1E-07

[1] Relative potency factors were applied to the CSFs for carcinogenic PAHs. Relative potency factors are derived in "Provisional Guidance for Quantitative Risk Assessment for Polycyclic Aromatic Hydrocarbons," USEPA, 1993.
[2] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[3] 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
Benzo(a)anthracene	O	620	ug/kg	1.1E-07	ND		0.01	5.8E-08	ND		
Benzo(a)pyrene	O	273	ug/kg	5.0E-08	ND		0.01	2.5E-08	ND		
Benzo(b)fluoranthene	O	287	ug/kg	5.2E-08	ND		0.01	2.7E-08	ND		
Benzo(k)fluoranthene	O	280	ug/kg	5.1E-08	ND		0.01	2.6E-08	ND		
Chrysene	O	290	ug/kg	5.3E-08	ND		0.01	2.7E-08	ND		
Dibenzo(a,h)anthracene	O	100	ug/kg	1.8E-08	ND		0.01	9.3E-09	ND		
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	6.0E-08	ND		0.01	3.1E-08	ND		
Manganese	I	14.6	mg/kg	2.7E-06	0.14	1.9E-05	0.001	1.4E-07	0.0056	2.4E-05	4.3E-05
TRPH	O	91800	ug/kg	1.7E-05	ND		0.01	8.6E-06	ND		
					SUMMARY HAZARD INDEX	2E-05				2E-05	4E-05

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral RfDs.
ND = no data available.

TABLE N-2

INHALATION OF PARTICULATES - SURFACE SOIL
CHILD TRANSIENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	4.97E+07	m^3/kg	[1]
CONCENTRATION AIR	CA	chemical-specific	mg/m^3	
INHALATION RATE	IR	0.833	m^3/hour	USEPA, 1991
BODY WEIGHT	BW	45	kg	USEPA, 1991
EXPOSURE TIME	ET	4	hours/day	Assumption
EXPOSURE FREQUENCY	EF	30	days/year	Assumption
EXPOSURE DURATION	ED	10	years	Assumption
CONVERSION FACTOR	CF	0.001	mg/ug	Organics only
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	10	years	Assumption

[1] PEF has been derived in Appendix I to this document, Derivation of Particulate Emission Factor.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.

EQUATIONS

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)

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

Where:

CA = C x CF x (1/PEF)

Note: For noncarcinogenic effects: AT = ED

TABLE N-2

INHALATION OF PARTICULATES - SURFACE SOIL
CHILD TRANSIENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day)⁻¹	CANCER RISK
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	1.1E-11	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	4.8E-12	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	5.0E-12	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	4.9E-12	ND	
Chrysene	O	290	ug/kg	5.84E-09	5.1E-12	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	1.7E-12	ND	
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	6.64E-09	5.8E-12	ND	
						SUMMARY CANCER RISK	0E+00

NE = not evaluated.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION RfD (mg/kg-day)	HAZARD QUOTIENT
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	7.6E-11	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	3.3E-11	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	3.5E-11	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	3.4E-11	ND	
Chrysene	O	290	ug/kg	5.84E-09	3.6E-11	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	1.2E-11	ND	
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	6.64E-09	4.0E-11	ND	
Manganese	I	14.6	mg/kg	2.94E-07	1.8E-09	0.0000143	1.3E-04
TRPH	O	91800	ug/kg	1.85E-06	1.1E-08	ND	
						SUMMARY HAZARD INDEX	1E-04

ND = no data available.

TABLE N-3

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
ADULT TRANSIENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

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/cm²-event	USEPA, 1992a
ABSORPTION FRACTION	ABSd	chemical specific	unitless	USEPA, 1992b
SURFACE AREA EXPOSED	SA	5,750	cm²	USEPA, 1992a
DOSE ABSORBED PER EVENT	DAevent	chemical specific	mg/cm2-event	USEPA, 1992a
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	24	days/year [1]	Assumption
EXPOSURE DURATION	ED	19	years	Assumption
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	19	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, 1992a. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; 1/92.
USEPA, 1992b. USEPA Region IV Guidance Memorandum; February 10, 1992.
See Appendix K to this report for dermal exposure assumptions.

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)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{DAevent \times SA \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

Where:

DAevent = CS x AF x ABSd x CF

Note: For noncarcinogenic effects: AT = ED

TABLE N-3

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
ADULT TRANSIENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 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
Benzo(a)anthracene	O	620	ug/kg	1.6E-08	0.73	1.2E-08	0.01	9.1E-09	0.8	7.3E-09	1.9E-08
Benzo(a)pyrene	O	273	ug/kg	7.0E-09	7.3	5.1E-08	0.01	4.0E-09	8	3.2E-08	8.3E-08
Benzo(b)fluoranthene	O	287	ug/kg	7.3E-09	0.73	5.3E-09	0.01	4.2E-09	0.8	3.4E-09	8.7E-09
Benzo(k)fluoranthene	O	280	ug/kg	7.1E-09	0.073	5.2E-10	0.01	4.1E-09	0.08	3.3E-10	8.5E-10
Chrysene	O	290	ug/kg	7.4E-09	0.0073	5.4E-11	0.01	4.3E-09	0.008	3.4E-11	8.8E-11
Dibenzo(a,h)anthracene	O	100	ug/kg	2.5E-09	7.3	1.9E-08	0.01	1.5E-09	8	1.2E-08	3.0E-08
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	8.4E-09	0.73	6.1E-09	0.01	4.8E-09	0.8	3.9E-09	1.0E-08
SUMMARY CANCER RISK						9E-08				6E-08	2E-07

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[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
Benzo(a)anthracene	O	620	ug/kg	5.8E-08	ND		0.01	3.3E-08	ND		
Benzo(a)pyrene	O	273	ug/kg	2.6E-08	ND		0.01	1.5E-08	ND		
Benzo(b)fluoranthene	O	287	ug/kg	2.7E-08	ND		0.01	1.6E-08	ND		
Benzo(k)fluoranthene	O	280	ug/kg	2.6E-08	ND		0.01	1.5E-08	ND		
Chrysene	O	290	ug/kg	2.7E-08	ND		0.01	1.6E-08	ND		
Dibenzo(a,h)anthracene	O	100	ug/kg	9.4E-09	ND		0.01	5.4E-09	ND		
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	3.1E-08	ND		0.01	1.8E-08	ND		
Manganese	I	14.6	mg/kg	1.4E-06	0.14	9.8E-06	0.001	7.9E-08	0.0056	1.4E-05	2.4E-05
TRPH	O	91800	ug/kg	8.6E-06	ND		0.01	5.0E-06	ND		
SUMMARY HAZARD INDEX						1E-05				1E-05	2E-05

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral RfDs.
ND = no data available.

TABLE N-4

INHALATION OF PARTICULATES - SURFACE SOIL
ADULT TRANSIENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	4.97E+07	m^3/kg	[1]
CONCENTRATION AIR	CA	chemical-specific	mg/m^3	
INHALATION RATE	IR	0.833	$m^3/hour$	USEPA, 1991
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE TIME	ET	4	hours/day	Assumption
EXPOSURE FREQUENCY	EF	24	days/year	Assumption
EXPOSURE DURATION	ED	19	years	Assumption
CONVERSION FACTOR	CF	0.001	mg/ug	Organics only
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	19	years	USEPA, 1991

[1] PEF has been derived in Appendix I to this report.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.

EQUATIONS

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)

$$\text{INTAKE} = \frac{CA \times IR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

Where:

CA = C x CF x (1/PEF)

Note: For noncarcinogenic effects, AT = ED

TABLE N-4

INHALATION OF PARTICULATES - SURFACE SOIL
ADULT TRANSIENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day)⁻¹-1	CANCER RISK
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	1.1E-11	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	4.7E-12	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	4.9E-12	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	4.8E-12	ND	
Chrysene	O	290	ug/kg	5.84E-09	5.0E-12	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	1.7E-12	ND	
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	6.64E-09	5.6E-12	ND	
						SUMMARY CANCER RISK	0E+00

NE = not evaluated.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION RfD (mg/kg-day)	HAZARD QUOTIENT
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	3.9E-11	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	1.7E-11	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	1.8E-11	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	1.8E-11	ND	
Chrysene	O	290	ug/kg	5.63E-09	1.8E-11	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	6.3E-12	ND	
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	6.64E-09	2.1E-11	ND	
Manganese	I	14.6	mg/kg	2.94E-07	9.2E-10	0.0000143	6.4E-05
TRPH	O	91800	ug/kg	1.85E-06	5.8E-09	ND	
						SUMMARY HAZARD INDEX	6E-05

ND = no data available.

ABB Environmental Services, Inc.
ATSSINH.XLS
3/18/96

TABLE N-5

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
SITE WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	100	mg/day	USEPA, 1992a
FRACTION INGESTED	FI	100%	unitless	Assumption
ADHERENCE FACTOR	AF	1	mg/cm^2-event	USEPA, 1992a
ABSORPTION FRACTION	ABS	chemical-specific	unitless	USEPA, 1992b
SURFACE AREA EXPOSED	SA	5,750	cm^2	USEPA, 1992a
DOSE ABSORBED PER EVENT	DAevent	chemical-specific	mg/cm2-event	USEPA, 1992a
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	12	days/year [1]	Assumption
EXPOSURE DURATION	ED	25	years	USEPA, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	25	years	USEPA, 1991

[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, 1992a. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
USEPA, 1992b. USEPA Region IV Guidance Memorandum; February 10, 1992.
See Appendix K to this report for dermal exposure assumptions.

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)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

$$\text{INTAKE-DERMAL} = \frac{DAevent \times SA \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

Where:

DAevent = CS x AF x ABS x CF

Note: For noncarcinogenic effects, AT = ED

TABLE N-5

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
SITE WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 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
Benzo(a)anthracene	O	620	ug/kg	1.0E-08	0.73	7.6E-09	0.01	6.0E-09	0.8	4.8E-09	1.2E-08
Benzo(a)pyrene	O	273	ug/kg	4.6E-09	7.3	3.3E-08	0.01	2.6E-09	8	2.1E-08	5.4E-08
Benzo(b)fluoranthene	O	287	ug/kg	4.8E-09	0.73	3.5E-09	0.01	2.8E-09	0.8	2.2E-09	5.7E-09
Benzo(k)fluoranthene	O	280	ug/kg	4.7E-09	0.073	3.4E-10	0.01	2.7E-09	0.08	2.2E-10	5.6E-10
Chrysene	O	290	ug/kg	4.9E-09	0.0073	3.6E-11	0.01	2.8E-09	0.008	2.2E-11	5.8E-11
Dibenzo(a,h)anthracene	O	100	ug/kg	1.7E-09	7.3	1.2E-08	0.01	9.6E-10	8	7.7E-09	2.0E-08
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	5.5E-09	0.73	4.0E-09	0.01	3.2E-09	0.8	2.5E-09	6.6E-09
SUMMARY CANCER RISK						6E-08				4E-08	1E-07

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral CSFs.
NE = not evaluated.

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
Benzo(a)anthracene	O	620	ug/kg	2.9E-08	ND		0.01	1.7E-08	ND		
Benzo(a)pyrene	O	273	ug/kg	1.3E-08	ND		0.01	7.4E-09	ND		
Benzo(b)fluoranthene	O	287	ug/kg	1.3E-08	ND		0.01	7.8E-09	ND		
Benzo(k)fluoranthene	O	280	ug/kg	1.3E-08	ND		0.01	7.6E-09	ND		
Chrysene	O	290	ug/kg	1.4E-08	ND		0.01	7.8E-09	ND		
Dibenzo(a,h)anthracene	O	100	ug/kg	4.7E-09	ND		0.01	2.7E-09	ND		
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	1.5E-08	ND		0.01	8.9E-09	ND		
Manganese	I	14.6	mg/kg	6.9E-07	0.14	4.9E-06	0.001	3.9E-08	0.0056	7.0E-06	1.2E-05
TRPH	O	91800	ug/kg	4.3E-06	ND		0.01	2.5E-06	ND		
SUMMARY HAZARD INDEX						5E-06				7E-06	1E-05

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral RfDs.
ND = no data available.

TABLE N-6

INHALATION OF PARTICULATES - SURFACE SOIL
SITE WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	4.97E+07	m^3/kg	[1]
CONCENTRATION AIR	CA	chemical-specific	mg/m^3	
INHALATION RATE	IR	0.833	m^3/hour	USEPA, 1991
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE TIME	ET	8	hours/day	Assumption
EXPOSURE FREQUENCY	EF	12	days/year	Assumption
EXPOSURE DURATION	ED	25	years	Assumption
CONVERSION FACTOR	CF	0.001	mg/ug	Organics only
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	25	years	USEPA, 1991

[1] PEF has been derived in Appendix I to this document, Derivation of Particulate Emission Factor.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance:
"Standard Default Exposure Factors"; OSWER Directive 9285.6-03.

EQUATIONS

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)

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

Where:

CA = C x CF x (1/PEF)

Note: For noncarcinogenic effects, AT = ED

TABLE N-6

INHALATION OF PARTICULATES - SURFACE SOIL
SITE WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day)^-1	CANCER RISK
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	1.4E-11	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	6.1E-12	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	6.5E-12	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	6.3E-12	ND	
Chrysene	O	290	ug/kg	5.84E-09	6.5E-12	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	2.2E-12	ND	
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	6.64E-09	7.4E-12	ND	
						SUMMARY CANCER RISK	0E+00

NE = not evaluated.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION RfD (mg/kg-day)	HAZARD QUOTIENT
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	3.9E-11	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	1.7E-11	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	1.8E-11	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	1.8E-11	ND	
Chrysene	O	290	ug/kg	5.84E-09	1.8E-11	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	6.3E-12	ND	
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	6.64E-09	2.1E-11	ND	
Manganese	I	14.6	mg/kg	2.94E-07	9.2E-10	0.0000143	6.4E-05
TRPH	O	91800	ug/kg	1.85E-06	5.8E-09	ND	
						SUMMARY HAZARD INDEX	6E-05

ND = no data available.

TABLE N-7

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
CHILD RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	200	mg/day	USEPA, 1991
FRACTION INGESTED	FI	100%	unitless	Assumption
ADHERENCE FACTOR	AF	1	mg/cm²-event	USEPA, 1992a
AGE-SPECIFIC SURFACE AREA	SA	age-specific	cm²	USEPA, 1989
ABSORPTION FRACTION	ABS	chemical-specific	unitless	USEPA, 1992b
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]	Assumption
EXPOSURE DURATION	ED	6	years	Assumption
AGE-SPECIFIC EXPOSURE DURATION	ED	age-specific	years	Assumption
AGE-WEIGHTED SURFACE AREA [2]	SAsoil/adj	766	cm2-year/kg	USEPA, 1992a
DOSE ABSORBED PER EVENT	DAevent	chemical-specific	mg/cm2-event	USEPA, 1992a
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	6	years	USEPA, 1991

[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 age1 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, 1992a. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
USEPA, 1992b. USEPA Region IV Guidance Memorandum, February 10, 1992.

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)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

INTAKE-DERMAL = (DAevent x EF / AT x 365 days/year) x SAsoil/adj

Where:

SAsoil/adj = SUM (SA x ED / BW)

DAevent = CS x AF x ABS x CF

Note: For noncarcinogenic effects, AT = ED.

TABLE N-7

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
CHILD RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF [1] (mg/kg-day)-1	CANCER RISK INGESTION	DERMAL ABS [2]	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [1, 3] (mg/kg-day)-1	CANCER RISK DERMAL	TOTAL CANCER RISK
Benzo(a)anthracene	O	620	ug/kg	6.8E-07	0.73	5.0E-07	0.01	6.5E-08	0.8	5.2E-08	5.5E-07
Benzo(a)pyrene	O	273	ug/kg	3.0E-07	7.3	2.2E-06	0.01	2.9E-08	8	2.3E-07	2.4E-06
Benzo(b)fluoranthene	O	287	ug/kg	3.1E-07	0.73	2.3E-07	0.01	3.0E-08	0.8	2.4E-08	2.5E-07
Benzo(k)fluoranthene	O	280	ug/kg	3.1E-07	0.073	2.2E-08	0.01	2.9E-08	0.08	2.4E-09	2.5E-08
Chrysene	O	290	ug/kg	3.2E-07	0.0073	2.3E-09	0.01	3.0E-08	0.008	2.4E-10	2.6E-09
Dibenzo(a,h)anthracene	O	100	ug/kg	1.1E-07	7.3	8.0E-07	0.01	1.0E-08	8	8.4E-08	8.8E-07
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	3.6E-07	0.73	2.6E-07	0.01	3.5E-08	0.8	2.8E-08	2.9E-07
				SUMMARY CANCER RISK		4E-06				4E-07	4E-06

[1] Relative potency factors were applied to the CSFs of carcinogenic PAHs. Relative potency factors are derived in "Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons," USEPA, 1993.
[2] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[3] Calculated from oral CSFs.
NE = not evaluated.

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
Benzo(a)anthracene	O	620	ug/kg	7.9E-06	ND		0.01	7.6E-07	ND		
Benzo(a)pyrene	O	273	ug/kg	3.5E-06	ND		0.01	3.3E-07	ND		
Benzo(b)fluoranthene	O	287	ug/kg	3.7E-06	ND		0.01	3.5E-07	ND		
Benzo(k)fluoranthene	O	280	ug/kg	3.6E-06	ND		0.01	3.4E-07	ND		
Chrysene	O	290	ug/kg	3.7E-06	ND		0.01	3.6E-07	ND		
Dibenzo(a,h)anthracene	O	100	ug/kg	1.3E-06	ND		0.01	1.2E-07	ND		
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	4.2E-06	ND		0.01	4.0E-07	ND		
Manganese	I	14.6	mg/kg	1.9E-04	0.14	1.3E-03	0.001	1.8E-06	0.0056	3.2E-04	1.7E-03
TRPH	O	91800	ug/kg	1.2E-03	ND		0.01	1.1E-04	ND		
				SUMMARY HAZARD INDEX		1E-03				3E-04	2E-03

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral RfDs.
ND = no data available.

TABLE N-8

INHALATION OF PARTICULATES - SURFACE SOIL
CHILD RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	4.97E+07	m^3/kg	[1]
CONCENTRATION IN AIR	CA	chemical-specific	mg/m^3	
INHALATION RATE	IR	0.833	$m^3/hour$	USEPA, 1991
BODY WEIGHT	BW	15	kg	USEPA, 1991
EXPOSURE TIME	ET	16	hours/day	USEPA, 1991
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

[1] PEF has been derived in Appendix I to this report.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x INHALATION CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / INHALATION REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{CA \times IR \times ET \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

Where:

$$CA = C \times CF \times (1/PEF)$$

Note:

For noncarcinogenic effects: AT = ED

TABLE N-8

INHALATION OF PARTICULATES - SURFACE SOIL
CHILD RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day)⁻¹-1	CANCER RISK
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	9.1E-10	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	4.0E-10	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	4.2E-10	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	4.1E-10	ND	
Chrysene	O	290	ug/kg	5.84E-09	4.3E-10	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	1.5E-10	ND	
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	6.64E-09	4.8E-10	ND	
					SUMMARY CANCER RISK		0E+00

NE = not evaluated.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION RfD (mg/kg-day)	HAZARD QUOTIENT
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	1.1E-08	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	4.7E-09	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	4.9E-09	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	4.8E-09	ND	
Chrysene	O	290	ug/kg	5.84E-09	5.0E-09	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	1.7E-09	ND	
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	6.64E-09	5.7E-09	ND	
Manganese	I	14.6	mg/kg	2.94E-07	2.5E-07	0.0000143	**1.8E-02**
TRPH	O	91800	ug/kg	1.85E-06	1.6E-06	ND	
					SUMMARY HAZARD INDEX		2E-02

ND = no data available.

TABLE N-9

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
ADULT RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

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/cm²-event	USEPA, 1992a
ABSORPTION FRACTION	ABSd	chemical-specific	unitless	USEPA, 1992b
SURFACE AREA EXPOSED	SA	5,750	cm²	USEPA, 1992a
DOSE ABSORBED PER EVENT	DAevent	chemical-specific	mg/cm2-event	USEPA, 1992a
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, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	24	years	USEPA, 1991

[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, 1992a. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
USEPA, 1992b. USEPA Region IV Guidance Memorandum, February 10, 1992.
See Appendix K to this report for dermal exposure assumptions.

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)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{DAevent \times SA \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

Where:

DAevent = CS x AF x ABSd x CF

Note: For noncarcinogenic effects, AT = ED.

TABLE N-9

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
ADULT RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF [1] (mg/kg-day)^-1	CANCER RISK INGESTION	DERMAL ABS [2]	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [3] (mg/kg-day)^-1	CANCER RISK DERMAL	TOTAL CANCER RISK
Benzo(a)anthracene	O	620	ug/kg	2.9E-07	0.73	2.1E-07	0.01	1.7E-07	0.8	1.3E-07	3.5E-07
Benzo(a)pyrene	O	273	ug/kg	1.3E-07	7.3	9.4E-07	0.01	7.4E-08	8	5.9E-07	1.5E-06
Benzo(b)fluoranthene	O	287	ug/kg	1.3E-07	0.73	9.8E-08	0.01	7.8E-08	0.8	6.2E-08	1.6E-07
Benzo(k)fluoranthene	O	280	ug/kg	1.3E-07	0.073	9.6E-09	0.01	7.6E-08	0.08	6.0E-09	1.6E-08
Chrysene	O	290	ug/kg	1.4E-07	0.0073	9.9E-10	0.01	7.8E-08	0.008	6.3E-10	1.6E-09
Dibenzo(a,h)anthracene	O	100	ug/kg	4.7E-08	7.3	3.4E-07	0.01	2.7E-08	8	2.2E-07	5.6E-07
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	1.5E-07	0.73	1.1E-07	0.01	8.9E-08	0.8	7.1E-08	1.8E-07
					SUMMARY CANCER RISK	2E-06				1E-06	3E-06

[1]Relative potency factors were applied to the CSFs for carcinogenic PAHs. Relative potency factors are derived in "Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons," USEPA, 1993.
[2] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[3] Calculated from oral CSFs.
ND = no data available.

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
Benzo(a)anthracene	O	620	ug/kg	8.5E-07	ND		0.01	4.9E-07	ND		
Benzo(a)pyrene	O	273	ug/kg	3.7E-07	ND		0.01	2.2E-07	ND		
Benzo(b)fluoranthene	O	287	ug/kg	3.9E-07	ND		0.01	2.3E-07	ND		
Benzo(k)fluoranthene	O	280	ug/kg	3.8E-07	ND		0.01	2.2E-07	ND		
Chrysene	O	290	ug/kg	4.0E-07	ND		0.01	2.3E-07	ND		
Dibenzo(a,h)anthracene	O	100	ug/kg	1.4E-07	ND		0.01	7.9E-08	ND		
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	4.5E-07	ND		0.01	2.6E-07	ND		
Manganese	I	14.6	mg/kg	2.0E-05	0.14	1.4E-04	0.001	1.2E-06	0.0056	2.1E-04	3.5E-04
TRPH	O	91800	ug/kg	1.3E-04	ND		0.01	7.2E-05	ND		
					SUMMARY HAZARD INDEX	1E-04				2E-04	3E-04

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral RfDs.
ND = no data available.

TABLE N-10

INHALATION OF PARTICULATES - SURFACE SOIL
ADULT RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	4.97E+07	m^3/kg	[1]
CONCENTRATION AIR	CA	chemical-specific	mg/m^3	
INHALATION RATE	IR	0.833	$m^3/hour$	USEPA, 1991
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE TIME	ET	16	hours/day	Assumption
EXPOSURE FREQUENCY	EF	350	days/year	USEPA, 1991
EXPOSURE DURATION	ED	24	years	USEPA, 1991
CONVERSION FACTOR	CF	0.001	mg/ug	Organics only
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	24	years	USEPA, 1991

[1] PEF has been derived in Appendix I to this report.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x INHALATION CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / INHALATION REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{CA \times IR \times ET \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

Where:

$$CA = C \times CF \times (1/PEF)$$

Note:
For noncarcinogenic effects: AT = ED

TABLE N-10

INHALATION OF PARTICULATES - SURFACE SOIL
ADULT RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day)^-1	CANCER RISK
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	7.8E-10	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	3.4E-10	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	3.6E-10	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	3.5E-10	ND	
Chrysene	O	290	ug/kg	5.84E-09	3.7E-10	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	1.3E-10	ND	
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	6.64E-09	4.2E-10	ND	
						SUMMARY CANCER RISK	0E+00

ND = no data available.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION RfD (mg/kg-day)	HAZARD QUOTIENT
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	2.3E-09	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	1.0E-09	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	1.1E-09	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	1.0E-09	ND	
Chrysene	O	290	ug/kg	5.84E-09	1.1E-09	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	3.7E-10	ND	
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	6.64E-09	1.2E-09	ND	
Manganese	I	14.6	mg/kg	2.94E-07	5.4E-08	0.0000143	3.8E-03
TRPH	O	91800	ug/kg	1.85E-06	3.4E-07	ND	
						SUMMARY HAZARD INDEX	4E-03

ND = no data available.

TABLE N-11

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
OCCUPATIONAL WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	50	mg/day	USEPA, 1991
FRACTION INGESTED	FI	100%	unitless	Assumption
ADHERENCE FACTOR	AF	1	mg/cm^2-event	USEPA, 1992a
ABSORPTION FRACTION	ABS	chemical-specific	unitless	USEPA, 1992b
SURFACE AREA EXPOSED	SA	2,300	cm^2	USEPA, 1992a
DOSE ABSORBED PER EVENT	DAevent	chemical-specific	mg/cm2-event	USEPA, 1992a
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, 1991
EXPOSURE DURATION	ED	25	years	USEPA, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	25	years	USEPA, 1991

[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, 1992a. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
USEPA, 1992b. USEPA Region IV Guidance Memorandum; February 10, 1992.
See Appendix K to this report for dermal exposure assumptions.

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)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{DAevent \times SA \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

Where:

DAevent = CS x AF x ABS x CF

Note: For noncarcinogenic effects, AT = ED

TABLE N-11

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
OCCUPATIONAL WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 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
Benzo(a)anthracene	O	620	ug/kg	1.1E-07	0.73	7.9E-08	0.01	5.0E-08	0.8	4.0E-08	1.2E-07
Benzo(a)pyrene	O	273	ug/kg	4.8E-08	7.3	3.5E-07	0.01	2.2E-08	8	1.8E-07	5.2E-07
Benzo(b)fluoranthene	O	287	ug/kg	5.0E-08	0.73	3.7E-08	0.01	2.3E-08	0.8	1.8E-08	5.5E-08
Benzo(k)fluoranthene	O	280	ug/kg	4.9E-08	0.073	3.6E-09	0.01	2.3E-08	0.08	1.8E-09	5.4E-09
Chrysene	O	290	ug/kg	5.1E-08	0.0073	3.7E-10	0.01	2.3E-08	0.008	1.9E-10	5.6E-10
Dibenzo(a,h)anthracene	O	100	ug/kg	1.7E-08	7.3	1.3E-07	0.01	8.0E-09	8	6.4E-08	1.9E-07
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	5.8E-08	0.73	4.2E-08	0.01	2.7E-08	0.8	2.1E-08	6.3E-08
SUMMARY CANCER RISK						6E-07				3E-07	1E-06

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral CSFs.
NE = not evaluated.

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
Benzo(a)anthracene	O	620	ug/kg	3.0E-07	ND		0.01	1.4E-07	ND		
Benzo(a)pyrene	O	273	ug/kg	1.3E-07	ND		0.01	6.1E-08	ND		
Benzo(b)fluoranthene	O	287	ug/kg	1.4E-07	ND		0.01	6.5E-08	ND		
Benzo(k)fluoranthene	O	280	ug/kg	1.4E-07	ND		0.01	6.3E-08	ND		
Chrysene	O	290	ug/kg	1.4E-07	ND		0.01	6.5E-08	ND		
Dibenzo(a,h)anthracene	O	100	ug/kg	4.9E-08	ND		0.01	2.3E-08	ND		
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	1.6E-07	ND		0.01	7.4E-08	ND		
Manganese	I	14.6	mg/kg	7.1E-06	0.14	5.1E-05	0.001	3.3E-07	0.0056	5.9E-05	1.1E-04
TRPH	O	91800	ug/kg	4.5E-05	ND		0.01	2.1E-05	ND		
SUMMARY HAZARD INDEX						5E-05				6E-05	1E-04

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral RfDs.
ND = not detected.

TABLE N-12

INHALATION OF PARTICULATES - SURFACE SOIL
OCCUPATIONAL WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	4.97E+07	m^3/kg	[1]
CONCENTRATION AIR	CA	chemical-specific	mg/m^3	
INHALATION RATE	IR	0.833	$m^3/hour$	USEPA, 1991
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	Assumption
CONVERSION FACTOR	CF	0.001	mg/ug	Organics only
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	25	years	USEPA, 1991

[1] PEF has been derived in Appendix I to this report.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance:
"Standard Default Exposure Factors"; OSWER Directive 9285.6-03.

EQUATIONS

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)

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

Where:

CA = C x CF x (1/PEF)

Note: For noncarcinogenic effects, AT = ED.

TABLE N-12

INHALATION OF PARTICULATES - SURFACE SOIL
OCCUPATIONAL WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day)^-1	CANCER RISK
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	2.9E-10	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	1.3E-10	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	1.3E-10	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	1.3E-10	ND	
Chrysene	O	290	ug/kg	5.84E-09	1.4E-10	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	4.7E-11	ND	
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	6.64E-09	1.5E-10	ND	
						SUMMARY CANCER RISK	0E+00

NE = not evaluated.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION RfD (mg/kg-day)	HAZARD QUOTIENT
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	8.1E-10	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	3.6E-10	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	3.8E-10	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	3.7E-10	ND	
Chrysene	O	290	ug/kg	5.84E-09	3.8E-10	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	1.3E-10	ND	
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	6.64E-09	4.3E-10	ND	
Manganese	I	14.6	mg/kg	2.94E-07	1.9E-08	0.0000143	1.3E-03
TRPH	O	91800	ug/kg	1.85E-06	1.2E-07	ND	
						SUMMARY HAZARD INDEX	1E-03

ND = no data available.

ABB Environmental Services, Inc.
OWSSINH.XLS
3/15/9

TABLE N-13

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
EXCAVATION WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	480	mg/day	USEPA, 1991
FRACTION INGESTED	FI	100%	unitless	Assumption
ADHERENCE FACTOR	AF	1	mg/cm^2-event	USEPA, 1992a
ABSORPTION FRACTION	ABS	chemical-specific	unitless	USEPA, 1992b
SURFACE AREA EXPOSED	SA	5,750	cm^2	USEPA, 1992a
DOSE ABSORBED PER EVENT	DAevent	chemical-specific	mg/cm2-event	USEPA, 1992a
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

[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, 1992a. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
USEPA, 1992b. USEPA Region IV Guidance Memorandum; February 10, 1992.
See Appendix K for dermal exposure assumptions.

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)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{DAevent \times SA \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

Where:
DAevent = CS x AF x ABS x CF

Note: For noncarcinogenic effects, AT = ED

TABLE N-13

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SURFACE SOIL
EXCAVATION WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 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
Benzo(a)anthracene	O	620	ug/kg	5.0E-09	0.73	3.6E-09	0.01	6.0E-10	0.8	4.8E-10	4.1E-09
Benzo(a)pyrene	O	273	ug/kg	2.2E-09	7.3	1.6E-08	0.01	2.6E-10	8	2.1E-09	1.8E-08
Benzo(b)fluoranthene	O	287	ug/kg	2.3E-09	0.73	1.7E-09	0.01	2.8E-10	0.8	2.2E-10	1.9E-09
Benzo(k)fluoranthene	O	280	ug/kg	2.3E-09	0.073	1.6E-10	0.01	2.7E-10	0.08	2.2E-11	1.9E-10
Chrysene	O	290	ug/kg	2.3E-09	0.0073	1.7E-11	0.01	2.8E-10	0.008	2.2E-12	1.9E-11
Dibenzo(a,h)anthracene	O	100	ug/kg	8.1E-10	7.3	5.9E-09	0.01	9.6E-11	8	7.7E-10	6.6E-09
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	2.7E-09	0.73	1.9E-09	0.01	3.2E-10	0.8	2.5E-10	2E-09
SUMMARY CANCER RISK						2E-08				3E-09	2E-08

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral CSFs.
NE = not evaluated.

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
Benzo(a)anthracene	O	620	ug/kg	3.5E-07	ND		0.01	4.2E-08	ND		
Benzo(a)pyrene	O	273	ug/kg	1.5E-07	ND		0.01	1.8E-08	ND		
Benzo(b)fluoranthene	O	287	ug/kg	1.6E-07	ND		0.01	1.9E-08	ND		
Benzo(k)fluoranthene	O	280	ug/kg	1.6E-07	ND		0.01	1.9E-08	ND		
Chrysene	O	290	ug/kg	1.6E-07	ND		0.01	2.0E-08	ND		
Dibenzo(a,h)anthracene	O	100	ug/kg	5.6E-08	ND		0.01	6.8E-09	ND		
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	1.9E-07	ND		0.01	2.2E-08	ND		
Manganese	I	14.6	mg/kg	8.2E-06	0.14	5.9E-05	0.001	9.9E-08	0.0056	1.8E-05	7.6E-05
TRPH	O	91800	ug/kg	5.2E-05	ND		0.01	6.2E-06	ND		
SUMMARY HAZARD INDEX						6E-05				2E-05	8E-05

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral RfDs.
ND = no data available.

TABLE N-14

INHALATION OF PARTICULATES - SURFACE SOIL
EXCAVATION WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	4.97E+07	m^3/kg	[1]
CONCENTRATION AIR	CA	chemical-specific	mg/m^3	
INHALATION RATE	IR	2.5	$m^3/hour$	USEPA, 1991
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

[1] PEF has been derived in Appendix I to this report, Derivation of Particulate Emission Factor.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance:
Standard Default Exposure Factors; OSWER Directive 9285.6-03.

EQUATIONS

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)

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

Where:

CA = C x CF x (1/PEF)

Note: For noncarcinogens, AT = ED.

TABLE N-14

INHALATION OF PARTICULATES - SURFACE SOIL
EXCAVATION WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day)^-1	CANCER RISK
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	4.2E-12	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	1.8E-12	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	1.9E-12	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	1.9E-12	ND	
Chrysene	O	290	ug/kg	5.84E-09	2.0E-12	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	6.8E-13	ND	
Indeno(1,2,3-cd)anthracene	O	330	ug/kg	6.64E-09	2.2E-12	ND	
					SUMMARY CANCER RISK		0E+00

NE = not evaluated.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION RfD (mg/kg-day)	HAZARD QUOTIENT
Benzo(a)anthracene	O	620	ug/kg	1.25E-08	2.9E-10	ND	
Benzo(a)pyrene	O	273	ug/kg	5.49E-09	1.3E-10	ND	
Benzo(b)fluoranthene	O	287	ug/kg	5.77E-09	1.4E-10	ND	
Benzo(k)fluoranthene	O	280	ug/kg	5.63E-09	1.3E-10	ND	
Chrysene	O	290	ug/kg	5.84E-09	1.4E-10	ND	
Dibenzo(a,h)anthracene	O	100	ug/kg	2.01E-09	4.7E-11	ND	
Indeno(1,2,3-cd)pyrene	O	330	ug/kg	6.64E-09	1.6E-10	ND	
Manganese	I	14.6	mg/kg	2.94E-07	6.9E-09	0.0000143	**4.8E-04**
TRPH	O	91800	ug/kg	1.85E-06	4.3E-08	ND	
					SUMMARY HAZARD INDEX		5E-04

ND = no data available.

TABLE N-15

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SUBSURFACE SOIL
EXCAVATION WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	480	mg/day	USEPA, 1991
FRACTION INGESTED	FI	100%	unitless	Assumption
ADHERENCE FACTOR	AF	1	mg/cm^2-event	USEPA, 1992a
ABSORPTION FRACTION	ABS	chemical-specific	unitless	USEPA, 1992b
SURFACE AREA EXPOSED	SA	5,750	cm^2	USEPA, 1992a
DOSE ABSORBED PER EVENT	DAevent	chemical-specific	mg/cm2-event	USEPA, 1992a
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

[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, 1992a. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
USEPA, 1992b. USEPA Region IV Guidance Memorandum; February 10, 1992.
See Appendix K to this report for dermal exposure assumptions.

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)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{DAevent \times SA \times EF \times ED}{BW \times AT \times 365\ \text{days/year}}$$

Where:
DAevent = CS x AF x ABS x CF

Note: For noncarcinogenic effects, AT = ED

TABLE N-15

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SUBSURFACE SOIL
EXCAVATION WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 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
Beryllium	I	0.32	mg/kg	2.6E-09	4.3	1.1E-08	0.001	3.1E-11	430	1.3E-08	2.4E-08
SUMMARY CANCER RISK						1E-08				1E-08	2E-08

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[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
Beryllium	I	0.32	mg/kg	1.8E-07	0.005	3.6E-05	0.001	2.2E-09	0.00005	4.3E-05	7.9E-05
Manganese	I	7.3	mg/kg	4.1E-06	0.14	2.9E-05	0.001	4.9E-08	0.0056	8.8E-06	3.8E-05
TRPH	O	215000	ug/kg	1.2E-04	ND		0.01	1.5E-05	ND		
SUMMARY HAZARD INDEX						7E-05				5E-05	1E-04

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral RfDs.
ND = no data available.

TABLE N-16

INHALATION OF PARTICULATES - SUBSURFACE SOIL
EXCAVATION WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
SOIL CONCENTRATION	C	chemical-specific	chemical-specific	
PART. EMISSION FACTOR	PEF	4.97E+07	m^3/kg	[1]
CONCENTRATION AIR	CA	chemical-specific	mg/m^3	
INHALATION RATE	IR	2.5	m^3/hour	USEPA, 1991
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

[1] PEF has been derived in Appendix I to this report, Derivation of Particulate Emission Factor.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance:
"Standard Default Exposure Factors"; OSWER Directive 9285.6-03.

EQUATIONS

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)

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

Where:

CA = C x CF x (1/PEF)

Note: For noncarcinogenic effects, AT = ED

TABLE N-16

INHALATION OF PARTICULATES - SUBSURFACE SOIL
EXCAVATION WORKER
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION [1]	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION CSF (mg/kg-day)⁻¹	CANCER RISK
Beryllium	I	0.32	mg/kg	6.44E-09	2.2E-12	8.4	1.8E-11
					SUMMARY CANCER RISK		2E-11

NE = not evaluated.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SOIL CONCENTRATION	UNITS	AIR CONCENTRATION (mg/m³)	INTAKE (mg/kg-day)	INHALATION RfD (mg/kg-day)	HAZARD QUOTIENT
Beryllium	I	0.32	mg/kg	6.44E-09	1.5E-10	ND	
Manganese	I	7.3	mg/kg	1.47E-07	3.4E-09	0.0000143	2.4E-04
TRPH	O	215000	ug/kg	4.33E-06	1.0E-07	ND	
					SUMMARY HAZARD INDEX		2E-04

ND = no data available.

TABLE N-17

INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED GROUNDWATER FROM SURFICIAL AQUIFER)
ADULT RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION WATER	CW	chemical-specific	ug/liter	
INGESTION RATE	IR	2	liters/day	USEPA, 1991
BODY WEIGHT	BW	70	kg	USEPA, 1991
CONVERSION FACTOR	CF	0.001	mg/ug	
EXPOSURE FREQUENCY	EF	350	days/year	USEPA, 1991
EXPOSURE DURATION	ED	30	years	USEPA, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	30	years	USEPA, 1991

USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance:
"Standard Default Exposure Factors"; OSWER Directive 9285.6-03.

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)

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

Note: For noncarcinogenic effects, AT = ED.

TABLE N-17

INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED GROUNDWATER FROM SURFICIAL AQUIFER)
ADULT RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION
1,1-Dichloroethane	590	ug/l	6.9E-03	ND	
1,1-Dichloroethene	350	ug/l	4.1E-03	0.6	2.5E-03
Benzene	26	ug/l	3.1E-04	0.029	8.9E-06
Trichloroethene	1700	ug/l	2.0E-02	0.011	2.2E-04
1,4-Dichlorobenzene	567	ug/l	6.7E-03	0.024	1.6E-04
4-Methylphenol	61	ug/l	7.2E-04	ND	
Benzo(b)fluoranthene	3	ug/l	3.5E-05	0.73	2.6E-05
bis(2-Ethylhexyl)phthalate	5	ug/l	5.9E-05	0.014	8.2E-07
Aroclor-1248	0.79	ug/l	9.3E-06	7.7	7.1E-05
Arsenic	9.9	ug/l	1.2E-04	1.75	2.0E-04
Chromium	36.6	ug/l	4.3E-04	ND	
TOTAL CANCER RISK					3E-03

NE = not evaluated.

TABLE N-17

INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED GROUNDWATER FROM SURFICIAL AQUIFER)
ADULT RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION
1,1,1-Trichloroethane	860	ug/l	2.4E-02	ND	
1,1-Dichloroethane	590	ug/l	1.6E-02	0.1	1.6E-01
1,1-Dichloroethene	350	ug/l	9.6E-03	0.009	1.1E+00
1,2-Dichloroethene (total)	1900	ug/l	5.2E-02	0.009	5.8E+00
Benzene	26	ug/l	7.1E-04	ND	
Trichloroethene	1700	ug/l	4.7E-02	0.006	7.8E+00
1,2-Dichlorobenzene	9800	ug/l	2.7E-01	0.09	3.0E+00
1,3-Dichlorobenzene	48.4	ug/l	1.3E-03	0.09	1.5E-02
1,4-Dichlorobenzene	567	ug/l	1.6E-02	0.09	1.7E-01
2-Methylnaphthalene	200	ug/l	5.5E-03	0.04	1.4E-01
4-Methylphenol	61	ug/l	1.7E-03	0.005	3.3E-01
Benzo(b)fluoranthene	3	ug/l	8.2E-05	ND	
Naphthalene	450	ug/l	1.2E-02	0.04	3.1E-01
bis(2-Ethylhexyl)phthalate	5	ug/l	1.4E-04	0.02	6.8E-03
Aroclor-1248	0.79	ug/l	2.2E-05	ND	
Aluminum	28854	ug/l	7.9E-01	1	7.9E-01
Arsenic	9.9	ug/l	2.7E-04	0.0003	9.0E-01
Chromium	36.6	ug/l	1.0E-03	0.005	2.0E-01
Iron	36500	ug/l	1.0E+00	ND	
Manganese	122	ug/l	3.3E-03	0.005	6.7E-01
Vanadium	26.5	ug/l	7.3E-04	0.007	1.0E-01
TRPH	1500	ug/l	4.1E-02	ND	
			TOTAL HAZARD INDEX		2E+01

ND = no data available.

TABLE N-18

CONCENTRATION OF VOCs WHILE SHOWERING
RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EMPIRICAL CONSTANTS

CONSTANT	SYMBOL	VALUE	UNIT	SOURCE
Liquid-film mass transfer for CO_2	K_l (CO_2)	20	cm/hr	Calculated
Gas-film mass transfer for water	K_g (H_2O)	3000	cm/hr	Calculated
Molar gas constant x Temperature	RT	0.024	atm-m³/mole	
Reference temperature	T_1	293	K	
Temperature of shower water	T_s	318	K	Assumption
Viscosity of water at shower temperature	u_s	0.6178	cp	Calculated
Viscosity of water at reference temperature	u_1	0.65	cp	Calculated
Shower droplet free-fall time	t_s	1.5	sec	Assumption
Droplet diameter	d	1	mm	Foster & Chrostowski, 1987
Flow rate in shower	FR	20	l/min	Assumption
Volume of shower area	SV	12	m³	Assumption
Air exchange rate	R	0.03	min^{-1}	Calculated
Time in shower	D_s	12	min	USEPA, 1989
Time at which concentration is being calculated	t	12	min	Assumption

Foster, S.A. and Chrostowski, P.C., 1987. Inhalation Exposures to Volatile Organic Contaminants in the Shower.
USEPA, 1989, Exposure Factors Handbook; EPA/600/8-89/043, May 1989.
All equations and definitions of terms are presented in Appendix J to this report, Calculation of Air Concentration Using the Shower Model.

TABLE N-18

CONCENTRATION OF VOCs WHILE SHOWERING
RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

SHOWER CONCENTRATIONS

COMPOUND	C_w (µg/l)	MW (g/mol)	H (atm·m³/mol)	k_l (cm/hr)	k_g (cm/hr)	K_L (cm/hr)	K_{al} (cm/hr)	C_{wd} (µg/l)	S (µg/m³·min)	$C_{(voc)}$ (µg/m³)
1,1-Dichloroethene	350	96.9	0.034	1.3E+01	1.3E+03	1.3E+01	1.4E+01	1.1E+02	1.8E+02	**1.8E+03**
1,2-Dichloroethene (total)	1900	96.9	0.00758	1.3E+01	1.3E+03	1.3E+01	1.4E+01	5.6E+02	9.3E+02	**9.4E+03**
Benzene	26	78.1	0.00559	1.5E+01	1.4E+03	1.4E+01	1.5E+01	8.3E+00	1.4E+01	**1.4E+02**
Trichloroethene	1700	131.4	0.0091	1.2E+01	1.1E+03	1.1E+01	1.2E+01	4.4E+02	7.4E+02	**7.4E+03**
1,1,1-Trichloroethane	860	133.0	0.0144	1.2E+01	1.1E+03	1.1E+01	1.2E+01	2.2E+02	3.7E+02	**3.8E+03**
1,1-Dichloroethane	590	99.0	0.00431	1.3E+01	1.3E+03	1.3E+01	1.3E+01	1.7E+02	2.8E+02	**2.8E+03**

C_w = Concentration in groundwater
MW = Molecular weight
H = Henry's Law constant
k_l = Chemical-specific mass-transfer coefficient
k_g = Chemical-specific gas mass-transfer coefficient
K_L = Mass transfer coefficient
K_{al} = Temperature correction of mass transfer coefficient
C_{wd} = Analyte concentration in water droplet
S = Release rate of analyte to air
$C_{(voc)}$ = Analyte concentration in bathroom air at time t.

$$C_{(voc)} = (S/R) \times (e^{(RDt)}-1) \times e^{(-Rt)}$$

TABLE N-19

INHALATION EXPOSURE TO VOCs WHILE SHOWERING (UNFILTERED GROUNDWATER FROM SURFICIAL AQUIFER)
ADULT RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SHOWER AIR	CA [1]	chemical-specific	ug/m^3	Modeled
CONVERSION FACTOR 1	CF_1	24	hours/day	
EXPOSURE TIME SHOWER	ET	0.2	hours/day	USEPA, 1989
EXPOSURE FREQUENCY	EF	350	days/year	USEPA, 1991
EXPOSURE DURATION	ED	30	years	USEPA, 1991
CONVERSION FACTOR 2	CF_2	365	days/year	
AVERAGING TIME CANCER	AT	70	years	USEPA, 1989
AVERAGING TIME NONCANCER	AT	30	years	USEPA, 1989

[1] Calculated via model by Foster and Chrostowski, Air Pollution Control Association Annual Meeting, 1987
USEPA, 1989. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, (Part A) EPA/540/1-89/002; December 1989.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Assumptions".

EQUATIONS

$$\text{CANCER RISK} = \text{AVG. CONC. } (ug/m^3) * \text{CANCER UNIT RISK } (ug/m^3)^{-1}$$

$$\text{HAZARD QUOTIENT} = \text{AVG.CONC.}(ug/m^3)/\text{REF. CONC. } (ug/m^3)$$

$$\text{AVG. CONC.} = \frac{CA_{air} * EF * ET * ED}{AT * CF1 * CF2}$$

TABLE N-19

INHALATION EXPOSURE TO VOCs WHILE SHOWERING (UNFILTERED GROUNDWATER FROM SURFICIAL AQUIFER)
ADULT RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	VOLATILE OR NON-VOLATILE? V/NV	SHOWER AIR CONCENTRATION (ug/m^3)	AVERAGE AIR CONCENTRATION LIFETIME (ug/m^3)	INHALATION CANCER UNIT RISK $(ug/m^3)^{-1}$	CANCER RISK
1,1-Dichloroethane	V	2800	9.6E+00	ND	
1,1-Dichloroethene	V	1800	6.2E+00	5.00E-05	3.1E-04
Benzene	V	140	4.8E-01	8.30E-06	4.0E-06
Trichloroethene	V	7400	2.5E+01	1.70E-06	4.3E-05
				SUMMARY CANCER RISK	4E-04

ND = no data available.

NONCARCINOGENIC EFFECTS

COMPOUND	VOLATILE OR NON-VOLATILE? V/NV	SHOWER AIR CONCENTRATION (ug/m^3)	AVERAGE AIR CONCENTRATION FOR TIME PERIOD (ug/m^3)	CHRONIC INHALATION RfC [1] (ug/m^3)	HAZARD QUOTIENT
1,1,1-Trichloroethane	V	3.8E+03	3.0E+01	1.00E+03	3.0E-02
1,1-Dichloroethane	V	2.8E+03	2.2E+01	5.00E+02	4.5E-02
1,1-Dichloroethene	V	1.8E+03	1.4E+01	ND	
1,2-Dichloroethene (total)	V	9.4E+03	7.5E+01	ND	
Benzene	V	1.4E+02	1.1E+00	ND	
Trichloroethene	V	7.4E+03	5.9E+01	ND	
				SUMMARY HAZARD INDEX	8E-02

[1] RfC is the Reference Concentration published by USEPA.
ND = no data available.

TABLE N-20

INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED GROUNDWATER FROM INTERMEDIATE AQUIFER)
ADULT RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION WATER	CW	chemical-specific	ug/liter	
INGESTION RATE	IR	2	liters/day	USEPA, 1991
BODY WEIGHT	BW	70	kg	USEPA, 1991
CONVERSION FACTOR	CF	0.001	mg/ug	
EXPOSURE FREQUENCY	EF	350	days/year	USEPA, 1991
EXPOSURE DURATION	ED	30	years	USEPA, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	30	years	USEPA, 1991

USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"; OSWER Directive 9285.6-03.

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)

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

Note: For noncarcinogenic effects, AT = ED.

TABLE N-20

INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED GROUNDWATER FROM INTERMEDIATE AQUIFER)
ADULT RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION
Arsenic	1.2	ug/l	1.4E-05	1.5	2.1E-05
			TOTAL CANCER RISK		2E-05

NE = not evaluated.

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION
Arsenic	1.2	ug/l	3.3E-05	0.0003	1.1E-01
Manganese	37.9	ug/l	1.0E-03	0.005	2.1E-01
			TOTAL HAZARD INDEX		3E-01

ND = no data available.

TABLE N-21

CALCULATION OF PC_{event} FOR DIRECT CONTACT WITH SURFACE WATER
ADULT, CHILD, OR ADOLESCENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
Diffusion depth per event	PC_{event}	chemical-specific	cm/event	
Permeability Constant from Water	K_p	chemical-specific	cm/hr	USEPA, 1992
Duration of a Single Event	t_{event}	2.6	hr	USEPA,1989
Thickness of Stratum Corneum	L_{sc}	10	um	USEPA, 1992
Octanol-water partition coefficient/104	B	chemical-specific	dimensionless	USEPA, 1992
Pi	Pi	3.14	dimensionless	USEPA, 1992
T [1]	T	chemical-specific	hr	USEPA, 1992
Time to Reach Steady State	t*	chemical-specific	hr	USEPA, 1992
Stratum Corneum Diffusion Coefficient	D_{sc}	chemical-specific	cm^2/hr	USEPA, 1992

EQUATIONS

INORGANICS

$$PC_{event} = K_p \times t_{event}$$

ORGANICS

$$PC_{event} = 2K_p \times (6T \times t_{event}/Pi)^{0.5}$$

Where $t_{event} < t^*$

and: $$PC_{event} = K_p \times [(t_{event}/(1+B)) + 2T \times ((1+3B)/(1+B))]$$

Where $t_{event} > t^*$

Note: $T = L_{sc}^2/6D_{sc}$

[1] The term T is not calculated here. Values are provided in USEPA, 1992.

REFERENCES

USEPA,1989. Risk Assessment Guidance for Superfund, Volume I, Part A, EPA/540/1-89/002, December 1989. This value is receptor-specific.

USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992.

COMPOUND	INORGANIC OR ORGANIC? (I/O)	K_p (cm/hr) [1]	T (hr) [1]	t* (hr) [1]	B (unitless) [1]	PCevent (cm/event)
Dibromochloromethane	O	3.9E-03	1.6E+00	3.9E+00	1.7E-02	2.20E-02
Bromodichloromethane	O	5.8E-03	8.7E-01	2.1E+00	1.2E-02	2.52E-02
Chloroform	O	1.3E-01	4.7E-01	1.1E+00	9.3E-03	4.59E-01
Antimony	I	1.0E-03	NA	NA	NA	2.60E-03

NA = not applicable. For inorganic analytes, this term is not used to calculate PC_{event}.

[1] Values are taken from USEPA, 1992. Dermal Exposure Assessment: Principles and Applications, EPA/600/8-91/011B.

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TABLE N-22

INGESTION OF AND DIRECT CONTACT WITH SURFACE WATER
CHILD TRANSIENT - WADING
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION WATER	CW	chemical-specific	ug/liter	
INGESTION RATE [1]	IR	0.13	liters/day	USEPA, 1989
AGE-SPECIFIC SURFACE AREA [2]	SA	age-specific	cm^2	USEPA, 1989
EVENT FREQUENCY	EV	1	events/day	Assumption
BODY WEIGHT	BW	45	kg	USEPA, 1991
DOSE ABSORBED PER EVENT	DA_{event}	chemical-specific	mg/cm^2-event	Calculated
EXPOSURE FREQUENCY	EF	45	days/year	Assumption
EXPOSURE DURATION	ED	10	years	Assumption
AGE-WEIGHTED SURFACE AREA [3]	SAsw/adj	1136	cm^2-yr/kg	Calculated per USEPA, 1992
DIFFUSION DEPTH PER EVENT [4]	PC_{event}	chemical-specific	cm/event	Calculated per USEPA, 1992
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	10	years	Assumption
CONVERSION FACTOR	CF1	0.001	mg/ug	
CONVERSION FACTOR	CF2	0.001	liter/cm^3	

[1] Ingestion Rate = 0.13 l/day = 50 ml/hour x 2.6 hours/day x 0.001 l/ml.
[2] Surface area assumes lower legs, hands, and feet are exposed.
[3] Age-weighted, body weight normalized surface area.
[4] PC_{event} calculated per the Dermal Guidance appendix to this report (Appendix K).
USEPA, 1989. Exposure Factors Handbook; EPA/600/8-89/043; May 1989.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Parameters";
USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE-INGESTION} = \frac{CW \times IR \times EF \times ED \times CF1}{BW \times AT \times 365\ days/yr}$$

$$\text{INTAKE-DERMAL} = \frac{DA_{event} \times EV \times EF \times SAsw/adj}{AT \times 365\ days/yr}$$

Where:

SAsw/adj = Sum (SA x ED / BW)

$DA_{event} = PC_{event} \times CW \times CF1 \times CF2$

Note: For noncarcinogenic effects, AT = ED.

TABLE N-22

INGESTION OF AND DIRECT CONTACT WITH SURFACE WATER
CHILD TRANSIENT - WADING
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF (mg/kg-day)^-1	CANCER RISK INGESTION	PCEVENT [1] (cm/event)	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [2] (mg/kg-day)^-1	CANCER RISK DERMAL	TOTAL CANCER RISK
Dibromochloromethane	1.3	ug/l	6.6E-08	8.4E-02	5.6E-09	2.20E-02	5.7E-08	ND		5.6E-09
Bromodichloromethane	3.5	ug/l	1.8E-07	6.2E-02	1.1E-08	2.52E-02	1.8E-07	ND		1.1E-08
Chloroform	5	ug/l	2.5E-07	6.1E-03	1.6E-09	4.59E-01	4.6E-06	6.1E-03	2.8E-08	3.0E-08
SUMMARY CANCER RISK					2E-08				3E-08	5E-08

[1] This chemical-specific value has been calculated in TableN-21 of this appendix.
[2] Calculated from oral CSFs.
ND = no data available.

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/l)	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL RfD (mg/kg-day)	HAZARD QUOTIENT INGESTION	PCEVENT [1] (cm/event)	INTAKE DERMAL (mg/kg-day)	DERMAL RfD [2] (mg/kg-day)	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Dibromochloromethane	1.3	ug/l	4.6E-07	2.0E-02	2.3E-05	2.20E-02	4.0E-07	ND		2.3E-05
Bromodichloromethane	3.5	ug/l	1.2E-06	2.0E-02	6.2E-05	2.52E-02	1.2E-06	ND		6.2E-05
Chloroform	5	ug/l	1.8E-06	1.0E-02	1.8E-04	4.59E-01	3.2E-05	1.0E-02	3.2E-03	3.4E-03
Antimony	16.2	ug/l	5.8E-06	4.0E-04	1.4E-02	2.60E-03	5.9E-07	4.0E-06	1.5E-01	1.6E-01
SUMMARY HAZARD INDEX					1E-02				2E-01	2E-01

[1] This chemical-specific value has been calculated in Table N-21 of this appendix.
[2] Calculated from oral RfDs.
ND = no data available.

TABLE N-23

INGESTION OF AND DIRECT CONTACT WITH SURFACE WATER
ADULT TRANSIENT - WADING
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION WATER	CW	chemical-specific	ug/liter	
INGESTION RATE [1]	IR	0.13	liters/day	USEPA, 1989
SURFACE AREA [2]	SA	5,750	cm^2	USEPA, 1992
EVENT FREQUENCY	EV	1	events/day	Assumption
BODY WEIGHT	BW	70	kg	USEPA, 1991
DOSE ABSORBED PER EVENT	DA_{event}	chemical-specific	mg/cm^2-event	Calculated
EXPOSURE TIME	ET	2.6	hours/day	Assumption
EXPOSURE FREQUENCY	EF	45	days/year	Assumption
EXPOSURE DURATION	ED	19	years	Assumption
DIFFUSION DEPTH PER EVENT	PC_{event}	chemical-specific	cm/event	[3]
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	19	years	Assumption
CONVERSION FACTOR	CF1	0.001	mg/ug	
CONVERSION FACTOR	CF2	0.001	$liter/cm^3$	

[1] Ingestion Rate = 0.13 l/day = 50 ml/hour x 2.6 hours/day x 0.001 l/ml
[2] Surface area assumes lower legs, hands, and feet are exposed.
[3] PC_{event} is calculated per Appendix K to this report.
USEPA, 1989. Exposure Factors Handbook; EPA/600/8-89/043; May 1989.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Parameters";
USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B.

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE-INGESTION} = \frac{CW \times IR \times EF \times ED \times CF1}{BW \times AT \times 365\ days/yr}$$

$$\text{INTAKE-DERMAL} = \frac{DA_{event} \times EV \times EF \times ED \times SA}{AT \times BW \times 365\ days/yr}$$

Where:

$DA_{event} = PC_{event} \times CW \times CF1 \times CF2$

Note: For noncarcinogenic effects, AT = ED.

TABLE N-23

INGESTION OF AND DIRECT CONTACT WITH SURFACE WATER
ADULT TRANSIENT - WADING
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF (mg/kg-day)^-1	CANCER RISK INGESTION	PCEVENT [1] (cm/event)	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [2] (mg/kg-day)^-1	CANCER RISK DERMAL	TOTAL CANCER RISK
Dibromochloromethane	1.3	ug/l	8.1E-08	8.4E-02	6.8E-09	2.20E-02	7.9E-08	ND		6.8E-09
Bromodichloromethane	3.5	ug/l	2.2E-07	6.2E-02	1.3E-08	2.52E-02	2.4E-07	ND		1.3E-08
Chloroform	5	ug/l	3.1E-07	6.1E-03	1.9E-09	4.59E-01	6.3E-06	6.1E-03	3.8E-08	4.0E-08
SUMMARY CANCER RISK					2E-08				4E-08	6E-08

[1] This chemical-specific value is calculated in Table N-21 of this appendix.
[2] Calculated from oral CSFs.
NE = not evaluated.

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/l)	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL RfD (mg/kg-day)	HAZARD QUOTIENT INGESTION	PCEVENT[1] (cm/event)	INTAKE DERMAL (mg/kg-day)	DERMAL RfD [2] (mg/kg-day)	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Dibromochloromethane	1.3	ug/l	3.0E-07	2.0E-02	1.5E-05	2.20E-02	2.9E-07	ND		1.5E-05
Bromodichloromethane	3.5	ug/l	8.0E-07	2.0E-02	4.0E-05	2.52E-02	8.9E-07	ND		4.0E-05
Chloroform	5	ug/l	1.1E-06	1.0E-02	1.1E-04	4.59E-01	2.3E-05	1.0E-02	2.3E-03	2.4E-03
Antimony	16.2	ug/l	3.7E-06	4.0E-04	9.3E-03	2.60E-03	4.3E-07	4.0E-06	1.1E-01	1.2E-01
SUMMARY HAZARD INDEX					9E-03				1E-01	1E-01

[1] This chemical-specific value is calculated in Table N-21 of this appendix.
[2] Calculated from oral RfDs.
ND = no data available.

TABLE N-24

INGESTION OF AND DIRECT CONTACT WITH SURFACE WATER
CHILD RESIDENT - WADING
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION WATER	CW	chemical-specific	ug/liter	
INGESTION RATE [1]	IR	0.13	liters/day	USEPA, 1989
AGE-SPECIFIC SURFACE AREA [2]	SA	age-specific	cm^2	USEPA, 1989
EVENT FREQUENCY	EV	1	events/day	Assumption
BODY WEIGHT	BW	15	kg	USEPA, 1991
DOSE ABSORBED PER EVENT	DA_{event}	chemical-specific	mg/cm^2-event	Calculated
EXPOSURE FREQUENCY	EF	100	days/year	Assumption
EXPOSURE DURATION	ED	6	years	Assumption
AGE-WEIGHTED SURFACE AREA [3]	SAaw/adj	766	cm^2-yr/kg	Calculated per USEPA, 1992
DIFFUSION DEPTH PER EVENT [4]	PC_{event}	chemical-specific	cm/event	Calculated per USEPA, 1992
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	6	years	Assumption
CONVERSION FACTOR	CF1	0.001	mg/ug	
CONVERSION FACTOR	CF2	0.001	liter/cm^3	

[1] Ingestion Rate = 0.13 l/day = 50 ml/hour x 2.6 hours/day x 0.001 l/ml.
[2] Surface area assumes lower legs, hands, and feet are exposed.
[3] Age-weighted, body weight normalized surface area.
[4] PC_{event} calculated per the Dermal Guidance appendix to this report (Appendix K).
USEPA, 1989. Exposure Factors Handbook; EPA/600/8-89/043; May 1989.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Parameters";
USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE-INGESTION} = \frac{CW \times IR \times EF \times ED \times CF1}{BW \times AT \times 365\ days/yr}$$

$$\text{INTAKE-DERMAL} = \frac{DA_{event} \times EV \times EF \times SAaw/adj}{AT \times 365\ days/yr}$$

Where:

$SAaw/adj = \Sigma_{age}\ (SA \times ED / BW)$

$DA_{event} = PC_{event} \times CW \times CF1 \times CF2$

Note: For noncarcinogenic effects, AT = ED.

TABLE N-24

INGESTION OF AND DIRECT CONTACT WITH SURFACE WATER
CHILD RESIDENT - WADING
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF (mg/kg-day)^-1	CANCER RISK INGESTION	PCEVENT [1] (cm/event)	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [2] (mg/kg-day)^-1	CANCER RISK DERMAL	TOTAL CANCER RISK
Dibromochloromethane	1.3	ug/l	2.6E-07	8.4E-02	2.2E-08	2.20E-02	8.6E-08	ND		2.2E-08
Bromodichloromethane	3.5	ug/l	7.1E-07	6.2E-02	4.4E-08	2.52E-02	2.6E-07	ND		4.4E-08
Chloroform	5	ug/l	1.0E-06	6.1E-03	6.2E-09	4.59E-01	6.9E-06	6.1E-03	4.2E-08	4.8E-08
SUMMARY CANCER RISK					7E-08				4E-08	1E-07

[1] This chemical-specific value has been calculated in Table N-21 of this appendix.
[2] Calculated from oral CSFs.
ND = no data available.

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/l)	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL RfD (mg/kg-day)	HAZARD QUOTIENT INGESTION	PCEVENT [1] (cm/event)	INTAKE DERMAL (mg/kg-day)	DERMAL RfD [2] (mg/kg-day)	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Dibromochloromethane	1.3	ug/l	3.1E-06	2.0E-02	1.5E-04	2.20E-02	1.0E-06	ND		1.5E-04
Bromodichloromethane	3.5	ug/l	8.3E-06	2.0E-02	4.2E-04	2.52E-02	3.1E-06	ND		4.2E-04
Chloroform	5	ug/l	1.2E-05	1.0E-02	1.2E-03	4.59E-01	8.0E-05	1.0E-02	8.0E-03	9.2E-03
Antimony	16.2	ug/l	3.8E-05	4.0E-04	9.6E-02	2.60E-03	1.5E-06	4.0E-06	3.7E-01	4.6E-01
SUMMARY HAZARD INDEX					1E-01				4E-01	5E-01

[1] This chemical-specific value has been calculated in Table N-21 of this appendix.
[2] Calculated from oral RfDs.
ND = no data available.

TABLE N-25

INGESTION OF AND DIRECT CONTACT WITH SURFACE WATER
ADULT RESIDENT - WADING
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION WATER	CW	chemical-specific	ug/liter	
INGESTION RATE [1]	IR	0.13	liters/day	USEPA, 1989
SURFACE AREA [2]	SA	5,750	cm2	USEPA, 1989
EVENT FREQUENCY	EV	1	events/day	Assumption
BODY WEIGHT	BW	70	kg	USEPA, 1991
DOSE ABSORBED PER EVENT	DAevent	chemical-specific	mg/cm2-event	Calculated
EXPOSURE TIME	ET	2.6	hours/day	Assumption
EXPOSURE FREQUENCY	EF	100	days/year	Assumption
EXPOSURE DURATION	ED	24	years	Assumption
DIFFUSION DEPTH PER EVENT	PCevent	chemical-specific	cm/event	Calculated per USEPA, 1992 [3]
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	24	years	USEPA, 1991
CONVERSION FACTOR	CF1	0.001	mg/ug	
CONVERSION FACTOR	CF2	0.001	liter/cm3	

[1] Ingestion Rate = 0.13 l/day = 50 ml/hour x 2.6 hours/day x 0.001 l/ml
[2] Surface area assumes lower legs, hands, and feet are exposed.
[3] PCevent is calculated in the Dermal Guidance Appendix to this report (Appendix K).
USEPA, 1989. Exposure Factors Handbook; EPA/600/8-89/043; May 1989.
USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Parameters."
USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B.

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)

$$\text{INTAKE-INGESTION} = \frac{CW \times IR \times EF \times ED \times CF1}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{DAevent \times EV \times EF \times ED \times SA}{AT \times BW \times 365\ \text{days/yr}}$$

Where:
DAevent = PCevent x CW x CF1 x CF2

Note: For noncarcinogenic effects, AT = ED.

TABLE N-25

INGESTION OF AND DIRECT CONTACT WITH SURFACE WATER
ADULT RESIDENT - WADING
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL CSF [1] (mg/kg-day)^-1	CANCER RISK INGESTION	PCEVENT[2] (cm/event)	INTAKE DERMAL (mg/kg-day)	DERMAL CSF [1, 3] (mg/kg-day)^-1	CANCER RISK DERMAL	TOTAL CANCER RISK
Dibromochloromethane	1.3	ug/liter	2.3E-07	8.4E-02	1.9E-08	2.20E-02	2.2E-07	ND		1.9E-08
Bromodichloromethane	3.5	ug/liter	6.1E-07	6.2E-02	3.8E-08	2.52E-02	6.8E-07	ND		3.8E-08
Chloroform	5	ug/liter	8.7E-07	6.1E-03	5.3E-09	4.59E-01	1.8E-05	6.1E-03	1.1E-07	1.1E-07
SUMMARY CANCER RISK					6E-08				1E-07	2E-07

[2] This chemical-specific value is calculated in Table N-21 of this appendix.
[3] Calculated from oral CSFs.
ND = no data available.

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/l)	UNITS	INTAKE INGESTION (mg/kg-day)	ORAL RfD (mg/kg-day)	HAZARD QUOTIENT INGESTION	PCEVENT[1] (cm/event)	INTAKE DERMAL (mg/kg-day)	DERMAL RfD [2] (mg/kg-day)^-1	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT
Dibromochloromethane	1.3	ug/liter	6.6E-07	2.0E-02	3.3E-05	2.20E-02	6.4E-07	ND		3.3E-05
Bromodichloromethane	3.5	ug/liter	1.8E-06	2.0E-02	8.9E-05	2.52E-02	2.0E-06	ND		8.9E-05
Chloroform	5	ug/liter	2.5E-06	1.0E-02	2.5E-04	4.59E-01	5.2E-05	1.0E-02	5.2E-03	5.4E-03
Antimony	16.2	ug/liter	8.2E-06	4.0E-04	2.1E-02	2.60E-03	9.5E-07	4.0E-06	2.4E-01	2.6E-01
SUMMARY HAZARD INDEX					2E-02				2E-01	3E-01

[1] This chemical-specific value is calculated in Table N-21 of this appendix.
[2] Calculated from oral RfDs.
ND = no data available.

TABLE N-26

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SEDIMENT
CHILD TRANSIENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SEDIMENT	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	100	mg/day	USEPA, 1991
FRACTION INGESTED	FI	100%	unitless	Assumption
ADHERENCE FACTOR	AF	1	mg/cm²-event	USEPA, 1992a
ABSORPTION FRACTION	ABS	chemical-specific	unitless	USEPA, 1992b
AGE-WEIGHTED SURFACE AREA [1]	$SA_{soil/adj}$	1,136	cm²	USEPA, 1992a
DOSE ABSORBED PER EVENT	DA_{event}	chemical-specific	mg/cm²-event	USEPA, 1992a
CONVERSION FACTOR	CF	1.00E-09	kg/ug	Organic conversion
CONVERSION FACTOR	CF	1.00E-06	kg/mg	Inorganic conversion
BODY WEIGHT	BW	45	kg	USEPA, 1991
EXPOSURE FREQUENCY	EF	45	days/year [2]	Assumption
EXPOSURE DURATION	ED	10	years	USEPA, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	10	years	USEPA, 1991

[1] 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.
[2] 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, 1992a. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
USEPA, 1992b. USEPA Region IV Guidance Memorandum; February 10, 1992.
See Appendix K to this report for dermal exposure assumptions.

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

$$\text{INTAKE-DERMAL} = (DA_{event} \times EF / AT \times 365\ days/year) \times SA_{soil/adj}$$

Where:

$SA_{soil/adj}$ = SUM(SAi x EDi/BWi)
DA_{event} = CS x AF x ABS x CF

Note: For noncarcinogenic effects, AT = ED.

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SEDIMENT 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 [3] (mg/kg-day)$^{-1}$	CANCER RISK DERMAL	TOTAL CANCER RISK
Aroclor-1254	O	180	ug/kg	7.0E-09	7.7	5.4E-08	0.06	2.2E-08	8.6	1.9E-07	2.4E-07
SUMMARY CANCER RISK						5E-08				2E-07	2E-07

[2] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[3] Calculated from oral CSFs.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SEDIMENT 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
Aroclor-1254	O	180	ug/kg	4.9E-08	0.00002	2.5E-03	0.06	1.5E-07	0.000018	8.4E-03	1.1E-02
Endrin ketone	O	1.5	ug/kg	4.1E-10	0.0003	1.4E-06	0.25	5.3E-09	ND		1.4E-06
SUMMARY HAZARD INDEX						2E-03				8E-03	1E-02

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral RfDs.
ND = no data available.

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TABLE N-27

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SEDIMENT
ADULT TRANSIENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SEDIMENT	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, 1992a
ABSORPTION FRACTION	ABS	chemical-specific	unitless	USEPA, 1992b
SURFACE AREA EXPOSED	SA	5,750	cm^2	USEPA, 1992a
DOSE ABSORBED PER EVENT	DA_{event}	chemical-specific	mg/cm^2-event	USEPA, 1992a
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	45	days/year [1]	Assumption
EXPOSURE DURATION	ED	19	years	USEPA, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	19	years	USEPA, 1991

[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, 1992a. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
USEPA, 1992b. USEPA Region IV Guidance Memorandum; February 10, 1992.
See Appendix K to this report for dermal exposure assumptions.

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

$$\text{INTAKE-DERMAL} = \frac{(DA_{event} \times EF \times ED \times SA)}{BW \times AT \times 365\ days/yr}$$

Where:

DA_{event} = CS x AF x ABS x CF

Note: For noncarcinogenic effects, AT = ED.

TABLE N-27

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SEDIMENT
ADULT TRANSIENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SEDIMENT 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
Aroclor-1254	O	180	ug/kg	8.6E-09	7.7	6.6E-08	0.06	3.0E-08	8.6	2.6E-07	3.2E-07
SUMMARY CANCER RISK						7E-08				3E-07	3E-07

[2] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[3] Calculated from oral CSFs.
NE = not evaluated.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SEDIMENT 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
Aroclor-1254	O	180	ug/kg	3.2E-08	0.00002	1.6E-03	0.06	1.1E-07	0.000018	6.1E-03	7.7E-03
Endrin ketone	O	1.5	ug/kg	2.6E-10	0.0003	8.8E-07	0.25	3.8E-09	ND		8.8E-07
SUMMARY HAZARD INDEX						2E-03				6E-03	8E-03

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral RfDs.
ND = no data available.

TABLE N-28

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SEDIMENT
CHILD RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SEDIMENT	CS	chemical-specific	chemical-specific	
INGESTION RATE	IR	200	mg/day	USEPA, 1991
FRACTION INGESTED	FI	100%	unitless	Assumption
ADHERENCE FACTOR	AF	1	mg/cm^2-event	USEPA, 1992a
ABSORPTION FRACTION	ABS	chemical-specific	unitless	USEPA, 1992b
AGE-WEIGHTED SURFACE AREA	$SA_{soil/sed}$	766	cm^2	[1]
DOSE ABSORBED PER EVENT	DA_{event}	chemical-specific	mg/cm^2-event	USEPA, 1992a
CONVERSION FACTOR	CF	1.00E-09	kg/ug	Organic conversion
CONVERSION FACTOR	CF	1.00E-06	kg/mg	Inorganic conversion
BODY WEIGHT	BW	15	kg	USEPA, 1991
EXPOSURE FREQUENCY	EF	100	days/year [2]	Assumption
EXPOSURE DURATION	ED	6	years	USEPA, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	6	years	USEPA, 1991

[1] 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 (see Appendix K to this report).
[2] 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, 1992a. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
USEPA, 1992b. USEPA Region IV Guidance Memorandum; February 10, 1992.

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

INTAKE-DERMAL = (DAevent x EF/ AT x 365 days/year) x SAsoil/sed)

Where:

$SA_{soil/sed}$ = SUM(SAi x EDi/BWi)
DA_{event} = CS x AF x ABS x CF

Note: For noncarcinogenic effects, AT = ED.

TABLE N-28

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SEDIMENT
CHILD RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SEDIMENT 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
Aroclor	O	180	ug/kg	5.6E-08	7.7	4.3E-07	0.06	3.2E-08	8.6	2.8E-07	7.1E-07
SUMMARY CANCER RISK						4E-07				3E-07	7E-07

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral CSFs.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SEDIMENT 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
Aroclor-1254	O	180	ug/kg	6.6E-07	0.00002	3.3E-02	0.06	3.8E-07	0.000018	2.1E-02	5.4E-02
Endrin ketone	O	1.5	ug/kg	5.5E-09	ND		0.25	1.3E-08	ND		
SUMMARY HAZARD INDEX						3E-02				2E-02	5E-02

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral RfDs.
ND = no data available.

TABLE N-29

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SEDIMENT
ADULT RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SEDIMENT	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, 1992a
ABSORPTION FRACTION	ABS	chemical-specific	unitless	USEPA, 1992b
SURFACE AREA EXPOSED	SA	5,750	cm^2	USEPA, 1992a
DOSE ABSORBED PER EVENT	DA_{event}	chemical-specific	mg/cm^2-event	USEPA, 1992a
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	100	days/year [1]	Assumption
EXPOSURE DURATION	ED	24	years	USEPA, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	24	years	USEPA, 1991

[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, 1992a. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
USEPA, 1992b. USEPA Region IV Guidance Memorandum; February 10, 1992.
See Appendix K to this report for dermal exposure assumptions.

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

$$\text{INTAKE-DERMAL} = \frac{(DA_{event} \times EF \times ED \times SA)}{BW \times AT \times 365\ days/yr}$$

Where:

DA_{event} = CS x AF x ABS x CF

Note: For noncarcinogenic effects, AT = ED.

TABLE N-29

DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SEDIMENT
ADULT RESIDENT
NAS CECIL FIELD
OPERABLE UNIT 8, SITE 3

CARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SEDIMENT 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
Aroclor-1254	O	180	ug/kg	2.4E-08	7.7	1.9E-07	0.06	8.3E-08	8.6	7.2E-07	9.0E-07
SUMMARY CANCER RISK						2E-07				7E-07	9E-07

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral CSFs.
NE = not evaluated.

NONCARCINOGENIC EFFECTS

COMPOUND	INORGANIC OR ORGANIC I/O	SEDIMENT 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
Aroclor-1254	O	180	ug/kg	7.0E-08	0.00002	3.5E-03	0.06	2.4E-07	0.000018	1.4E-02	1.7E-02
Endrin ketone	O	1.5	ug/kg	5.9E-10	ND		0.25	8.4E-09	ND		
SUMMARY HAZARD INDEX						4E-03				1E-02	2E-02

[1] USEPA Region IV guidance specifies absorption factors of 1% for organics and 0.1% for inorganics (February 10, 1992).
[2] Calculated from oral RfDs.
ND = no data available.

APPENDIX O

HUMAN HEALTH TOXICITY PROFILES

1,1,1-Trichloroethane. 1,1,1-Trichloroethane is a man-made, chlorinated volatile organic chemical. It is used as a solvent for paints, as a cleanser to remove grease and oil, and is contained in household spot removers, aerosol sprays, and glues.

1,1,1-Trichloroethane is extensively absorbed through the gastrointestinal tract, the lungs, and to a lesser extent, through the skin. Like many chlorinated volatile compounds, 1,1,1-trichloroethane depresses the central nervous system and impairs coordination, equilibrium, and judgement in both humans and animals when exposed by any route. Additionally, exposures to high concentrations of 1,1,1-trichloroethane may produce adverse cardiovascular effects, including arrhythmias and decreased blood pressure. Reproductive and developmental toxicity have not been reported in human epidemiological studies. Evidence for or against the potential carcinogenicity of 1,1,1-trichloroethane in humans and animals has not been established.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1993. "Toxicological Profile for 1,1,1-Trichloroethane"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service. October, 1993.

MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

1,1-Dichloroethane. 1,1-DCA is used primarily as an industrial solvent and as a dissolving agent for paint, varnish, and finish removers. Formerly, it was used as an anesthetic as it causes central nervous system (CNS) depression and anesthesia upon inhalation. Hepatotoxicity and nephrotoxicity has been observed in rodents. The USEPA has classified 1,1-DCA as a group C, possible human carcinogen based on conflicting bioassay results in mice and rats. Closely related compounds are not thought to be carcinogenic.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

1,1-Dichloroethene. 1,1-Dichloroethene is a man-made chlorinated solvent that is used to make polyvinylidene chloride copolymers, which are used as flexible films for packaging all types of materials, including food.

Data of 1,1-dichloroethene exposure in humans is limited. However, available evidence suggest that 1,1-dichloroethene causes CNS depression and liver toxicity in humans. Toxicity data on laboratory animals confirm this evidence, and also indicate that 1,1-dichloroethene may produce adverse effects on the kidney, heart, and lung. Pharmacokinetic data from laboratory animals suggest that 1,1-dichloroethene is metabolized to toxic metabolites, and that these metabolites are responsible for the adverse effects. Therefore, organs with high biotransformation enzyme activity, such as the liver, kidney, and lungs, are likely to be adversely impacted. Limited evidence in animals suggests that 1,1-dichloroethene may be carcinogenic. Therefore, the USEPA has placed 1,1-dichloroethene in weight-of-evidence group C, possible human carcinogen.

References:

MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

Agency for Toxic Substances and Disease Registry (ATSDR), 1992. "Toxicological Profile for 1,1-Dichloroethene"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October 1992.

1,2-Dichloroethylene. 1,2-Dichloroethylene (total) (1,2-DCE) has had limited industrial usage in the United States because of its flammability. At one time it was used as a general anesthetic. Acute human exposure to 1,2-DCE has produced irritation of the skin and mucous membranes, vertigo, and nausea. 1,2-DCE produces CNS depression, narcosis, and irritation in laboratory animals. Chronic exposure studies in mice identify the liver and possibly the immune system as sensitive target organs. 1,2-dichloroethene has not been classified by the USEPA for carcinogenicity.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1989. "Toxicological Profile for 1,2-Dichloroethene"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October, 1989.

Benzene. Benzene is a common industrial solvent which is used in paints, plastics, rubber, and in the manufacture of detergents and pharmaceuticals. It is also a component of gasoline. Several epidemiological studies provide sufficient evidence of a causal relationship between benzene exposure and leukemia in humans. Benzene is a known inducer of aplastic anemia in humans, with a latency period of up to 10 years. It reduces the number of white blood cells and other blood components, which may progress to a reduction in all blood cell types. Exposure to high concentrations of benzene in the air causes CNS depression and cardiovascular effects. Benzene has been reported to cause subjective symptoms (e.g., headache and nausea). Accordingly, benzene has been classified as a group A carcinogen by the USEPA.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1989. Toxicological Profile for Benzene. U.S. Public Health Service.

Bromodichloromethane. Originally bromodichloromethane was used as a solvent for fats, waxes, and resins, as a flame retardant, as a heavy liquid for mineral and salt separations, and as a fire extinguisher ingredient. Currently, it is used as a chemical intermediate for organic synthesis and as a laboratory reagent. No data is available on the effects of bromodichloromethane in humans. Female rats developed liver tumors following an oral exposure to bromodichloromethane. Both male and female rats developed kidney tumors following an oral exposure. Tumors of the large intestine were also observed in male and female rats following an oral exposure. Both chronic and subchronic studies in rats and mice indicate that the liver and kidney are susceptible to injury following exposure to bromodichloromethane. The USEPA has designated bromodichloromethane as a B2 carcinogen, a probable human carcinogen.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1990. Toxicological Profile for Bromodichloromethane. U.S. Public Health Service.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Chloroform. Originally used as a general anesthetic, chloroform is used now in the production of air conditioning coolant, as a solvent, and in the manufacture of pesticides and dyes. It can also be found in dry cleaning agents, plastics, and floor polishes, and as a by-product of drinking water purification. Acute exposure to chloroform via inhalation produces dizziness and gastrointestinal upset. Dermal contact with chloroform produces burns. It is a CNS depressant, and chronic exposure has been shown to cause liver and kidney toxicity as well as cardiac arrhythmias. Several studies indicate that chloroform is carcinogenic via the oral route causing liver carcinoma in mice and kidney tumors. The USEPA has designated chloroform as a B2 carcinogen, a probable human carcinogen.

References:

Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Dibromochloromethane. Dibromochloromethane is used as a chemical intermediate in the manufacture of fire-extinguishing agents, aerosol propellants, refrigerants, and pesticides. There are no data on the effect of dibromochloromethane in humans. In female mice treated with dibromochloromethane by gavage for 2 years, there was some evidence of carcinogenicity. This evidence included an increased incidence of hepatocellular adenomas and an increased combined incidence of hepatocellular adenomas or carcinomas. However, the evidence of carcinogenicity in male mice was equivocal. There was an increase in hepatocellular adenomas but the combined incidence of hepatocellular adenomas or carcinomas was only marginally increased. There was no evidence of carcinogenicity in male or female rats exposed to dibromochloromethane. In both mice and rats, dibromochloromethane caused kidney damage following oral exposures. Dibromochloromethane was reported to induce sister chromatid exchanges in human lymphocytes *in vitro* and mouse bone marrow cells. Male mice experienced no dominant lethal effects when administered dibromochloromethane in drinking water. Negative results have also been reported in a teratology study for rats. Dibromochloromethane is classified by USEPA as a C, possible human carcinogen.

References:

Agency for Toxic Substances and Disease Registry (ATSDR), 1990. Toxicological Profile for Bromoform and Chlorodibromomethane. U.S. Public Health Service.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

The Installation restoration Program Toxicology Guide, 1989. Dibromochloromethane. The Installation Restoration Program Toxicology Guide, Volume 1.

Trichloroethylene (TCE). TCE is used as an industrial solvent, in metal degreasing and extraction processes, in the dry-cleaning industry, as a diluent, in paints and adhesives, and in textile processing. Oral exposure to TCE has resulted in nervous system effects such as headache, nausea, facial numbness, and blurred vision. High-level, acute exposure to TCE through both the inhalation

and ingestion routes has been shown to cause death in humans. Short term exposures have caused ataxia, sleep disturbances, and trigeminal neuropathy. The most common effect observed in animal studies has been liver enlargement. *In-vitro* mutagenicity tests have demonstrated weak positive responses. TCE has been shown to be carcinogenic in animals by a mechanism which is very similar to a potential human mechanism. Inhalation and oral exposure produced liver and lung tumors in mice, and kidney adenocarcinomas and leukemia in rats. It is classified as a B2, probable human carcinogen.

References:
Clayton, George D. and Florence E. Clayton, (Eds), 1981. Patty's Industrial Hygiene and Toxicology, 3rd Revised Edition; John Wiley & Sons; New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

1,2-Dichlorobenzene. 1,2-dichlorobenzene has been used as a solvent, fumigant, insecticide, and chemical intermediate. 1,2-dichlorobenzene is a CNS depressant. Chronic exposure to this chemical causes hepatotoxicity and renal toxicity. 1,2-dichlorobenzene has been classified by EPA in group D, not classifiable regarding carcinogenicity.

References:
Clayton, George D. and Florence E. Clayton, editors, 1981. Patty's Industrial Hygiene and Toxicology, 3rd Revised Edition; John Wiley & Sons; New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

1,3-Dichlorobenzene. Commercial production of 1,3-dichlorobenzene is negligible. It has potential uses as a pesticide or fumigant. 1,3-Dichlorobenzene may occur as a contaminant of 1,2- or 1,4-dichlorobenzene formulations. There is no carcinogenicity data available. Statistically significant, dose-related increases in micronuclei were observed in bone marrow cells of male mice injected intraperitoneally with 1,3-dichlorobenzene. However, no reversions significantly above control were observed in the Salmonella/microsome assay, in an E. coli reversion test, or in Bacillus subtilis DNA-deficient repair test. In rats, no teratogenic effects were observed. There is limited information on toxicity of 1,3-dichlorobenzene. Liver dysfunction and minimal liver necrosis were observed in rats following exposure to 1,3-dichlorobenzene. *In vivo* studies in rats, in which hepatotoxic effects of three dichlorobenzenes were compared, indicated that the isomers tested can be ranked as follows: 1,2-dichlorobenzene>1,3-dichlorobenzene>1,4-dichlorobenzene. 1,3-dichlorobenzene is classified by USEPA as a D, not classifiable to human carcinogenicity.

References:
The Installation restoration Program Toxicology Guide, 1989. Dibromochloromethane. The Installation Restoration Program Toxicology Guide, Volume 2.

1,4-Dichlorobenzene. 1,4-Dichlorobenzene has been used as mothballs, an insecticidal fumigant, a germicide, and a space deodorant. Human exposure to 1,4-dichlorobenzene has produced irritation to skin, throat, and eyes; prolonged exposure to high concentrations may cause weakness, dizziness, loss of weight, or liver injury. In several studies involving female rats and mice, no overt

signs of toxicity were apparent at any exposure level. Nontumor and tumor pathology did not indicate any treatment related effect of either species. An embryotoxicity and teratology study on rats did not demonstrate any signs of embryo- or fetotoxicity or teratogenicity at any exposure level (Loeser, 1983). In a series of mutagenicity tests, 1,4-dichlorobenzene did not produce a mutagenetic response. (Loeser, 1983). Other exposure studies in rats have produced developmental abnormalities, fetotoxicity, and kidney tumors. Additional exposure studies in animals have produced histological changes in the lung, cirrhosis and necrosis of the liver, swelling of the tubular epithelium of the kidneys. 1,4-dichlorobenzene has been classified by the USEPA as a group C carcinogen, possibly carcinogenic to humans.

References:
Heath Effects Summary Tables (HEAST), 1993. United States Environmental Protection Agency.

Loeser E, Litchfield MH; Food Chem Toxicol 21 (6): 825-32 (1983)

2-Methylnaphthalene. 2-Methylnaphthalene is a member of the polycyclic aromatic hydrocarbons (PAH) class of organic compounds, and is used in the synthesis of chemicals such as insecticides. Toxicological data on 2-methylnaphthalene is extremely limited. However, based on its structural similarity to naphthalene, it is likely to be metabolized through a similar process and, therefore, is expected to exert effects similar to those induced by naphthalene. Humans can absorb naphthalene via the inhalation, oral, and dermal routes. Evidence from human and animal studies suggests that naphthalene is metabolized by the P450 mixed function oxidase system to form metabolites that exert toxic effects. The primary target organ for naphthalene metabolites in humans is the red blood cell. Various types and severities of anemia resulting from erythrocyte hemolysis have been documented in humans and animals exposed to naphthalene. Some evidence also suggests that naphthalene metabolites can induce cataracts in humans and animals. No studies were located investigating genotoxicity or cancer in humans.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1989. Toxicological Profile for Naphthalene and 2-Methylnaphthalene. U.S. Public Health Service.

2-Methylphenol/4-Methylphenol. 2-Methylphenol and 4-methylphenol are present in wood and tobacco smoke, crude oil, and coal tar. Anthropogenic sources include disinfectants and deodorizers. Dermal contact with methylphenols may cause a rash, skin irritation, or nephrotoxicity. Animal studies have indicated that exposure to methylphenols causes nervous system effects including muscle twitching and loss of coordination. Some experiments suggest that methylphenols may act as promoters of carcinogenicity. The USEPA has not classified methylphenols regarding carcinogenicity.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1990. Toxicological Profile for Creosols. U.S. Public Health Service

Benzo(a)anthracene. Benzo(a)anthracene is a member of the polycyclic aromatic hydrocarbons (PAH) class of compounds which contain two or more aromatic rings. Both natural and anthropogenic sources contribute to the ubiquitous distribution of PAHs in the environment. They occur naturally in coal tar and crude oil and

are formed from incomplete combustion of organic material. Benzo(a)anthracene is a product of pyrolysis in tobacco smoke. It has produced skin tumors in laboratory animals after dermal application. Although there are no human data that specifically link exposure to benzo(a)anthracene to human cancers, benzo(a)anthracene is a component of mixtures that have been associated with human cancer. As such, benzo(a)anthracene has been classified by EPA as a B2, probable human carcinogen.

References:

Clayton, George D. and Florence E. Clayton, (Eds). 1981. Patty's Industrial Hygiene and Toxicology, 3rd Revised Edition; John Wiley & Sons; New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Benzo(a)pyrene. Benzo(a)pyrene is a member of the polycyclic aromatic hydrocarbons (PAH) class of compounds which contain two or more aromatic rings. Both natural and anthropogenic sources contribute to the ubiquitous distribution of PAHs in the environment. They occur naturally in coal tar and crude oil and are formed from incomplete combustion of organic material. Human data demonstrating a causal relationship linking benzo(a)pyrene to carcinogenicity are lacking. However, multiple animal studies in many species demonstrate benzo(a)pyrene to be carcinogenic following administration by a variety of routes. The mechanism through which benzo(a)pyrene elicits its carcinogenic potential is well understood. Benzo(a)pyrene has produced positive results in numerous genotoxicity assays. Benzo(a)pyrene has been classified by the EPA as a B2, probable human carcinogen.

References:

Agency for Toxic Substances and Disease Registry (ATSDR), 1989. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. U.S. Public Health Service.

Clayton, George D. and Florence E. Clayton, editors, 1981. Patty's Industrial Hygiene and Toxicology, 3rd Revised Edition; John Wiley & Sons; New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Benzo(b)fluoranthene. Benzo(b)fluoranthene is a member of the polycyclic aromatic hydrocarbons (PAH) class of compounds which contain two or more aromatic rings. Both natural and anthropogenic sources contribute to the ubiquitous distribution of PAHs in the environment. They occur naturally in coal tar and crude oil and are formed from incomplete combustion of organic material. Although there are no human data that specifically link exposure to benzo(b)-fluoranthene to human cancers, benzo(b)fluoranthene is a component of mixtures that have been associated with human cancer. Benzo(b)fluoranthene produced tumors in mice after lung implantation, intraperitoneal, or subcutaneous injection, and skin painting experiments. Benzo(b)fluoranthene has been classified as a B2, probable human carcinogen, by the USEPA.

References:

Agency for Toxic Substances and Disease Registry (ATSDR), 1987 Toxicological Profile for Benzo(b)fluoranthene. U.S. Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR), 1989. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. U.S. Public Health Service.

Benzo(k)fluoranthene. Benzo(k)fluoranthene is a member of the polycyclic aromatic hydrocarbons (PAH) class of compounds which contain two or more aromatic rings. Both natural and anthropogenic sources contribute to the ubiquitous distribution of PAHs in the environment. They occur naturally in coal tar and crude oil and are formed from incomplete combustion of organic material. Although there are no human data that specifically link exposure to benzo(k)-fluoranthene to human cancers, benzo(k)fluoranthene is a component of mixtures that have been associated with human cancer. These include coal tar, soot, coke oven emissions and cigarette smoke. Benzo(k)fluoranthene produced tumors after lung implantation in mice and when administered with a promoting agent in skin-painting studies. Benzo(k)fluoranthene has been classified by EPA as a B2, probable human carcinogen.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1989. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. U.S. Public Health Service.

Chrysene. Chrysene is one of the polycyclic aromatic hydrocarbon (PAH) compounds which are formed during the combustion of organic material. Although there are no human data that specifically link exposure to chrysene to human cancers, chrysene is a component of mixtures that have been associated with human cancer. These include coal tar, soot, coke oven emissions, and cigarette smoke. Chrysene has produced papillomas and carcinomas in mice dermally exposed to chrysene. Chrysene has been classified as a B2, probable human carcinogen, due to its similarities with other carcinogenic PAHs and available experimental evidence.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1989. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. U.S. Public Health Service, October, 1989.

Dibenz(a,h)anthracene. Dibenz(a,h)anthracene is a member of the polycyclic aromatic hydrocarbon (PAH) class of compounds which contain two or more aromatic rings. Both natural and anthropogenic sources contribute to the ubiquitous distribution of PAHs in the environment. The primary source of atmospheric PAH is incomplete combustion of wood and fuel. Human data demonstrating a causal relationship linking dibenz(a,h)anthracene to carcinogenicity are lacking. However, chronic exposure of mice to dibenz(a,h)anthracene demonstrated a dose-response relationship for skin tumors. Dibenz(a,h)anthracene has been classified as a B2, probable human carcinogen, by the USEPA.

References:
Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Agency for Toxic Substances and Disease Registry (ATSDR), 1993. Toxicological Profile for Polycyclic Aromatic Hydrocarbons - Draft. U.S. Public Health Service.

Indeno(1,2,3-cd)pyrene. Indeno(1,2,3-cd)pyrene is a member of the polycyclic aromatic hydrocarbon (PAH) class of compounds which contain two or more aromatic

rings. Both natural and anthropogenic sources contribute to the ubiquitous distribution of PAH in the environment. The primary source of atmospheric PAH is incomplete combustion of wood and fuel. Animal data suggest that dermal application indeno(1,2,3-cd)pyrene does not result in skin tumors, however it does exhibit a dose-response relationship as skin tumor initiator. Indeno(1,2,3-cd)pyrene is classified by the USEPA as a B2, or probable carcinogen.

References:
Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Agency for Toxic Substances and Disease Registry (ATSDR), 1993. Toxicological Profile for Polycyclic Aromatic Hydrocarbons - Draft. U.S. Public Health Service.

Naphthalene. In the United States, naphthalene is used in the production of phthalic anhydride, carbaryl (an insecticide), tanning agents, moth repellents, and surfactants. Humans can absorb naphthalene via the inhalation, oral, and dermal routes. Evidence from human and animal studies suggests that naphthalene is metabolized by the P450 mixed function oxidase system to form metabolites that exert toxic effects. The primary target organ for naphthalene metabolites in humans is the red blood cell. Various types and severities of anemia resulting from erythrocyte hemolysis have been documented in humans and animals exposed to naphthalene. Some evidence also suggests that naphthalene metabolites can induce cataracts in humans and animals. There is inadequate evidence of carcinogenicity (USEPA classifies the compound as a D carcinogen).

References:
Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Agency for Toxic Substances and Disease Registry (ATSDR), 1989. Toxicological Profile for Naphthalene and 2-Methylnaphthalene. U.S. Public Health Service.

Bis(2-ethylhexyl)phthalate (DEHP). DEHP is used industrially as a plasticizer for resins and is found in many plastic materials as it makes them more flexible. It is also used in manufacturing organic pump fluids in electrical capacitors. Acute exposure to DEHP has produced eye and mucous membrane irritation, nausea, and diarrhea. Chronic exposure of laboratory animals to DEHP indicate that the target organs are the liver, causing morphological and biochemical changes, as well as the testes, producing damage to the seminiferous tubules. DEHP has produced developmental and reproductive effects in laboratory animals including spina bifida and reduced fertility. DEHP has been shown to cause a dose-related increase in liver tumors in mice and rats. Thus, the USEPA has designated DEHP as a B2, probable human carcinogen.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1991. Toxicological Profile for Di(2-ethylhexyl)phthalate. U.S. Public Health Service.

Polychlorinated Biphenyls (PCBs). PCBs were historically used in electrical capacitors and transformers due to their thermal stability and dielectric capability. There are many different aroclors (PCB congeners) whose toxicological properties vary according to the conger. Acute exposure to PCBs generally

produces chloracne, eye irritation, gastrointestinal disturbances, and headaches. Chronic exposure to PCBs even at low levels can cause liver function changes in humans. Animal studies have indicated that PCBs are teratogenic. PCBs have been classified as B2 carcinogens by the USEPA.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1989. Toxicological Profile for Selected PCBs. U.S. Public Health Service.

Endrin Ketone. Endrin ketone, like endrin aldehyde, is not a commercial product, but rather an impurity in the pesticide endrin. Endrin was a commonly used agricultural insecticide-rodenticide from the early 1960s to 1986, when its production in the United States was voluntarily terminated by the manufacturer. Endrin is absorbed via inhalation, oral, and dermal exposure routes. The primary toxic manifestation resulting from endrin exposure is acute neurotoxia. Both humans and animals have exhibited uncontrolled jerking, tremors, convulsions and death following endrin exposure. The endrin concentrations required to produce these effects have not been well quantified, but it is estimated that current environmental endrin concentrations are not significant enough to induce adverse neurological effects in humans. Animal studies suggest that endrin could pose a reproductive hazard to humans, but this has not been supported by clinical findings in humans. Endrin was not mutagenic in *vitro* assays, nor was it determined to be a causative cancer agent in epidemiologic studies.

References:

ATSDR, 1989. Toxicological Profile for Endrin and Endrin Aldehyde. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October, 1989.

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 which burn coal, and aluminum mining and smelting. Human exposure to aluminum may occur through ingestion of foods grown in soil that contains aluminum and use of antacids, antiperspirants, and other drugstore 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 suggests 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.

Antimony. Antimony enters the environment during the mining and processing of its ores and other related compounds. Small amounts of antimony are also released into the environment by incinerators and coal burning power plants. Antimony will strongly adhere to soil which contains iron, manganese, or aluminum. Antimony was used for medicinal purposes to treat people infected with parasites. However, chronic exposure can cause eye, skin, and lung irritation, as well as heart problems, vomiting, and diarrhea. The oral RfD, based on an oral drinking water study in rats, showed changes in glucose and cholesterol

metabolism. Antimony has not been evaluated by the USEPA for evidence of human carcinogenic potential.

References:

Agency for Toxic Substances and Disease Registry (ATSDR), 1991. Toxicological Profile for Antimony. U.S. Public Health Service.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Arsenic. The principle use of arsenic is in products used for wood preservation. It is also used in the manufacture of insecticides, herbicides, algicides, with smaller amounts used in the production of glass and nonferrous alloys. 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 as group A, human carcinogen, based on increased incidence of lung cancer in occupational studies.

References:

Agency for Toxic Substances and Disease Registry (ATSDR), 1992. Toxicological Profile for Arsenic. U.S. Public Health Service.

Beryllium. Atmospheric beryllium is derived primarily from the combustion of coal. It eventually is deposited in soil and sediment where it is retained in its insoluble form, beryllium oxide. When airborne, the lung is the primary target organ of beryllium toxicity via the inhalation pathway. Exposure to beryllium causes granuloma formation similar to sarcoidosis and miliary tuberculosis. Multisystem involvement includes lymph nodes, spleen, liver, heart, kidney, and bone. It is also a dermal sensitizer and a primary skin irritant that produces contact dermatitis, skin granulomas, and ulcers. Beryllium has been classified as a B2, probable human carcinogen.

References:

United States Environmental Protection Agency (USEPA), 1987. "Health Assessment Document for Beryllium;" Office of Health and Environmental Assessment; USEPA/600/8-84/026F; November 1987.

Chromium. Chromium has been used in plating for corrosion resistance and decorative purposes, in the manufacture of alloys, and in printing, dying, and photography. The toxicity of chromium depends upon its valence state. Hexavalent chromium is more toxic via inhalation than trivalent chromium. The effects of inhalation exposure to hexavalent chromium include ulcers of the upper respiratory tract, nasal inflammation, perforation of the nasal septa and lung cancer. Most trivalent chromium compounds are inactive in short-term geno-toxicity assays. Trivalent chromium compounds have not been found to be carcinogenic by any route of exposure. There is epidemiological evidence of an association between chromium and lung cancer. The USEPA has classified hexavalent chromium as an A, human carcinogen, by the inhalation route.

References:

Amdur, Mary O., John Doull, Curtis D. Klaassen (Eds), 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Iron. Iron is a naturally occurring element which is essential to the biological functions of living systems. Acute iron toxicity may occur after ingestion of more than 0.5 g of iron or 2.5 g of ferrous sulfate. Clinical signs of this condition include bloody vomitus due to ulceration of the gastrointestinal tract, signs of shock, metabolic acidosis, liver damage, and coagulation defects The mechanism of the toxicity is thought to begin with acute mucosal cell damage, absorption of the ferrous ions directly into circulation, which causes capillary endothelial cell damage in liver. Chronic iron overload may be characterized by disturbances in liver function, diabetes mellitus, and even endocrine disturbances and cardiovascular effects. There is inadequate evidence of carcinogenicity (USEPA classifies the compound as a D carcinogen).

References:
Goyer, R.A. 1991. Toxic effects of metals. In: Casarett and Doull's Toxicology: The Basic Science of Poisons, Fourth Edition. Eds: M.O.Amdur, J.Doull, and C.D.Klaassen.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Manganese. Manganese is a naturally occurring substance found in many types of rock. It does not generally occur in the environment as the pure metal; rather, it is found combined with other chemicals such as sulfur, oxygen, and chlorine. Manganese is mixed with iron to make various types of steel. Manganese is a component of some ceramics, pesticides, fertilizers, and in nutritional supplements. In small doses manganese is beneficial to human health. Manganese miners and steel workers exposed to elevated concentrations of manganese have evidenced mental and emotional disturbances and slow and clumsy body movements. Target organs of manganese are the lung and CNS. When inhaled, manganese dust can also cause lung irritation. EPA has classified manganese as a D, not classifiable as to human carcinogenicity.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1991. Toxicological Profile for Manganese. U.S. Public Health Service.

Vanadium. Vanadium is widely, but sparsely, distributed in the earth's crust and in the environment. It is invaluable as an alloying agent with steel; ferrovanadium alloys are used in high-stress applications such as bearings, jet engines, and cutting tools. Human and animal studies indicate that vanadium is readily absorbed from the lungs and poorly absorbed from the gastrointestinal tract. It distributes primarily to the bone and kidney. Vanadium is a respiratory irritant. Inhalation of vanadium dust in both animals and occupationally-exposed workers induces mild to moderate respiratory irritation. The effects are reversible and subside when exposure is discontinued. No studies were located regarding cancer in humans or animals following inhalation, oral, or dermal exposures. However, vanadium has been found to induce DNA damage in

human cell cultures, suggesting that vanadium may have the potential to be genotoxic to humans.

References:

Agency for Toxic Substances and Disease Registry (ATSDR), 1990. Toxicological Profile for Vanadium. U.S. Public Health Service.

APPENDIX P

HUMAN HEALTH DOSE-RESPONSE TABLES

Table P-1
Oral Dose-Response Data for Carcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Chemical	Weight of Evidence	Oral Slope Factor (mg/kg/day)(-1)	Source	Test Species	Exposure Route	Tumor Type	Study Source
Volatile Organic Compounds							
1,1,1-Trichloroethane	D	NE					
1,1-Dichloroethane	C	NE					
1,1-Dichloroethylene	C	6.0e-01	IRIS	Rat	Oral-drinking water	Adrenal	IRIS
1,2-Dichloroethylene (total)	D	NE					
Benzene	A	2.9e-02	IRIS	Human	Inhalation	Leukemia	IRIS
Bromodichloromethane	B2	6.2e-02	IRIS	Mouse	Oral-gavage	Kidney	IRIS
Chloroform	B2	6.1e-03	IRIS	Rat	Oral-drinking water	Kidney	IRIS
Dibromochloromethane	C	8.4e-02	IRIS	Mouse	Oral-gavage	Liver	IRIS
Trichloroethylene	B2	1.1e-02	(1)				
Semivolatile Organic Compounds							
1,2-Dichlorobenzene	D	NE					
1,3-Dichlorobenzene	D	NE					
1,4-Dichlorobenzene	C	2.4e-02	HEAST	Mouse	Oral-gavage	Liver	HEAST
2-Methylnaphthalene	D	NE					
4-Methylphenol	C	NE					
Benzo(a)Anthracene	B2	7.3e+00	(4)				
Benzo(a)Pyrene	B2	7.3e+00	IRIS	Mouse	Oral-diet	Forestomach	IRIS
Benzo(b)Fluoranthene	B2	7.3e+00	(4)				
Benzo(g,h,i)perylene	D	NE					
Benzo(k)Fluoranthene	B2	7.3e+00	(4)				
bis(2-Ethylhexyl)phthalate	B2	1.4e-02	IRIS	Rat	Oral-diet	Liver	IRIS
Chrysene	B2	7.3e+00	(4)				
Dibenz(a,h)Anthracene	B2	7.3e+00	(4)				
Indeno(1,2,3-c,d)Pyrene	B2	7.3e+00	(4)				
Naphthalene	D	NE					

See notes at end of table.

Table P-1
Oral Dose-Response Data for Carcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Chemical	Weight of Evidence	Oral Slope Factor (mg/kg/day)(-1)	Source	Test Species	Exposure Route	Tumor Type	Study Source
Pesticides/PCBs							
Aroclor-1248	B2	7.7e+00	(11)				
Aroclor-1254	B2	7.7e+00	(11)				
Endrin ketone	D	NE					
Inorganic Analytes							
Aluminum	D	NE					
Antimony	D	NE					
Arsenic	A	1.5e+00	IRIS (16)	Human	Oral-drinking water	Skin	IRIS
Beryllium	B2	4.3e+00	IRIS	Rat	Oral-drinking water	Total	IRIS
Chromium	D	NE					
Iron	D	NE					
Manganese	D	NE					
Vanadium	D	NE					

(1) This value was provided by the Environmental Criteria and Assessment Office (ECAO) of the USEPA in response to a specific request.
(4) The ingestion slope factor for benzo(a)pyrene was used as a surrogate for all PAHs classified as A or B carcinogens and for which a chemical-specific slope factor was not available.
(9) The values for chlordane have been used as surrogates for alpha- and gamma-chlordane.
(11) The ingestion slope factor for PCBs, in which Aroclor-1260 was evaluated, has been used as a surrogate for all Aroclors.
(15) Values for 1,3-dichloropropene were used as surrogates for cis- and trans-1,3-dichloropropene.
(16) The ingestion slope factor for arsenic has been calculated from the drinking water unit risk of 5.00E-05 per (micrograms per liter).
(20) "Dinitrotoluene mixture, 2,4-/2,6-" has been used as a surrogate for 2,4- and 2,6-dinitrotoluene.

Notes: Integrated Risk Information System (IRIS) on-line database search, current as of November 1994.
Health Effects Assessment Summary Tables (HEAST), current as of March 1994.
Weight of Evidence (route-specific):

NE = Not Evaluated.
A = Human carcinogen.
B = Probable human carcinogen (B1 = limited human evidence; B2 = sufficient human evidence).
C = Possible human carcinogen.
D = Not classifiable as to human carcinogenicity.

Table P-2
Inhalation Dose-Response Data for Carcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Chemical	Weight of Evidence	Inhalation Slope Factor (mg/kg/day)(-1)	Source	Inhalation Unit Risk ($\mu g/m^3$)(-1)	Source	Test Species	Exposure Route	Tumor Type	Study Source
Volatile Organic Compounds									
1,1,1-Trichloroethane	D	NE		NE					
1,1-Dichloroethane	C	NE		NE					
1,1-Dichloroethylene	C	1.2e+00	HEAST	5.0e-05	IRIS	Mouse	Inhalation	Kidney	IRIS
1,2-Dichloroethylene (total)	D	NE		NE					
Benzene	A	2.9e-02	HEAST	8.3e-06	IRIS	Human	Inhalation	Leukemia	IRIS
Bromodichloromethane	D	NE		NE					
Chloroform	B2	8.1e-02	HEAST	2.3e-05	IRIS	Mouse	Oral-gavage	Liver	IRIS
Dibromochloromethane	D	NE		NE					
Trichloroethylene	B2	6.0e-03	(1)	1.7e-06	(1)				
Semivolatile Organic Compounds									
1,2-Dichlorobenzene	D	NE		NE					
1,3-Dichlorobenzene	D	NE		NE					
1,4-Dichlorobenzene	D	NE		NE					
2-Methylnaphthalene	D	NE		NE					
4-Methylphenol	C	NE		NE					
Benzo(a)Anthracene	B2	NE		NE					
Benzo(a)Pyrene	B2	NE		NE					
Benzo(b)Fluoranthene	B2	NE		NE					
Benzo(k)Fluoranthene	B2	NE		NE					
bis(2-Ethylhexyl)phthalate	D	NE		NE					
Chrysene	B2	NE		NE					
Dibenz(a,h)Anthracene	B2	NE		NE					
Indeno(1,2,3-c,d)Pyrene	B2	NE		NE					
Naphthalene	D	NE		NE					

See notes at end of table.

Table P-2 (Continued)
Inhalation Dose-Response Data for Carcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Chemical	Weight of Evidence	Inhalation Slope Factor (mg/kg/day)(-1)	Source	Inhalation Unit Risk ($\mu g/m^3$)(-1)	Source	Test Species	Exposure Route	Tumor Type	Study Source
Pesticides/PCBs									
Aroclor-1248	B2	NE		NE					
Aroclor-1254	B2	NE		NE					
Endrin ketone	D	NE		NE					
Inorganic Analytes									
Aluminum	D	NE		NE					
Antimony	D	NE		NE					
Arsenic	A	5.0e+01	HEAST	4.3e-03	IRIS	Human	Inhalation	Lung	IRIS
Beryllium	B2	8.4e+00	HEAST	2.4e-03	IRIS	Human	Inhalation	Lung	IRIS
Chromium	A	4.1e+01	HEAST (7)	1.2e-02	IRIS (7)	Human	Inhalation	Lung	IRIS
Iron	D	NE		NE					
Manganese	D	NE		NE					
Vanadium	D	NE		NE					

(1) This value was provided by the Environmental Criteria and Assessment Office (ECAO) of the USEPA in response to a specific request.
(3) The inhalation slope factor for benzo(a)pyrene was used as a surrogate for all PAHs classified as A or B carcinogens and for which a chemical-specific slope factor was not available.
(7) The toxicity values for chromium are based on chromium VI.
(9) The values for chlordane have been used as surrogates for alpha- and gamma-chlordane.
(13) The toxicity values for nickel are based on nickel refinery dust.
(15)Values for 1,3-dichloropropene were used as surrogates for cis- and trans-1,3-dichloropropene.

Notes: Integrated Risk Information System (IRIS) on-line database search, current as of November 1994.
Health Effects Assessment Summary Tables (HEAST), current as of March 1994.
Weight of Evidence (route-specific):

NE = Not Evaluated.
A = Human carcinogen.
B = Probable human carcinogen (B1 = limited human evidence; B2 = sufficient human evidence).
C = Possible human carcinogen.
D = Not classifiable as to human carcinogenicity.

Table P-3
Dermal Dose-Response Data for Carcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Compound	Weight of Evidence	Oral Slope Factor (mg/kg-day)-1	Oral Absorption Efficiency	Reference	Dermal Slope Factor (mg/kg-day)-1
Volatile Organic Compounds					
1,1,1-Trichloroethane	D	NE			NE
1,1-Dichloroethane	C	NE		(26)	NE
1,1-Dichloroethylene	C	6.0e-01	100%	Putcha et al., 1986	6.0e-01
1,2-Dichloroethylene (total)	D	NE			NE
Benzene	A	2.9e-02		(26)	2.9e-02
Bromodichloromethane	B2	6.2e-02			
Chloroform	B2	6.1e-03	100%	Brown et al., 1974	6.1e-03
Dibromochloromethane	C	8.4e-02			
Trichloroethylene	B2	1.1e-02	100%	Prout et al., 1985	1.1e-02
Semivolatile Organic Compounds					
1,2-Dichlorobenzene	D	NE			NE
1,3-Dichlorobenzene	D	NE			NE
1,4-Dichlorobenzene	C	2.4e-02	100%	ATSDR, 1989b	2.4e-02
2-Methylnaphthalene	D	NE			NE
4-Methylphenol	C	NE			NE
Benzo(a)Anthracene	B2	7.3e+00	91%	(30)	8.0e+00
Benzo(a)Pyrene	B2	7.3e+00	91%	Hecht et al., 1979	8.0e+00
Benzo(b)Fluoranthene	B2	7.3e+00	91%	(30)	8.0e+00
Benzo(k)Fluoranthene	B2	7.3e+00	91%	(30)	8.0e+00
bis(2-Ethylhexyl)phthalate	B2	1.4e-02	100%	Chadwick et al., 1982	1.4e-02
Chrysene	B2	7.3e+00	91%	(30)	8.0e+00
Dibenz(a,h)Anthracene	B2	7.3e+00	91%	(30)	8.0e+00
Indeno(1,2,3-c,d)Pyrene	B2	7.3e+00	91%	(30)	8.0e+00
Naphthalene	D	NE			NE

See notes at end of table.

Table P-3 (Continued)
Dermal Dose-Response Data for Carcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Compound	Weight of Evidence	Oral Slope Factor (mg/kg-day)-1	Oral Absorption Efficiency	Reference	Dermal Slope Factor (mg/kg-day)-1
Pesticides/PCBs					
Aroclor-1248	B2	7.7e+00	90%	Albro & Fishbein, 1972	8.56e+00
Aroclor-1254	B2	7.7e+00	90%	Albro & Fishbein, 1972	8.56e+00
Endrin ketone	D	NE			NE
Inorganic Analytes					
Aluminum	D	NE			NE
Antimony	D	NE			NE
Arsenic	A	1.5e+00	98%	Vahter, 1983	1.5e+00
Beryllium	B2	4.3e+00	1%	Owen, 1990	4.3e+02
Chromium	D	NE			NE
Iron	D	NE			NE
Manganese	D	NE			NE
Vanadium	D	NE			NE

(26) This toxicity values is based on absorbed dose. Therefore, no adjustment of this value is necessary.
(28) SVOCs lacking specific information on absorption efficiency are assigned a default value of 50 percent (USEPA Region IV, 1993).
(30) The oral absorption efficiency of all PAHs is assumed to be identical to that of benzo(a)pyrene, based on structural analogy.
(32) The oral absorption efficiency of DDE and DDD is assumed to be identical to that of DDT, based on structural analogy.
(33) The oral absorption efficiency of alpha-chlordane is assumed to be identical to that of gamma-chlordane, based on structural analogy.
(34) The oral absorption efficiency of heptachlor epoxide is assumed to be identical to that of heptachlor, based on structural analogy.

Notes: For documentation concerning oral slope factors, refer to Table 1.
Weight of Evidence (route-specific):

NE = Not Evaluated.
A = Human carcinogen.
B = Probable human carcinogen (B1 = limited human evidence; B2 = sufficient human evidence).
C = Possible human carcinogen.
D = Not classifiable as to human carcinogenicity.

Table P-4
Oral Dose-Response Data for Noncarcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, 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						
Volatile Organic Compounds										
1,1,1-Trichloroethane	ND		ND							
1,1-Dichloroethane	1.0e-01	HEAST	1.0e+00	HEAST	Inhalation	Low	No effects observed	Rat	1000 H,A,S	HEAST
1,1-Dichloroethylene	9.0e-03	IRIS	9.0e-03	HEAST	Oral-drinking water	Medium	Hepatic lesions	Rat	1000 H,A,L	IRIS
1,2-Dichloroethylene (total)	9.0e-03	HEAST (14)	9.0e-03	HEAST (14)						
Benzene	ND		ND							
Bromodichloromethane	2.0e-02	IRIS	2.0e-02	HEAST	Oral-gavage	Medium	Renal cytomegaly	Mouse	1000 H,A,L	IRIS
Chloroform	1.0e-02	IRIS	1.0e-02	HEAST	Oral-capsule	Medium	Fatty cyst formation in liver	Dog	1000 H,A,L	IRIS
Dibromochloromethane	2.0e-02	IRIS	2.0e-01	HEAST	Oral-gavage	Medium	Hepatic lesions	Rat	1000 H,A,S	IRIS
Trichloroethylene	6.0e-03	(1)	ND							
Semivolatile Organic Compounds										
1,2-Dichlorobenzene	9.0e-02	IRIS	ND		Oral-gavage	Low	No adverse effects observed	Rat	1000 H,A,D	IRIS
1,3-Dichlorobenzene	9.0e-02	(2)	ND							
1,4-Dichlorobenzene	9.0e-02	(2)	ND							
2-Methylnaphthalene	4.0e-02	(3)	ND							
4-Methylphenol	5.0e-03	HEAST	5.0e-03	HEAST	Oral-gavage	Medium	Hypoactivity, respiratory distress	Rabbit	1000 H,A,S	HEAST
Benzo(a)Anthracene	ND		ND							
Benzo(a)Pyrene	ND		ND							
Benzo(b)Fluoranthene	ND		ND							
Benzo(k)Fluoranthene	ND		ND							
bis(2-Ethylhexyl)phthalate	2.0e-02	IRIS	ND		Oral-diet	Medium	Increased liver weight	Guinea pig	1000 H,A,S,L	IRIS

See notes at and of table.

Table P-4 (Continued)
Oral Dose-Response Data for Noncarcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, 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						
Semivolatile Organic Compounds (Continued)										
Chrysene	ND		ND							
Dibenz(a,h)Anthracene	ND		ND							
Indeno(1,2,3-c,d)Pyrene	ND		ND							
Naphthalene	4.0e-02	(1)	ND							
Pesticides/PCBs										
Aroclor-1248	2.0e-05	(6)	ND							
Aroclor-1254	2.0e-05	IRIS	ND		Oral-capsule	Medium	Immunological and clinical effects	Monkey	100 H,A,S,L	IRIS
Endrin ketone	3.0e-04	(4)	ND							
Inorganic Analytes										
Aluminum	1.0e+00	(1)	ND							
Antimony	4.0e-04	IRIS	4.0e-04	HEAST	Oral-drinking water	Low	Reduced lifespan	Rat	1000 H,A,L	IRIS
Arsenic	3.0e-04	IRIS	3.0e-04	HEAST	Oral-drinking water	Medium	Hyperpigmentation, keratosis	Human	3 D	IRIS
Beryllium	5.0e-03	IRIS	5.0e-03	HEAST	Oral-drinking water	Low	No effects observed	Rat	100 H,A	IRIS
Chromium	5.0e-03	IRIS (7)	2.0e-02	HEAST (7)	Oral-drinking water	Low	No effects observed	Rat	500 H,A,S	IRIS
Iron	ND		ND							
Manganese Food	1.4e-01	IRIS	1.4e-01	HEAST	Oral-diet	NA	CNS effects	Human	1	IRIS
Drinking Water	5.0e-03	IRIS	5.0e-03	HEAST	Oral-drinking water	NA	CNS effects	Human	1	IRIS
Vanadium	7.0e-03	HEAST	7.0e-03	HEAST	Oral-drinking water	Low	No effects observed	Rat	100 H,A	HEAST

See notes at end of table.

Table P-4 (Continued)
Oral Dose-Response Data
for Noncarcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

(1) This value was provided by the Environmental Criteria and Assessment Office (ECAO) of the USEPA in response to a specific request.
(2) The value for 1,2-dichlorobenzene has been used as a surrogate for 1,3-dichlorobenzene and 1,4-dichlorobenzene, based on structural analogy.
(3) The value for naphthalene has been used as a surrogate for 2-methylnaphthalene, based on structural analogy.
(4) The value for endrin has been used as a surrogate for endrin ketone, based on structural analogy.
(6) The chronic ingestion RfD for Aroclor-1254 has been used as a surrogate for all Aroclors lacking chemical-specific RfDs.
(7) The toxicity values for chromium are based on chromium VI.
(9) The values for chlordane have been used as surrogates for alpha- and gamma-chlordane.
(10) The values for endosulfan have been used as surrogates for endosulfan II and endosulfan sulfate.
(12) A drinking water standard for copper of 1.3 mg/L exists. Inadequate toxicity information is available to calculate an RfD.
(14) The values for 1,1-dichloroethylene have been used as surrogates for 1,2-dichloroethylene (total) adopted based on analogy.
(15)Values for 1,3-dichloropropene were used as surrogates for cis- and trans-1,3-dichloropropene.
(17) The ingestion RfD values for nickel are based on nickel, soluble salts.
(18) The ingestion RfD values for thallium are based on thallium sulfate.
(23) This mercury value is specific for inorganic mercury.
(25) This value is provided for childhood exposures. An oral RfD of 1.8e-01 mg/kg-day is provided for adult exposures (ECAO).

Notes: Integrated Risk Information System (IRIS) on-line database search, current as of November 1994.
Health Effects Assessment Summary Tables (HEAST), current as of March 1994.

Uncertainty factors:
ND = No Data.
NA = Not Applicable.
H = Variation in human sensitivity.
A = Animal to human extrapolation.
S = Extrapolation from subchronic to chronic (NOAEL).
L = Extrapolation from lowest observed adverse effects level to NOAEL.
D = Inadequate data.
M = Modifying factor.

Table P-5
Inhalation Dose-Response Data for Noncarcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Chemical	Chronic		Subchronic		Study Type	Confidence Level	Critical Effect	Test Animal	Uncertainty Factor	Study Source
	RfC ($\mu g/m^3$)	Source	RfC ($\mu g/m^3$)	Source						
Volatile Organic Compounds										
1,1,1-Trichloroethane	1.0e+03		ND							
1,1-Dichloroethane	5.0e+02	HEAST (3)	5.0e+03	HEAST (4)	Inhalation	Low	Kidney damage	Cat	1000 H,A,S	HEAST
1,1-Dichloroethylene	ND		ND							
1,2-Dichloroethylene (total)	ND		ND							
Benzene	ND		ND							
Bromodichloromethane	ND		ND							
Chloroform	ND		ND							
Dibromochloromethane	ND		ND							
Trichloroethylene	ND		ND							
Semivolatile Organic Compounds										
1,2-Dichlorobenzene	2.0e+02	HEAST (16)	2.0e+03	HEAST	Inhalation	Low	Decreased weight gain	Rat	1000 H,A,S	HEAST
1,3-Dichlorobenzene	ND		ND							
1,4-Dichlorobenzene	8.0e+02	IRIS	2.5e+03	HEAST	Inhalation	Medium	Increased liver weight	Rat	100 H,A,S	IRIS
2-Methylnaphthalene	ND		ND							
4-Methylphenol	ND		ND							
Benzo(a)Anthracene	ND		ND							
Benzo(a)Pyrene	ND		ND							
Benzo(b)Fluoranthene	ND		ND							
Benzo(k)Fluoranthene	ND		ND							
bis(2-Ethylhexyl)phthalate	ND		ND							

See notes at end of table.

Table P-5 (Continued)
Inhalation Dose-Response Data for Noncarcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

Chemical	Chronic		Subchronic		Study Type	Confidence Level	Critical Effect	Test Animal	Uncertainty Factor	Study Source
	RfC ($\mu g/m^3$)	Source	RfC ($\mu g/m^3$)	Source						
Semivolatile Organic Compounds (Continued)										
Chrysene	ND		ND							
Dibenz(a,h)Anthracene	ND		ND							
Indeno(1,2,3-c,d)Pyrene	ND		ND							
Naphthalene	ND		ND							
Pesticides/PCBs										
Aroclor-1248	ND		ND							
Aroclor-1254	ND		ND							
Endrin ketone	ND		ND							
Inorganic Analytes										
Aluminum	ND		ND							
Antimony	ND		ND							
Arsenic	ND		ND							
Beryllium	ND		ND							
Chromium	ND		ND							
Iron	ND		ND							
Manganese	5.0e-02	IRIS	ND		Inhalation	Medium	Impaired neurobehavioral function	Human	1000 H,L,D	IRIS
Vanadium	ND		ND							

See notes at end of table.

Table P-5 (Continued)
Inhalation Dose-Response Data for Noncarcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

(3) 1,1-Dichloroethane has a chronic inhalation RfD of 1.0e-01 mg/kg-day (HEAST).
(4) 1,1-Dichloroethane has a subchronic inhalation RfD of 1.0e+00 mg/kg-day (HEAST).
(6) 4-Methyl-2-pentanone has a chronic inhalation RfD of 2.0e-02 mg/kg-day (HEAST).
(7) 4-Methyl-2-pentanone has a subchronic inhalation RfD of 2.0e-01 mg/kg-day (HEAST).
(8) 1,2,4-Trichlorobenzene has a chronic inhalation RfD of 3.0e-03 mg/kg-day (HEAST).
(9) 1,2,4-Trichlorobenzene has a subchronic inhalation RfD of 3.0e-02 mg/kg-day (HEAST).
(10) Nitrobenzene has a chronic inhalation RfD of 6.0e-04 mg/kg-day (HEAST).
(11) Nitrobenzene has a subchronic inhalation RfD of 6.0e-04 mg/kg-day (HEAST).
(12) Barium has a chronic inhalation RfD of 1.0e-04 mg/kg-day (HEAST).
(13) Barium has a subchronic inhalation RfD of 1.0e-03 mg/kg-day (HEAST).
(14) Chlorobenzene has a chronic inhalation RfD of 5.0e-03 mg/kg-day (HEAST).
(15) Values for 1,3-dichloropropene were used as surrogates for cis- and trans-1,3-dichloropropene.
(16) 1,2-Dichlorobenzene has a chronic inhalation RfD of 4.0e-02 mg/kg-day (HEAST).
(21) The mercury RfC values were developed specifically for elemental mercury.

Notes: Integrated Risk Information System (IRIS) on-line database search, current as of November 1994.
Health Effects Assessment Summary Tables (HEAST), current as of March 1994.
Uncertainty factors:
A = Animal to human extrapolation.
H = Variation in human sensitivity.
S = Extrapolation from subchronic to chronic NOAEL.
L = Extrapolation from LOAEL to NOAEL.
D = Inadequate data.
M = Modifying factor.

ND = No Data.
NA = Not Applicable.

Table P-6
Dermal Dose-Response Data for Noncarcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

	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)
Volatile Organic Compounds						
1,1,1-Trichloroethane	ND	ND			ND	ND
1,1-Dichloroethane	1.0e-01	1.0e+00		(26)	1.0e-01	1.0e+00
1,1-Dichloroethylene	9.0e-03	9.0e-03	100%	Putcha et al., 1986	9.0e-03	9.0e-03
1,2-Dichloroethylene (total)	9.0e-03	9.0e-03	100%	(24)	9.0e-03	9.00e-03
Benzene	ND	ND		(26)	ND	ND
Bromodichloromethane	2.0e-02	2.0e-02				
Chloroform	1.0e-02	1.0e-02	100%	Brown et al., 1974	1.0e-02	1.0e-02
Dibromochloromethane	2.0e-02	2.0e-01				
Trichloroethylene	7.0e-03	ND	100%	Prout et al., 1985	7.0e-03	ND
Semivolatile Organic Compounds						
1,2-Dichlorobenzene	9.0e-02	ND	100%	(27)	9.0e-02	ND
1,3-Dichlorobenzene	9.0e-02	ND	100%	(27)	9.0e-02	ND
1,4-Dichlorobenzene	9.0e-02	ND	100%	ATSDR, 1989b	9.0e-02	ND
2-Methylnaphthalene	4.0e-02	ND	91%	(30)	3.6e-02	ND
4-Methylphenol	5.0e-03	5.0e-03	95%	(29)	4.8e-03	4.75e-03
Benzo(a)Anthracene	ND	ND	91%	(30)	ND	ND
Benzo(a)Pyrene	ND	ND	91%	Hecht et al., 1979	ND	ND
Benzo(b)Fluoranthene	ND	ND	91%	(30)	ND	ND
Benzo(k)Fluoranthene	ND	ND	91%	(30)	ND	ND
bis(2-Ethylhexyl)phthalate	2.0e-02	ND	100%	Chadwick et al., 1982	2.0e-02	ND
Chrysene	ND	ND	91%	(30)	ND	ND
Dibenz(a,h)Anthracene	ND	ND	91%	(30)	ND	ND
Indeno(1,2,3-c,d)Pyrene	ND	ND	91%	(30)	ND	ND
Naphthalene	4.0e-02	ND	100%	Chang, 1943	4.0e-02	ND

See notes at end of table.

Table P-6 (Continued)
Dermal Dose-Response Data for Noncarcinogenic Effects

Baseline Risk Assessment
Operable Unit 8
Naval Air Station Cecil Field
Jacksonville, Florida

	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)
Pesticides/PCBs						
Aroclor-1248	2.0e-05	ND	90%	Albro & Fishbein, 1972	1.8e-05	ND
Aroclor-1254	2.0e-05	ND	90%	Albro & Fishbein, 1972	1.8e-05	ND
Endrin ketone	3.0e-04	ND			ND	ND
Inorganic Analytes						
Aluminum	1.0e+00	ND	20%	(38)	2.0e-01	ND
Antimony	4.0e-04	4.00e-04	1%	ATSDR, 1991a	4.0e-06	4.00e-06
Arsenic	3.0e-04	3.00e-04	98%	Vahter, 1983	2.94e-04	2.94e-04
Beryllium	5.0e-03	5.00e-03	1%	Owen, 1990	5.0e-05	5.00e-05
Chromium	5.0e-03	2.00e-02	11%	Ogawa, 1976	5.5e-04	2.20e-03
Iron	ND	ND			ND	ND
Manganese	1.4e-01	1.4e-01	4%	ATSDR, 1991b	5.6e-03	5.60e-03
Vanadium	7.0e-03	7.0e-03	3%	ATSDR, 1991d	2.1e-04	2.10e-04

(24) The oral absorption efficiency of 1,2-dichloroethylene is assumed to be identical to that of 1,1-dichloroethylene, based on structural analogy.
(25) VOCs lacking specific information on absorption efficiency are assigned a default value of 80% (USEPA Region IV, 1993).
(26) This toxicity values is based on absorbed dose. Therefore, no adjustment of this value is necessary.
(27) The oral absorption efficiency of 1,2-dichlorobenzene and 1,3-dichlorobenzene is assumed to be identical to that of 1,4-dichlorobenzene, based on structural analogy.
(28) SVOCs lacking specific information on absorption efficiency are assigned a default value of 50% (USEPA Region IV, 1993).
(29) The oral absorption efficiency of 4-methylphenol is assumed to be identical to that of phenol (ATSDR, 1989e), based on structural analogy.
(30) The oral absorption efficiency of all PAHs is assumed to be identical to that of benzo(a)pyrene, based on structural analogy.
(31) The oral absorption efficiency of all phthalates is assumed to be identical to that of bis(2-ethylhexyl)phthalate, based on structural analogy.
(32) The oral absorption efficiency of DDE and DDD is assumed to be identical to that of DDT, based on structural analogy.
(33) The oral absorption efficiency of alpha-chlordane is assumed to be identical to that of gamma-chlordane, based on structural analogy.
(35) The oral absorption efficiency of 1,1,1-trichloroethane is assumed to be identical to that of 1,1,2-trichloroethane, based on structural analogy.
(36) The oral absorption efficiency of heptachlor epoxide is assumed to be identical to that of heptachlor, based on structural analogy.
(37) The oral absorption efficiency of endosulfan sulfate is assumed to be identical to that of endosulfan, based on structural analogy.
(38) Inorganics lacking specific information on absorption efficiency are assigned a default value of 20 percent (USEPA Region IV, 1993).

Notes: For documentation concerning chronic and subchronic oral RfDs, refer to Table P-4.

ND = No Data.

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APPENDIX R

RESULTS OF AQUATIC SAMPLING AT OPERABLE UNIT 8

ADDENDUM
TO
AQUATIC BIOLOGICAL SAMPLING SERVICES CONDUCTED AT NAVAL AIR STATION CECIL FIELD

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1. INTRODUCTION

In support of ABB Environmental Services, Inc. (ABB-ES) work at Naval Air Station (NAS) Cecil Field, Jacksonville, Florida, EA Engineering, Science and Technology provided aquatic biological sampling services. The aquatic sampling was conducted near hazardous waste sites in streams and lakes at NAS Cecil Field. The results of these studies will be used by ABB-ES to support both the assessment of ecological risks at these sites and remedial decision making. The objectives of the ecological assessment of these sites was to characterize aquatic habitats and to collect macroinvertebrates and fish. This report is an addendum to Aquatic Biological Sampling Services Conducted at NAS Cecil Field which was submitted in January 1994. The field and lab methods and data analyses for this report are the same as those described in the January 1994 report. The results of the macroinvertebrate sample analyses for all of the remaining stations not covered in the first report are presented here.

2. STUDY AREA

The study area consisted of Rowell Creek, Sal Taylor Creek, Yellow Water Creek, Lake Fretwell, and tributaries to these water bodies at NAS Cecil Field. Reference sites were also established on the streams upstream from identified or potential hazardous waste influence. In addition, all stream stations were compared to Five Mile Creek, a State of Florida regional reference site. Most station locations were previously established by ABB-ES personnel as part of other sampling programs and during Hester-Dendy sampler placement. An ABB-ES ecologist was onsite during the biological sampling and was responsible for determining the exact sampling locations.

This report will include data from Rowell Creek (Station R1, 1-3), Rowell Creek Golf Course (Station R1, 1-3), Golf Course (Stations 1 and 2), Lake Fretwell (Stations 1-8), Yellow Water Creek (Station R1, 1 and 2), Site 5 (Stations 2-5), Site 6 (Station 1), Sal Taylor Creek (Station R1, 1-8), Site 8 (Stations 1 and 2), and Site 9 (Station 1). Site 18 (Station 1) was visited, but due to lack of water, no biological collections were made; however, a physical/chemical characterization was conducted.

3. RESULTS

3.1 PHYSICAL/CHEMICAL CHARACTERIZATIONS

A summary of the physical/chemical characterizations and habitat assessment scores for each station sampled is included in Tables 3-1 and 3-2 and Tables 3-3 and 3-4, respectively. The data are presented in two groupings, the stream stations and the lake stations, for comparisons by major habitat type.

Riparian Zone/Instream Features

The riparian zone at most stations was predominantly forest with the exceptions of GC-BIO-1, RC-BIO-3, and STC-BIO-1 through 4, which were all located in open areas (Table 3-1). Local watershed erosion was classified as slight to moderate at many stations, but was classified as heavy at only one station, RC-GC-BIO-3. Non-point source pollution was obvious at 5-BIO-3 through 5, 9-BIO-1, 18-BIO-1, GC-BIO-1 and 2, RC-BIO-1 through 3, and RC-GC-BIO-1 through 3. Channelization was evident at GC-BIO-2 and STC-BIO-1 through 4. Canopy cover varied between moderate to heavy shade in the forested areas.

The lake stations were either near forests, roads, or in the center of the lake (Table 3-2). Erosion and non-point source pollution were slight where they occurred.

Sediment/Substrate

Petroleum sediment odor was evident at 5-BIO-3 and 4, 8-BIO-2, and STC-BIO-1 through 3. Anaerobic sediment odor was noted at 9-BIO-1, RC-GC-BIO-1, RC-GC-BIO-3, and STC-BIO-4.

Sand was a major substrate type at many stream stations. Leaf pack was a major component at 5-BIO-2 through 5, and aquatic vegetation was common at GC-BIO-1 and STC-BIO-1 through 4.

Sediment odor was normal at all lake stations. Mud/muck/silt and detritus were the predominant substrate types at most stations. Sand was a major substrate type at LF-BIO-5 and 8, and aquatic vegetation was common at LF-BIO-7.

TABLE 3-1 PHYSICAL/CHEMICAL CHARACTERIZATION INFORMATION FROM STREAM STATIONS SAMPLED AT NAS-CECIL FIELD, JUNE 1993

RIPARIAN ZONE/INSTREAM FEATURES

STATION	PERCENT FOREST	PERCENT FIELD/ PASTURE	PERCENT RESIDENTIAL	PERCENT OTHER	LOCAL WATERSHED EROSION	NPS POLLUTION	STREAM WIDTH (M)	HIGH WATER MARK (M)
FIVE MILE CREEK	100	0	0	0	NONE	NONE	3-7	3
5-BIO-2	75	0	0	25	MODERATE	OBVIOUS	0.5-1.0	1.0
5-BIO-3	80	0	0	20	SLIGHT	OBVIOUS	0.2-1.0	1.0
5-BIO-4	100	0	0	0	MODERATE	OBVIOUS	1.00	2.0
5-BIO-5	95	0	0	5	SLIGHT	OBVIOUS	1.00	2.0
8-BIO-1	90	10	0	0	NONE	SOME	0.50	0.5
8-BIO-2	95	5	0	0	NONE	SOME	1.00	0.5
9-BIO-1	100	0	0	0	MODERATE	OBVIOUS	1.00	2.0
18-BIO-1	100	0	0	0	MODERATE	OBVIOUS	5.00	3.0
GC-BIO-1	0	0	0	100	SLIGHT	OBVIOUS	5.0-6.0	2.0
GC-BIO-2	80	0	0	20	MODERATE	OBVIOUS	5.00	4.0
RC-BIO-1	100	0	0	0	MODERATE	OBVIOUS	8.00	2.5
RC-BIO-2	100	0	0	0	MODERATE	OBVIOUS	10.00	2.9
RC-BIO-3	25	0	0	75	MODERATE	OBVIOUS	3.00	2.0
RC-GC-BIO-1	100	0	0	0	MODERATE	OBVIOUS	4.00	4.0
RC-GC-BIO-2	100	0	0	0	MODERATE	OBVIOUS	4.00	4.0
RC-GC-BIO-3	80	0	0	20	HEAVY	OBVIOUS	3.0-4.0	6.0
STC-BIO-1	0	100	0	0	MODERATE	SOME	2.00	1.5
STC-BIO-2	0	100	0	0	MODERATE	SOME	3.00	1.5
STC-BIO-3	0	100	0	0	MODERATE	SOME	5.0	1.5
STC-BIO-4	5	95	0	0	NONE	SOME	1.0-3.0	2.0
STC-BIO-5	100	0	0	0	MODERATE	NONE	5.0-6.0	4.0
STC-BIO-6	100	0	0	0	MODERATE	NONE	6.0-8.0	4.0
STC-BIO-7	100	0	0	0	MODERATE	NONE	4.00	3.0
STC-BIO-R1	100	0	0	0	SLIGHT	SOME	2.00	2.0
YWC-BIO-1	90	0	10	0	SLIGHT	SOME	3.0-10.0	0.5
YWC-BIO-2	95	0	5	0	MODERATE	SOME	4.00	3.0
YWC-BIO-R1	100	0	0	0	SLIGHT	NONE	1.00	2.0

TABLE 3-1 (Cont.)

RIPARIAN ZONE/INSTREAM FEATURES						SEDIMENT/SUBSTRATE	
STATION	STREAM DEPTH (M)	VELOCITY	IMPOUNDED	CHANNELIZED	CANOPY COVER	SEDIMENT ODOR	SEDIMENT OILS
FIVE MILE CREEK	0.1-1	0.1	NO	NO	MOD. SHADE	NORMAL	ABSENT
5-BIO-2	0.1-0.5	0.00	NO	NO	MOD. SHADE	NORMAL	ABSENT
5-BIO-3	0.1-0.2	0.00	NO	NO	HEAVY SHADE	PETROLEUM	ABSENT
5-BIO-4	0.20	0.00	NO	NO	HEAVY SHADE	PETROLEUM	ABSENT
5-BIO-5	0.50	0.00	NO	NO	MOD. SHADE	NORMAL	ABSENT
8-BIO-1	0.20	0.00	NO	NO	LIGHT SHADE	NORMAL	SLIGHT
8-BIO-2	0.30	0.00	NO	NO	LIGHT SHADE	PETROLEUM	MODERATE
9-BIO-1	0.20	<0.1	NO	NO	HEAVY SHADE	ANAEROBIC	ABSENT
18-BIO-1	0.00	0.00	NO	NO	HEAVY SHADE	--	--
GC-BIO-1	0.2-1.0	<0.5	NO	NO	OPEN	NORMAL	ABSENT
GC-BIO-2	2.00	<0.1	NO	YES	HEAVY SHADE	NORMAL	ABSENT
RC-BIO-1	1.50	<0.5	NO	NO	MOD. SHADE	NORMAL	ABSENT
RC-BIO-2	1.90	<0.5	NO	NO	MOD. SHADE	NORMAL	ABSENT
RC-BIO-3	0.2-0.5	0.20	NO	NO	LIGHT SHADE	CHLORINE	ABSENT
RC-GC-BIO-1	1.00	<0.5	NO	NO	MOD. SHADE	ANAEROBIC	ABSENT
RC-GC-BIO-2	1.00	<0.5	NO	NO	MOD. SHADE	NORMAL	ABSENT
RC-GC-BIO-3	0.50	<0.5	NO	NO	MOD. SHADE	ANAEROBIC	ABSENT
STC-BIO-1	1.00	0.00	NO	YES	OPEN	PETROLEUM	MODERATE
STC-BIO-2	0.50	<0.5	NO	YES	OPEN	PETROLEUM	MODERATE
STC-BIO-3	0.30	<0.5	NO	YES	OPEN	PETROLEUM	MODERATE
STC-BIO-4	1.00	<0.5	NO	YES	OPEN	ANAEROBIC	ABSENT
STC-BIO-5	0.5-1.5	<0.5	NO	NO	MOD. SHADE	NORMAL	ABSENT
STC-BIO-6	0.2-1.0	0.10	NO	NO	MOD. SHADE	NORMAL	ABSENT
STC-BIO-7	0.30	<0.3	NO	NO	MOD. SHADE	NORMAL	ABSENT
STC-BIO-R1	0.2-0.5	<0.5	NO	NO	HEAVY SHADE	NORMAL	ABSENT
YWC-BIO-1	0.2-0.5	0.20	NO	NO	HEAVY SHADE	NORMAL	ABSENT
YWC-BIO-2	0.2-1.0	<0.1	NO	NO	HEAVY SHADE	NORMAL	ABSENT
YWC-BIO-R1	0.20	0.30	NO	NO	HEAVY SHADE	NORMAL	ABSENT

TABLE 3-1 (Cont.)

SEDIMENT/SUBSTRATE

STATION	PERCENT WOODY DEBRIS (SNAGS)	PERCENT LEAF PACKS	PERCENT AQUATIC VEGETATION	PERCENT BANKS/ ROOTS	PERCENT RIFFLES	PERCENT SAND	PERCENT MUD/MUCK/ SILT	PERCENT LEAF MATS	PERCENT OTHER (DETRITUS)	PERCENT OTHER (CLAY)	TOTAL
FIVE MILE CREEK	5	0	35	0	0	50	0	10	0	0	100
5-BIO-2	0	50	10	0	0	10	30	0	0	0	100
5-BIO-3	5	80	0	5	0	10	0	0	0	0	100
5-BIO-4	25	50	0	0	0	15	5	5	0	0	100
5-BIO-5	0	75	0	5	0	15	0	0	5	0	100
8-BIO-1	5	0	0	0	0	60	0	0	35	0	100
8-BIO-2	5	0	0	10	0	40	0	0	45	0	100
9-BIO-1	20	30	0	0	0	40	10	0	0	0	100
18-BIO-1	--	--	--	--	--	--	--	--	--	--	--
GC-BIO-1	0	10	80	0	0	5	5	0	0	0	100
GC-BIO-2	25	20	0	10	0	30	5	10	0	0	100
RC-BIO-1	15	0	0	15	0	60	0	10	0	0	100
RC-BIO-2	10	0	0	10	0	60	0	20	0	0	100
RC-BIO-3	10	5	5	0	0	80	0	0	0	0	100
RC-GC-BIO-1	20	25	0	10	0	45	0	0	0	0	100
RC-GC-BIO-2	20	25	0	10	0	45	0	0	0	0	100
RC-GC-BIO-3	10	15	0	15	0	40	10	10	0	0	100
STC-BIO-1	0	0	50	20	0	15	0	0	15	0	100
STC-BIO-2	0	0	50	20	0	15	0	0	15	0	100
STC-BIO-3	0	0	75	0	0	10	0	0	15	0	100
STC-BIO-4	0	0	50	0	0	10	0	0	30	10	100
STC-BIO-5	15	15	0	20	0	0	50	0	0	0	100
STC-BIO-6	10	10	0	15	0	65	0	0	0	0	100
STC-BIO-7	10	0	10	10	0	70	0	0	0	0	100
STC-BIO-R1	20	25	0	0	0	45	10	0	0	0	100
YWC-BIO-1	20	20	5	5	0	50	0	0	0	0	100
YWC-BIO-2	10	15	10	20	0	45	0	0	0	0	100
YWC-BIO-R1	40	15	0	20	0	25	0	0	0	0	100

TABLE 3-1 (Cont.)

WATER QUALITY

STATION	DEPTH (M)	TEMP (C)	PH (SU)	DO (MG/L)	COND (UMHOS/CM)	SECCHI
FIVE MILE CREEK	1	23	4.4	5.8	62	0.3
5-BIO-2	0.3	26.1	5.6	3.4	99	0.30
5-BIO-3	0.2	24.5	6.8	1.0	120	0.20
5-BIO-4	0.2	23.6	6.9	0.4	177	0.20
5-BIO-5	0.5	24.1	6.0	0.8	91	0.50
8-BIO-1	0.2	26.6	6.3	5.3	67	0.20
8-BIO-2	0.2	26.0	6.4	2.8	76	0.20
9-BIO-1	0.2	22.4	5.8	4.3	62	0.20
18-BIO-1	0.2	22.6	5.6	3.5	88	--
GC-BIO-1	0.2	25.1	6.4	4.2	144	0.20
GC-BIO-2	0.5	27.5	7.0	5.6	186	0.90
RC-BIO-1	0.5	28.0	7.3	5.7	187	1.50
RC-BIO-2	0.5	27.9	7.8	5.9	187	1.70
RC-BIO-3	0.2	27.1	6.7	5.2	437	0.20
RC-GC-BIO-1	0.2	21.8	5.4	0.9	173	1.00
RC-GC-BIO-2	1.0	23.4	6.2	1.4	168	1.00
RC-GC-BIO-3	0.4	23.2	6.6	2.3	195	0.40
STC-BIO-1	0.5	25.7	5.8	4.3	92	1.00
STC-BIO-2	0.3	26.5	6.2	7.4	148	0.30
STC-BIO-3	0.3	26.5	6.2	4.9	146	0.30
STC-BIO-4	1.0	24.3	5.9	3.4	125	1.00
STC-BIO-5	0.2	24.9	6.5	5.0	79	1.2
STC-BIO-6	0.2	25.6	6.7	6.8	143	0.20
STC-BIO-7	0.2	25.6	6.7	6.8	143	0.20
STC-BIO-R1	0.2	25.1	6.3	3.7	169	0.20
YWC-BIO-1	0.2	25.2	6.4	4.4	99	0.20
YWC-BIO-2	0.2	24.4	6.5	4.4	114	1.00
YWC-BIO-R1	0.2	23.9	6.5	4.1	105	0.20

TABLE 3-1 (Cont.)

WATER QUALITY (Cont.)

STATION	STREAM TYPE	WATER ODOR	WATER SURFACE OILS	CLARITY	COLOR	PERIPHYTON	FISH	AQUATIC MACROPHYTES	IRON SULFUR BACTERIA
FIVE MILE CREEK	SWAMP & BOG	NORMAL	NONE	CLEAR	TANNIC	COMMON	COMMON	COMMON	ABSENT
5-BIO-2	SAND-BOTTOM	NORMAL	NONE	CLEAR	TANNIC	RARE	RARE	RARE	ABSENT
5-BIO-3	SWAMP & BOG	NORMAL	NONE	CLEAR	TANNIC	RARE	RARE	RARE	ABSENT
5-BIO-4	SWAMP & BOG	NORMAL	NONE	CLEAR	TANNIC	RARE	ABUNDANT	ABSENT	ABSENT
5-BIO-5	SAND-BOTTOM	NORMAL	NONE	CLEAR	TANNIC	RARE	RARE	COMMON	ABSENT
8-BIO-1	SAND-BOTTOM	NORMAL	NONE	TURBID	OTHER	RARE	COMMON	ABSENT	ABSENT
8-BIO-2	SAND-BOTTOM	NORMAL	NONE	CLEAR	CLEAR	RARE	COMMON	ABSENT	ABSENT
9-BIO-1	SWAMP & BOG	NORMAL	NONE	CLEAR	TANNIC	RARE	RARE	ABSENT	ABSENT
18-BIO-1	--	NORMAL	NONE	TURBID	MUDDY	ABSENT	COMMON	ABSENT	ABSENT
GC-BIO-1	SAND-BOTTOM	NORMAL	NONE	CLEAR	TANNIC	ABUNDANT	COMMON	ABUNDANT	ABSENT
GC-BIO-2	SAND-BOTTOM	NORMAL	NONE	CLEAR	TANNIC	RARE	ABSENT	ABSENT	ABSENT
RC-BIO-1	SAND-BOTTOM	NORMAL	NONE	CLEAR	TANNIC	RARE	RARE	ABSENT	ABSENT
RC-BIO-2	SAND-BOTTOM	NORMAL	NONE	CLEAR	TANNIC	RARE	RARE	RARE	ABSENT
RC-BIO-3	SAND-BOTTOM	CHLORINE	NONE	CLEAR	CLEAR	ABSENT	ABSENT	ABSENT	ABSENT
RC-GC-BIO-1	SAND-BOTTOM	NORMAL	NONE	CLEAR	TANNIC	RARE	RARE	ABSENT	ABSENT
RC-GC-BIO-2	SAND-BOTTOM	NORMAL	NONE	CLEAR	TANNIC	RARE	RARE	ABSENT	ABSENT
RC-GC-BIO-3	SAND-BOTTOM	NORMAL	NONE	CLEAR	TANNIC	RARE	COMMON	ABSENT	ABSENT
STC-BIO-1	SAND-BOTTOM	NORMAL	SHEEN	CLEAR	CLEAR	COMMON	COMMON	COMMON	ABSENT
STC-BIO-2	SAND-BOTTOM	NORMAL	SHEEN	CLEAR	CLEAR	COMMON	COMMON	COMMON	ABSENT
STC-BIO-3	SAND-BOTTOM	NORMAL	NONE	CLEAR	CLEAR	RARE	RARE	ABSENT	ABSENT
STC-BIO-4	SAND-BOTTOM	NORMAL	NONE	CLEAR	GREEN	ABUNDANT	--	ABUNDANT	ABSENT
STC-BIO-5	SAND-BOTTOM	NORMAL	NONE	TURBID	TANNIC	RARE	RARE	RARE	ABSENT
STC-BIO-6	SAND-BOTTOM	NORMAL	NONE	CLEAR	CLEAR	COMMON	COMMON	RARE	ABSENT
STC-BIO-7	SAND-BOTTOM	NORMAL	NONE	CLEAR	CLEAR	COMMON	COMMON	RARE	ABSENT
STC-BIO-R1	SAND-BOTTOM	NORMAL	NONE	CLEAR	TANNIC	RARE	RARE	ABSENT	ABSENT
YWC-BIO-1	SAND-BOTTOM	NORMAL	NONE	CLEAR	TANNIC	RARE	RARE	RARE	ABSENT
YWC-BIO-2	SAND-BOTTOM	NORMAL	NONE	CLEAR	TANNIC	RARE	COMMOMN	COMMON	ABSENT
YWC-BIO-R1	SAND-BOTTOM	NORMAL	NONE	CLEAR	TANNIC	RARE	COMMOMN	ABSENT	ABSENT

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TABLE 3-2 PHYSICAL/CHEMICAL CHARACTERIZATION INFORMATION FROM LAKE STATIONS SAMPLED AT NAS-CECIL FIELD, JUNE 1993

RIPARIAN ZONE/INSTREAM FEATURES

STATION	PERCENT FOREST	PERCENT RESIDENTIAL	PERCENT OTHER (LAKE)	PERCENT OTHER (ROADS)	LOCAL WATERSHED EROSION	NPS POLLUTION	SYSTEM WIDTH (M)	HIGH WATER MARK (M)	SYSTEM DEPTH (M)	IMPOUNDED	CANOPY COVER
LF-BIO-1	40	10	50	0	SLIGHT	SOME	--	2.3	1.30	YES	OPEN
LF-BIO-2	0	0	100	0	NONE	NONE	--	2.0	1.00	YES	OPEN
LF-BIO-3	50	0	50	0	NONE	NONE	--	2.2	1.20	YES	OPEN
LF-BIO-4	100	0	0	0	NONE	NONE	--	2.5	1.50	YES	OPEN
LF-BIO-5	50	0	0	50	SLIGHT	SOME	--	2.7	1.70	YES	OPEN
LF-BIO-6	75	0	0	25	SLIGHT	SOME	--	4.5	3.50	YES	OPEN
LF-BIO-7	50	0	0	50	SLIGHT	SOME	6.0-7.0	3.2	2.20	YES	OPEN
LF-BIO-8	60	0	40	0	NONE	NONE	5.0-10.0	2.4	1.40	YES	OPEN
6-BIO-1	60	0	40	0	SLIGHT	NONE	3.0-5.0	3.0	0.2-0.5	YES	OPEN

TABLE 3-2 (Cont.)

SEDIMENT/SUBSTRATE

STATION	SEDIMENT ODOR	SEDIMENT OILS	PERCENT WOODY DEBRIS (SNAGS)	PERCENT LEAF PACKS	PERCENT AQUATIC VEGETATION	PERCENT BANKS/ ROOTS	PERCENT RIFFLES	PERCENT SAND	PERCENT MUD/MUCK/ SILT	PERCENT LEAF MATS	PERCENT OTHER (DETRITUS)	PERCENT OTHER (CLAY)	TOTAL
LF-BIO-1	NORMAL	ABSENT	0	0	0	0	0	0	30	0	50	20	100
LF-BIO-2	NORMAL	ABSENT	0	0	0	0	0	10	50	0	40	0	100
LF-BIO-3	NORMAL	ABSENT	0	0	0	0	0	10	50	0	40	0	100
LF-BIO-4	NORMAL	ABSENT	0	0	0	0	0	0	25	0	75	0	100
LF-BIO-5	NORMAL	ABSENT	0	0	0	0	0	50	30	0	20	0	100
LF-BIO-6	NORMAL	ABSENT	0	0	0	0	0	0	75	15	10	0	100
LF-BIO-7	NORMAL	ABSENT	0	0	50	0	0	0	25	25	0	0	100
LF-BIO-8	NORMAL	ABSENT	0	0	0	0	0	50	25	0	25	0	100
6-BIO-1	NORMAL	ABSENT	10	15	25	0	0	0	30	0	20	0	100

TABLE 3-2 (Cont.)

WATER QUALITY

STATION	DEPTH TOP (M)	TEMP TOP (C)	PH TOP (SU)	DO TOP (MG/L)	COND TOP (UMHOS/CM)	DEPTH BOTTOM (M)	TEMP BOTTOM (C)	PH BOTTOM (SU)	DO BOTTOM (MG/L)	COND BOTTOM (UMHOS/CM)	SECCHI (M)
LF-BIO-1	0.2	31.9	7.9	7.6	178	1.3	31.0	7.7	7.1	178	1.30
LF-BIO-2	0.2	31.4	7.7	7.7	179	1.0	30.8	7.6	8.3	180	1.00
LF-BIO-3	0.2	30.1	7.2	6.5	177	1.2	29.3	7.1	6.5	179	1.20
LF-BIO-4	0.2	28.9	6.9	5.6	178	1.5	27.8	6.8	4.8	178	1.50
LF-BIO-5	0.2	29.0	7.6	5.9	180	1.7	27.7	7.1	4.0	180	1.70
LF-BIO-6	0.2	27.8	8.1	5.6	181	3.5	25.1	6.2	0.1	194	1.30
LF-BIO-7	0.2	27.3	6.8	4.0	183	2.2	27.0	6.7	3.0	183	2.20
LF-BIO-8	0.2	30.7	7.4	6.9	169	1.4	28.0	7.1	2.7	159	1.40
6-BIO-1	--	--	--	--	--	0.5	26	6.5	1.7	175	0.5

TABLE 3-2 (Cont.)

WATER QUALITY (Cont.)

STATION	SYSTEM TYPE	WATER ODOR	WATER SURFACE OILS	CLARITY	COLOR	PERIPHYTON	FISH	AQUATIC MACROPHYTES	IRON SULFUR BACTERIA
LF-BIO-1	LAKE	NORMAL	NONE	CLEAR	TANNIC	ABUNDANT	ABSENT	RARE	ABSENT
LF-BIO-2	LAKE	NORMAL	NONE	CLEAR	TANNIC	ABUNDANT	ABSENT	ABUNDANT	ABSENT
LF-BIO-3	LAKE	NORMAL	NONE	CLEAR	TANNIC	ABUNDANT	ABSENT	COMMON	ABSENT
LF-BIO-4	LAKE	NORMAL	NONE	CLEAR	TANNIC	ABUNDANT	ABSENT	COMMON	ABSENT
LF-BIO-5	LAKE	NORMAL	NONE	CLEAR	TANNIC	ABUNDANT	ABSENT	ABSENT	ABSENT
LF-BIO-6	LAKE	NORMAL	NONE	CLEAR	TANNIC	ABUNDANT	ABSENT	ABSENT	ABSENT
LF-BIO-7	LAKE	NORMAL	NONE	CLEAR	TANNIC	ABUNDANT	ABUNDANT	ABUNDANT	ABSENT
LF-BIO-8	LAKE	NORMAL	NONE	CLEAR	TANNIC	ABUNDANT	COMMON	ABUNDANT	ABSENT
6-BIO-1	POND	NORMAL	NONE	CLEAR	TANNIC	ABUNDANT	COMMON	COMMON	ABSENT

TABLE 3-3 HABITAT ASSESSMENT SCORES FOR STREAM STATIONS SAMPLED AT NAS-CECIL FIELD, JUNE 1993

STATION	BOTTOM SUBSTRATE	WATER VELOCITY	ARTIFICIAL CHANNEL	BANK STABILITY	RIPARIAN ZONE VEGETATION	FLOW ADJUSTMENT	TOTAL SCORE	PERCENT COMPARISON TO REFERENCE
FIVE MILE CREEK	24	8	15	10	10	5	67	100
5-BIO-2	5	0	12	8	5	--	30	44.8
5-BIO-3	7	0	12	5	4	--	28	41.8
5-BIO-4	15	2	12	3	5	--	37	55.2
5-BIO-5	5	0	12	8	3	--	28	41.8
8-BIO-1	3	0	13	9	4	--	29	43.3
8-BIO-2	5	1	13	9	6	--	34	50.7
9-BIO-1	16	7	13	5	8	--	49	73.1
GC-BIO-1	16	5	3	9	2	--	35	52.2
GC-BIO-2	20	3	12	6	8	--	49	73.1
RC-BIO-1	20	6	14	7	7	--	54	80.6
RC-BIO-2	20	6	14	8	7	--	55	82.1
RC-BIO-3	12	20	12	7	3	--	54	80.6
RC-GC-BIO-1	23	3	14	5	7	--	52	77.6
RC-GC-BIO-2	23	3	14	3	7	--	50	74.6
RC-GC-BIO-3	20	3	14	2	4	--	43	64.2
STC-BIO-1	5	0	2	2	2	--	11	16.4
STC-BIO-2	5	2	2	2	2	--	13	19.4
STC-BIO-3	5	3	2	2	2	--	14	20.9
STC-BIO-4	5	5	3	8	2	--	23	34.3
STC-BIO-5	18	18	14	5	8	--	63	94
STC-BIO-6	12	16	13	7	6	--	54	80.6
STC-BIO-7	21	21	13	6	5	--	66	98.5
STC-BIO-R1	18	10	14	8	6	--	56	83.6
YWC-BIO-1	24	7	14	9	8	--	62	92.5
YWC-BIO-2	25	10	14	6	5	--	60	89.6
YWC-BIO-R1	24	22	14	8	7	--	75	100

TABLE 3-4 HABITAT ASSESSMENT SCORES FOR LAKE STATIONS SAMPLED AT NAS-CECIL FIELD, JUNE 1993

STATION	BOTTOM SUBSTRATE	WATER VELOCITY	ARTIFICIAL CHANNEL	BANK STABILITY	RIPARIAN ZONE VEGETATION	FLOW ADJUSTMENT	TOTAL SCORE
LF-BIO-1	4	0	14	6	2	--	26
LF-BIO-2	10	0	14	9	2	--	35
LF-BIO-3	10	0	14	9	4	--	37
LF-BIO-4	10	0	14	9	4	--	37
LF-BIO-5	7	0	14	9	0	--	30
LF-BIO-6	7	0	14	9	0	--	30
LF-BIO-7	18	0	14	8	6	--	46
LF-BIO-8	10	0	14	9	5	--	38
6-BIO-1	24	0	14	9	5	--	52

Water Quality

Water quality measurements were made at or near the bottom of the stream stations. Water depth was 1 meter or less at all stations. Water temperature ranged from 21.8 to 28.0°C and pH ranged from 5.4 to 7.8, with pH at most stations less than 7.0. The dissolved oxygen (DO) values ranged from a very low value of 0.4 mg/L at 5-BIO-4 to 7.4 mg/L at STC-BIO-2. Other very low values were recorded at 5-BIO-3 (1.0 mg/L), 5-BIO-5 (0.8 mg/L) RC-GC-BIO-2 (0.9 mg/L), and RC-GC-BIO-2 (1.4 mg/L). In general, DO levels were low, ranging from 2.3 to 6.8 mg/L. Conductivity ranged from 62 to 437 μmhos/cm, with most measurements less than 200 μmhos/cm.

Water odor was normal at all stream stations except RC-BIO-3, which is located below the wastewater treatment plant and smelled like chlorine. Water surface oils were present as a sheen only at STC-BIO-1 and 2. Water clarity was classified as clear at most stations, except 8-BIO-1, 18-BIO-1, and STC-BIO-5, which were turbid. Water color was tannic at many stations, with some classified as clear, muddy (18-BIO-1), and green (STC-BIO-4). Periphyton was rare or absent at most stations and abundant at GC-BIO-1 and STC-BIO-4. Aquatic macrophytes were absent or rare at most stations and abundant at GC-BIO-1 and STC-BIO-4.

Water quality measurements were made both near the bottom and at the surface at the lake stations. Both temperature and pH were slightly higher at the surface. The combined surface and bottom temperature values ranged from 25.1 to 31.9°C, and pH ranged from 6.2 to 8.1. Conductivity did not vary appreciably from surface to bottom, ranging from 177 to 194 μmhos/cm overall. DO was substantially different from surface to bottom at some stations. At LF-BIO-6, the deepest station (3.5 m), the bottom DO was 0.1 mg/L compared to 5.6 mg/L at the surface. The surface/bottom combined range was 0.1 to 8.3 mg/L. Bottom DO was low (1.7 mg/L) at the small pond station, 6-BIO-1.

No unusual water odors or surface oils were noted at the lake stations. All stations had clear, tannic colored water with abundant periphyton. Aquatic macrophytes were abundant at LF-BIO-2, 7, and 8, and absent to common at the other stations.

Habitat Assessment

Habitat quality scores at the stream stations were lowest at STC-BIO-1 through 4 (habitat scores of 11 to 23) and ranged as high as 75 at the reference station at Yellow Water Creek, YWC-BIO-R1 (Table 3-3). The reference station at Sal Taylor Creek, STC-BIO-R1 (56),

had a moderately high score. Five Mile Creek, the regional reference that will be compared with all the macroinvertebrate data, had a score of 67. Most scores ranged between 43 and 66. Moderately low scores also occurred at 5-BIO-2 through 5 (28-37), 8 BIO-1 and 2 (29 and 34), and GC-BIO-1 (35).

Although the habitat assessment procedure is designed for stream habitat, information that was applicable to the lake stations was tabulated and scores were assigned (Table 3-4). These scores were only comparable to each other and did show some variability. The scores at Lake Fretwell ranged from 26 at LF-BIO-1 to 46 at LF-BIO-7. At the pond station, 6-BIO-1, the score was 52.

3.2 BENTHIC MACROINVERTEBRATE COMMUNITY

A taxonomic list of the benthic macroinvertebrates collected in the study is presented in Table 3-5. It includes all taxa that were collected from the stream and lake stations using the combination of the dip net, Hester-Dendy, and Ponar samplers. A macroinvertebrate data listing including all the information on identification and enumeration of the organisms collected at the stations sampled is listed in Appendix A. The metrics were calculated, based on the information in Appendix A, for each station location from the three separate sample types and are presented in Tables 3-6 through 3-8. Since significant chemical contamination was not detected in sediment samples from STC-BIO-6 and 7, and RC-GC-BIO-2 and 3, the Hester-Dendy and Ponar samples were not processed. Dip net samples were processed and the data were reported for informational purposes.

Metrics are measurements of various components of the structure and function of the community. Independently, they provide information on the status of the portion of the community they represent. Together the metrics contribute to an integrated assessment of the biological condition of the community. The data are presented in three major station groupings according to watershed as follows:

1. Lake Fretwell and pond station (Ponar data only)
2. Rowell Creek, Golf Course, Site 5, and reference stations
3. Sal Taylor Creek, Yellow Water Creek, and reference stations

Dip Net Samples

The metric values selected for analyses of the dip net data are presented in Table 3-9. These values were assigned bioassessment ranking scores and the total scores to be compared to the

TABLE 3-5 MACROINVERTEBRATE TAXA LIST FOR NAS—CECIL FIELD, JUNE 1993

Tricladida
Nemertea
Nematoda
Oligochaeta
- Lumbriculidae
- Enchytraeidae
- Tubificidae
- Tubificidae imm. w
- Tubificidae imm. w/o
- *Limnodrilus hoffmeisteri*
- *Ilyodrilus templetoni*
- *Aulodrilus pigueti*
- *Bothrioneurum vejdovskyanum*
- Naididae
- *Slavina appendiculata*
- *Dero*
- *Dero digitata*
- *Dero flabelliger*
- *Dero (Aulophorus)*
- *Dero furcata*
- *Dero (Dero)*
- *Nais*
- *Nais communis*
- *Pristina osborni*
- *Pristina aequiseta*
- *Pristina leidyi*

Hirudinea
- *Helobdella*
- *Helobdella elongata*
- *Helobdella triserialis*
- *Helobdella fusca*
- Glossiphoniidae
- *Placobdella papillifera*
- Hirudinidae
- Erpobdellidae
- *Mooreobdella microstoma*

Gastropoda
- Pleuroceridae
- Hydrobiidae
- Lymnaeidae
- Ancylidae
- Planorbidae
- *Physella*

Pelecypoda
- *Corbicula fluminea*
- Sphaeriidae
- Unionidae

Arachnoidea
- Acarina

TABLE 3-5 (Cont.)

Malacostraca
- *Asellus*
- Gammaridae
- *Gammarus*
- *Hyalella azteca*
- *Crangonyx*
- *Palaemonetes paludosus*
- Astacidae

Collembola

Ephemeroptera
- *Stenonema*
- *Stenacron*
- Baetidae
- Baetis
- *Callibaetis*
- *Centroptilum*
- Ephemerellidae
- *Caenis*
- *Paraleptophlebia*

Odonata
- Anisoptera
- Aeshnidae
- *Boyeria*
- *Nasiaeschna*
- Gomphidae
- *Dromogomphus*
- *Progomphus*
- Libellulidae
- Corduliidae
- Macromiidae
- Calopterygidae
- *Calopteryx*
- *Hetaerina*
- Coenagrionidae
- *Argia*

Hemiptera
- Belostomatidae
- Corixidae
- Notonectidae

Coleoptera
- *Haliplus*
- *Derovatellus*
- *Laccophilus*
- *Peltodytes*
- Dytiscidae
- *Celina*
- *Gyrinus*
- *Dineutus*

TABLE 3-5 (Cont.)

- Hydrophilidae
  - *Tropisternus*
  - *Berosus*
  - *Helichus*
  - Elmidae
  - *Stenelmis*
  - *Dubiraphia*
  - *Microcylloepus*
  - *Ancyronyx*
  - *Ancyronyx variegata*
  - Curculionidae
- Megaloptera
  - Corydalidae
  - *Corydalus cornutus*
  - *Nigronia serricornis*
  - *Sialis*
- Trichoptera
  - *Chimarra*
  - Psychomyiidae
  - *Lype diversa*
  - *Psychomyia flavida*
  - Hydropsychidae
  - *Cheumatopsyche*
  - *Hydropsyche*
  - Hydroptilidae
  - *Oxyethira*
  - Leptoceridae
  - *Oecetis*
  - *Phylocentropus*
  - Polycentropodidae
  - *Cyrnellus fraternus*
  - *Polycentropus*
- Lepidoptera
- Diptera
  - *Chaoborus*
  - *Tipulidae*
  - *Tipula*
  - *Hexatoma*
  - *Bittacomorpha*
  - Ceratopogonidae
  - Culicidae
  - Simuliidae
  - Chironomidae
  - Orthocladiinae
  - Tanypodinae
  - *Clinotanypus*
  - *Coelotanypus*
  - *Procladius*

TABLE 3-5 (Cont.)

Chironomini
Cricotopus bicinctus
Stenochironomus
Cladotanytarsus
Tanytarsini
Tanytarsus
Tanytarsus Epler F
Chironomus
Cryptochironomus
Polypedilum fallax
Polypedilum convictum
Polypedilum illinoense
Polypedilum scalaenum
Ablabesmyia
Dicrotendipes
Nanocladius
Paralauterborniella
Rheotanytarsus
Parachironomus
Pentaneura
Parametriocnemus
Paratanytarsus
Larsia
Labrundinia
Nilotanypus
Rheocricotopus
Thienemanniella
Tribelos
Cryptotendipes
Paracladopelma
Phaenopsectra
Cladopelma
Stelechomyia
Xylotopus
Thienemannimyia
Cladotanytarsus
Mesosmittia
Harnischia
Natarsia
Glyptotendipes
Tanypus
Microtendipes
Pseudochironomus
Omisus
Endochironomus
Stictochironomus
Zavreliella
Empididae

TABLE 3-5 (Cont.)

Hemerodromia
Psychodidae
Stratiomyidae
Tabanidae

TABLE 3-6 SUMMARY OF METRICS CALCULATED FOR EACH STATION SAMPLED WITH A DIP NET AT NAS-CECIL FIELD, JUNE 1993

Location	Total Taxa	Number individuals per sq. M	Dominant Taxon	Percent Dominant Taxon	Florida Index	Shannon-Weaver Index (base 2)	Percent Diptera	Percent Chironomid	Percent EPT	Percent Collector-filterers	Percent Shredders	Percent Calcium Dependent	Hilsenhoff Biotic Index
5 Mile Creek	32	824	LUMBRICULIDAE	10.7	12	4.500	21.4	20.4	9.7	9.7	15.5	17.5	6.9
5-BIO-2	19	36	CORDULIIDAE	32.4	8	3.230	31.5	22.2	2.8	13.0	6.5	11.1	7.1
5-BIO-3	19	36	ANCYLIDAE	26.2	7	3.286	45.8	42.1	0.0	2.8	10.3	34.6	7.7
5-BIO-4	16	320	CHIRONOMUS	36.9	7	2.983	71.8	69.9	0.0	1.0	18.4	15.5	8.9
5-BIO-5	10	30	ANCYLIDAE	58.2	4	1.969	7.7	5.5	0.0	2.2	5.6	62.6	6.7
6-BIO-1	25	938	DERO FLABELLIGER	43.3	5	3.168	25.9	20.4	1.0	6.0	6.0	4.0	8.7
8-BIO-1	12	21	ASTACIDAE	27.0	4	2.741	17.5	15.9	0.0	0.0	30.2	27.0	6.8
8-BIO-2	8	13	COENAGRIONIDAE	23.7	2	2.483	5.3	5.3	0.0	0.0	21.1	21.1	7.2
9-BIO-1	21	68	AULODRILUS PIGUETI	18.7	4	3.725	42.4	40.4	0.0	8.9	17.7	30.5	6.7
GC-BIO-1	24	1353	CAENIS	25.5	4	3.592	13.8	13.1	39.3	3.4	8.3	11.0	6.5
GC-BIO-2	24	296	DERO FLABELLIGER	27.4	7	3.768	36.8	33.7	3.2	10.5	7.4	21.1	7.4
RC-BIO-1	20	453	PHYSELLA	21.6	7	3.628	51.5	48.5	0.0	17.5	12.4	33.0	7.1
RC-BIO-2	30	1017	PLANORBIDAE	18.3	8	4.097	29.4	29.4	4.6	11.9	16.5	43.1	7.3
RC-BIO-3	12	197	P. ILLINOENSE	59.6	3	2.189	62.0	62.0	0.0	4.7	60.2	9.5	6.4
RC-BIO-R1	20	368	DERO (DERO)	17.4	3	3.755	62.0	58.7	1.1	6.5	6.5	7.6	7.7
RC-GC-BIO-1	19	333	DUBIRAPHIA	20.6	5	3.587	19.6	19.6	8.4	1.9	4.7	5.6	7.4
RC-GC-BIO-2	21	448	DERO (DERO)	16.7	6	3.888	25.0	25.0	12.5	2.1	2.1	15.6	7.6
RC-GC-BIO-3	23	117	DICROTENDIPES	21.6	5	3.927	46.6	45.5	0.0	12.5	8.0	18.2	7.0
RC-GC-BIO-R1	21	1307	DICROTENDIPES	39.3	8	2.898	76.4	74.3	5.7	25.0	10.7	5.7	6.9
STC-BIO-1	7	420	DERO (DERO)	64.4	2	1.626	2.2	2.2	0.0	0.0	0.0	0.0	9.9
STC-BIO-2	16	190	DICROTENDIPES	45.1	3	2.924	69.6	65.7	0.0	0.0	13.7	4.9	7.6
STC-BIO-3	18	155	P. ILLINOENSE	33.1	6	2.802	77.3	77.3	0.0	1.0	36.8	1.6	7.3
STC-BIO-4	20	42	LARSIA	19.8	4	3.282	87.3	85.7	0.0	0.0	11.9	1.6	7.7
STC-BIO-5	22	1391	HYDROBIIDAE	51.7	3	2.587	16.8	16.8	2.7	22.1	1.3	71.1	7.4
STC-BIO-6	32	376	P. PALUDOSUS	16.5	11	4.195	24.8	24.8	18.2	16.5	20.7	32.2	5.7
STC-BIO-7	33	289	P. ILLINOENSE	12.9	12	4.540	44.1	41.9	23.7	17.2	19.4	10.8	6.1
STC-BIO-8	52	179	STENELMIS	15.6	23	4.615	19.7	13.0	12.3	16.5	8.6	26.8	6.2
STC-BIO-R1	14	14	CORDULIIDAE	40.5	4	2.988	11.9	9.5	0.0	0.0	16.7	26.2	6.2
YWC-BIO-1	25	299	ASELLUS	24.0	5	3.884	26.0	24.0	7.3	4.2	28.1	39.6	6.8
YWC-BIO-2	35	352	COENAGRIONIDAE	14.2	15	4.524	16.8	16.8	10.6	8.8	14.2	27.4	6.4
YWC-BIO-R1	20	376	STENELMIS	31.4	7	3.071	6.6	5.0	10.7	10.7	0.8	28.1	5.5

TABLE 3-7 SUMMARY OF METRICS CALCULATED FOR EACH STATION SAMPLED WITH A HESTER-DENDY ARTIFICIAL SUBSTRATE SAMPLER AT NAS-CECIL FIELD, JUNE 1993

Location	Total Taxa	Number individuals per sq. M	Dominant Taxon	Percent Dominant Taxon	Florida Index	Shannon-Weaver Index (base 2)	Percent Diptera	Percent Chironomid	Percent EPT	Percent Collector-filterers	Percent Shredders	Percent Calcium Dependent	Hilsenhoff Biotic Index
5 MILE CREEK	30	326	TANYTARSUS SP. A	15.3	15	4.612	60.5	60.5	5.6	29.8	9.7	0.8	6.4
5-BIO-2	14	498	CHIRONOMUS	81.0	5	1.332	92.6	90.5	0.0	1.1	4.2	3.7	9.4
GC-BIO-1	21	777	DERO (DERO)	66.4	4	2.001	6.8	6.1	12.5	1.4	0.3	8.5	9.0
GC-BIO-2	15	195	PLANORBIDAE	54.1	3	2.386	10.8	9.5	0.0	0.0	6.8	74.3	6.5
RC-BIO-3	22	26686	P. ILLINOENSE	97.0	12	0.279	99.5	99.5	0.0	0.0	98.6	0.0	6.0
RC-BIO-R1	22	687	CHIRONOMUS	50.2	3	2.529	89.3	88.5	0.8	0.8	4.2	0.8	8.7
RC-GC-BIO-1	25	1156	CHIRONOMUS	22.2	8	3.198	81.3	81.3	1.1	1.7	10.7	1.4	7.9
RC-GC-BIO-R1	23	953	ABLABESMYIA	18.5	6	2.887	81.5	80.9	1.4	3.9	3.3	10.2	7.4
STC-BIO-1	2	95	TUBIFICIDAE IMM. W	63.9	0	0.944	0.0	0.0	0.0	0.0	0.0	0.0	10.0
STC-BIO-2	7	313	DICROTENDIPES	68.1	0	1.419	76.5	76.5	0.0	0.0	0.0	1.7	8.4
STC-BIO-4	7	74	DICROTENDIPES	46.4	1	1.991	96.4	96.4	0.0	0.0	28.6	0.0	7.4
STC-BIO-5	26	885	ABLABESMYIA	20.8	8	3.527	66.1	66.1	0.9	6.3	18.5	24.4	7.0
STC-BIO-8	41	3860	LYPE DIVERSA	24.1	14	3.509	34.1	22.2	34.1	7.4	1.4	12.5	4.7
YWC-BIO-1	35	1835	DICROTENDIPES	62.3	12	2.484	78.2	76.5	5.0	3.2	4.0	3.6	7.8
YWC-BIO-2	28	1338	DICROTENDIPES	49.7	9	2.804	88.6	88.4	4.5	13.9	5.1	0.4	7.1
YWC-BIO-R1	36	1475	ANCYLIDAE	27.9	8	3.900	35.5	20.9	17.5	12.1	3.2	30.0	5.6

TABLE 3-8 SUMMARY OF METRICS CALCULATED FOR EACH STATION SAMPLED WITH A PONAR GRAB SAMPLER AT NAS-CECIL FIELD, JUNE 1993

Location	Total Taxa	Number individuals per sq. M	Dominant Taxon	Percent Dominant Taxon	Florida Index	Shannon-Weaver Index (base 2)	Percent Diptera	Percent Chironomid	Percent EPT	Percent Collector-filterers	Percent Shredders	Percent Calcium Dependent	Hilsenhoff Biotic Index
5-BIO-2	13	702	CHIRONOMUS	30.6	3	2.807	77.6	75.5	0.0	2.0	0.0	8.2	8.7
5-BIO-3	24	1691	TUBIFICIDAE IMM. W/O	32.2	5	3.116	44.9	43.2	0.0	3.4	4.2	10.2	8.9
5-BIO-4	10	1247	TUBIFICIDAE IMM. W/O	60.9	2	1.973	32.2	28.7	0.0	1.1	5.7	3.4	9.4
5-BIO-5	5	143	CULICIDAE	30.0	2	2.246	50.0	20.0	0.0	30.0	0.0	20.0	7.3
6-BIO-1	25	831	PELECYPODA	12.1	5	4.303	60.3	39.7	5.2	13.8	15.5	17.2	7.2
8-BIO-1	13	459	PROCLADIUS	18.8	3	3.368	46.9	46.9	0.0	6.3	9.4	12.5	7.0
8-BIO-2	8	459	TUBIFICIDAE IMM. W/O	37.5	1	2.394	37.5	37.5	0.0	0.0	3.1	3.1	9.1
9-BIO-1	17	2924	TRIBELOS	38.2	4	2.814	61.8	61.3	0.0	2.5	2.5	11.8	6.4
GC-BIO-1	34	6034	CERATOPOGONIDAE	16.6	5	4.151	55.6	39.0	5.9	9.7	6.7	3.3	7.3
GC-BIO-2	26	1663	TRIBELOS	22.4	6	3.696	46.6	43.1	0.9	22.4	6.0	24.1	6.8
LF-BIO-1	20	3268	TANTARSUS	40.8	5	2.882	76.3	75.9	0.9	40.8	0.4	3.1	7.8
LF-BIO-2	26	5475	TANTARSUS	43.3	5	3.082	78.3	78.0	5.5	44.1	9.9	1.8	7.6
LF-BIO-3	20	4773	TANTARSUS	46.2	5	2.687	72.1	72.1	3.0	46.2	0.6	1.8	7.6
LF-BIO-4	20	5862	TANTARSUS	43.8	4	2.767	78.0	78.0	2.4	43.8	0.7	3.2	7.6
LF-BIO-5	10	1648	TUBIFICIDAE IMM. W/O	53.0	1	1.978	43.5	41.7	0.0	0.0	0.0	0.0	9.7
LF-BIO-6	8	1663	CHAOBORUS	63.8	0	1.332	66.4	2.6	0.0	0.9	0.0	0.0	8.6
LF-BIO-7	25	1433	TANYTARSINI	26.0	4	3.657	77.0	75.0	1.0	36.0	2.0	10.0	7.4
LF-BIO-8	22	2709	TANYTARSUS	41.3	1	2.983	60.3	58.7	0.0	41.3	0.5	3.2	7.8
RC-BIO-1	16	4085	TUBIFICIDAE IMM. W/O	53.7	3	2.404	18.9	11.6	0.0	10.9	0.7	6.0	9.3
RC-BIO-2	24	4042	DERO (DERO)	25.2	2	3.218	30.1	29.8	1.1	12.8	9.2	19.5	8.2
RC-BIO-3	14	10,736	P. ILLINOENSE	42.2	3	2.434	77.2	77.2	0.0	1.5	53.5	1.5	7.7
RC-BIO-R1	23	2480	PHAENOPSECTRA	43.4	2	2.844	69.4	68.2	9.8	11.6	0.6	2.3	7.6
RC-GC-BIO-1	28	7167	TRIBELOS	23.8	6	3.356	65.0	64.8	0.6	1.4	1.9	2.8	7.9
RC-GC-BIO-R1	42	11,624	DICROTENDIPES	32.2	12	3.627	68.9	66.9	1.5	15.8	5.3	9.6	7.4
STC-BIO-1	4	143	TUBIFICIDAE IMM. W/O	70.0	1	1.357	10.0	10.0	0.0	0.0	10.0	0.0	9.5
STC-BIO-2	19	1261	DICROTENDIPES	61.4	4	2.306	72.7	72.7	0.0	0.0	3.4	1.1	8.3
STC-BIO-3	17	731	TUBIFICIDAE IMM. W/O	27.5	2	3.453	41.2	39.2	0.0	7.8	2.0	13.7	8.7
STC-BIO-4	10	530	PROCLADIUS	40.5	2	2.645	86.5	81.1	0.0	0.0	10.8	0.0	8.3
STC-BIO-5	32	5862	SPHAERIIDAE	36.9	5	3.204	29.1	29.1	0.0	39.1	6.4	40.8	8.2
STC-BIO-8	23	2981	SPHAERIIDAE	45.7	8	2.687	14.4	12.5	1.0	47.6	2.4	47.1	8.1
STC-BIO-R1	24	2609	TUBIFICIDAE IMM. W/O	39.6	5	3.003	4.4	4.4	0.5	7.1	0.5	12.1	8.9
YWC-BIO-1	29	3268	PELECYPODA	31.6	1	3.339	25.0	19.7	1.3	35.5	16.7	39.9	7.1
YWC-BIO-2	46	4974	TUBIFICIDAE IMM. W/O	19.9	9	4.417	35.2	28.2	2.9	18.4	10.1	23.9	7.2
YWC-BIO-R1	33	6479	STENELMIS	29.9	6	3.531	29.2	25.9	4.9	21.7	16.6	16.2	6.3

TABLE 3-9 SELECTED METRICS FOR BIOASSESSMENT SCORING FOR MACROINVERTEBRATES COLLECTED WITH A DIP NET FROM CECIL FIELD STATIONS, JUNE 1993

	STATIONS							
METRIC	5 MILE CREEK	5-BIO-2	5-BIO-3	5-BIO-4	5-BIO-5	8-BIO-1	8-BIO-2	9-BIO-1
TAXA RICHNESS	32	19	19	16	10	12	8	21
FLORIDA INDEX	12	8	4	4	4	4	2	4
HBI	6.9	7.1	7.7	8.9	6.7	6.8	7.2	6.7
EPT INDEX	4	1	0	0	0	0	0	0
CHIRONOMID TAXA	7	5	6	7	3	4	2	10
% DOMINANT TAXON	10.7	32.4	26.2	36.9	58.2	27.0	23.7	18.7
% SHREDDERS	15.5	6.5	10.3	18.4	5.5	30.2	21.1	17.7
% FILTERER-COLLECTORS	9.7	13.0	2.8	1.0	2.2	0	0	8.9

Note: EPT = Ephemeroptera Plecoptera Trichoptera
HBI = Hilsenhoff Biotic Index

TABLE 3-9 (Cont)

METRIC	GC-BIO-1	GC-BIO-2	RC-BIO-1	RC-BIO-2	RC-BIO-3	RC-BIO-R1	RC-GC-BIO-1	RC-GC-BIO-2	RC-GC-BIO-3	RC-GC-BIO-R1
	STATIONS									
TAXA RICHNESS	24	24	20	3Q	12	20	19	21	23	21
FLORIDA INDEX	4	7	7	8	3	3	5	6	5	8
HBI	6.5	7.4	7.1	7.3	6.4	7.7	7.4	7.6	7.0	6.9
EPT INDEX	3	1	0	3	0	1	1	2	0	4
CHIRONOMID TAXA	6	7	8	9	3	9	6	6	8	8
% DOMINANT TAXON	25.5	27.4	21.6	18.3	59.6	17.4	20.6	16.7	21.6	39.3
% SHREDDERS	8.3	7.4	12.4	16.5	60.2	6.5	4.7	2.1	8.0	10.7
% FILTERER-COLLECTORS	3.4	10.5	17.5	11.9	4.7	6.5	1.9	2.1	12.5	25.0

TABLE 3-9 (Cont)

METRIC	STC-BIO-1	STC-BIO-2	STC-BIO-3	STC-BIO-4	STC-BIO-5	STC-BIO-6	STC-BIO-7	STC-BIO-8	STC-BIO-R1
	STATIONS								
TAXA RICHNESS	7	16	18	20	22	32	33	52	14
FLORIDA INDEX	2	3	6	4	3	11	12	23	4
HBI	9.9	7.6	7.3	7.7	7.4	5.7	6.1	6.2	6.2
EPT INDEX	0	0	0	0	3	5	8	8	0
CHIRONOMID TAXA	1	5	8	9	6	8	9	15	3
% DOMINANT TAXON	64.4	45.1	33.1	19.8	51.7	16.5	12.9	15.6	40.5
% SHREDDERS	0	13.7	36.8	11.9	1.3	20.7	19.4	8.6	16.7
% FILTERER-COLLECTORS	0	0	1.0	0	22.1	16.5	17.2	16.5	0

TABLE 3-9 (Cont)

METRIC	STATIONS		
	YWC-BIO-1	YWC-BIO-2	YWC-BIO-R1
TAXA RICHNESS	25	35	20
FLORIDA INDEX	5	15	7
HBI	6.8	6.4	5.5
EPT INDEX	2	4	3
CHIRONOMID TAXA	6	8	4
% DOMINANT TAXON	24.0	14.2	31.4
% SHREDDERS	28.1	14.2	0.8
% FILTERER-COLLECTORS	4.2	8.8	10.7

reference stations were calculated for each station (Table 3-10). The State of Florida's regional reference, Five Mile Creek, was used for all station comparisons. The data from the upstream reference stations at NAS Cecil Field, RC-BIO-R1, RC-GC-BIO-RI, STC-BIO-R1, and YWC-BIO-R1, were also plotted on the graphs to compare to the regional reference and all other stations.

The total metric scores ranged from lows of 2 at STC-BIO-1 and 8 at 5-BIO-5 to a high of 40 at STC-BIO-8. Other stations with high scores included STC-BIO-7 (38), STC-BIO-6 (36), and YWC-BIO-2 (30), all of which were higher than the score at Five Mile Creek (28). The Cecil Field reference stations, RC-BIO-R1 (18), RC-GC-BIO-R1 (26), STC-BIO-R1 (16), and YWC-BIO-R1 (24), all scored below Five Mile Creek.

The relationship between habitat quality and biological condition among all stations is illustrated as a line graph (Figures 3-1 and 3-2). Ninety-five percent confidence intervals were calculated for the data around the regression line to obtain the expected range of values for biological condition, given the level of habitat quality. In this manner, outlyers can be readily identified and attributed to causes beyond habitat limitations.

The biological and habitat scores were divided by the reference score for a percent comparability value. Then, the regression analysis was performed and the stations were plotted. Interpretation of these plots depends on the understanding that there are essentially three parts to the curve. Station plots that fall within the 95 percent confidence interval lines indicate a predictable condition of the biological community in response to habitat quality. This relationship can be expected only in the absence of poor water quality; that is, poor water quality would prevent the biological community from reaching its potential even though appropriate habitat conditions exist. Sites that fall in the lower right-hand area indicate the depression of biological condition in habitat, which has the capacity to support a healthy community. This is usually an indication of toxic conditions resulting from poor water quality. Artificial (and usually temporary) elevation of biological condition because of organic enrichment would put sites in the upper left-hand area of this graph.

Two groups of stations were plotted against Five Mill Creek and selected Cecil Field reference stations. In Figure 3-1, the following stations lie within the predictable condition of the biological community in response to the habitat quality: YWC-BIO-R1, 9-BIO-1, GC-BIO-1 and 2, RC-GC-BIO-3, 5-BIO-3, and RC-BIO-R1. Stations RC-GC-BIO-R1 and 5-BIO-2 exhibited a higher benthic quality than might have been expected. This may be representative of a situation indicative of nutrient enrichment, which will artificially sustain a more diverse fauna than dictated by the habitat quality. Stations RC-GC-BIO-1 and 2,

TABLE 3-10 BIOASSESSMENT SCORES FOR MACROINVERTEBRATES COLLECTED WITH A DIP NET FROM CECIL FIELD STATIONS, JUNE 1993

	STATIONS							
METRIC	5 MILE-CREEK	5-BIO-2	5-BIO-3	5-BIO-4	5-BIO-5	8-BIO-1	8-BIO-2	9-BIO-1
TAXA RICHNESS	4	2	2	2	0	0	0	2
FLORIDA INDEX	6	4	4	4	2	2	0	2
HBI	4	4	4	0	4	4	4	4
EPT INDEX	2	0	0	0	0	0	0	0
CHIRONOMID TAXA	2	2	2	2	0	2	0	4
% DOMINANT TAXON	6	6	6	4	2	6	6	6
% SHREDDERS	2	0	0	2	0	4	2	2
% FILTERER-COLLECTORS	2	4	0	0	0	0	0	2
TOTAL SCORE	28	22	18	14	8	18	12	22
% COMPARISON TO REFERENCE	100	78.6	64.3	50.0	28.6	64.3	42.8	78.6

Note: EPT = Ephemeroptera Plecoptera Trichoptera
HBI = Hilsenhoff Biotic Index

TABLE 3-10 (Cont)

METRIC	GC-BIO-1	GC-BIO-2	RC-BIO-1	RC-BIO-2	RC-BIO-3	RC-BIO-R1	RC-GC-BIO-1	RC-GC-BIO-2	RC-GC-BIO-3	RC-GC-BIO-R1
	STATIONS									
TAXA RICHNESS	2	2	2	4	0	2	2	2	2	2
FLORIDA INDEX	2	4	4	4	0	0	2	2	2	4
HBI	6	4	4	4	6	4	4	4	4	4
EPT INDEX	2	0	0	2	0	0	0	0	0	2
CHIRONOMID TAXA	2	2	4	4	0	4	2	2	4	4
% DOMINANT TAXON	6	6	6	6	2	6	6	6	6	4
% SHREDDERS	0	0	0	2	6	0	0	0	0	0
% FILTERER-COLLECTORS	0	2	4	2	0	2	0	0	2	6
TOTAL SCORE	20	20	24	28	14	18	16	16	20	26
% COMPARISON TO REFERENCE	71.4	71.4	85.7	100	50.0	64.3	57.1	57.1	71.4	92.8

TABLE 3-10 (Cont)

METRIC	STC-BIO-1	STC-BIO-2	STC-BIO-3	STC-BIO-4	STC-BIO-5	STC-BIO-6	STC-BIO-7	STC-BIO-8	STC-BIO-R1
	STATIONS								
TAXA RICHNESS	0	2	2	2	2	4	4	6	2
FLORIDA INDEX	0	0	2	2	0	6	6	6	2
HBI	0	4	4	4	4	6	6	6	6
EPT INDEX	0	0	0	0	2	4	6	6	0
CHIRONOMID TAXA	0	2	4	4	2	4	4	6	0
% DOMINANT TAXON	2	4	4	6	4	6	6	6	4
% SHREDDERS	0	0	4	0	0	2	2	0	2
% FILTERER-COLLECTORS	0	0	0	0	6	4	4	4	0
TOTAL SCORE	2	12	20	18	20	36	38	40	16
% COMPARISON TO REFERENCE	7.1	42.8	71.4	64.3	71.4	100	100	100	57.1

TABLE 3-10 (Cont)

METRIC	STATIONS YWC-BIO-1	YWC-BIO-2	YWC-BIO-R1
TAXA RICHNESS	2	4	2
FLORIDA INDEX	2	6	4
HBI	4	6	6
EPT INDEX	0	2	2
CHIRONOMID TAXA	2	4	2
% DOMINANT TAXON	6	6	6
% SHREDDERS	2	0	0
% FILTERER-COLLECTORS	0	2	2
TOTAL SCORE	18	30	24
% COMPARISON TO REFERENCE	64.3	100	85.7

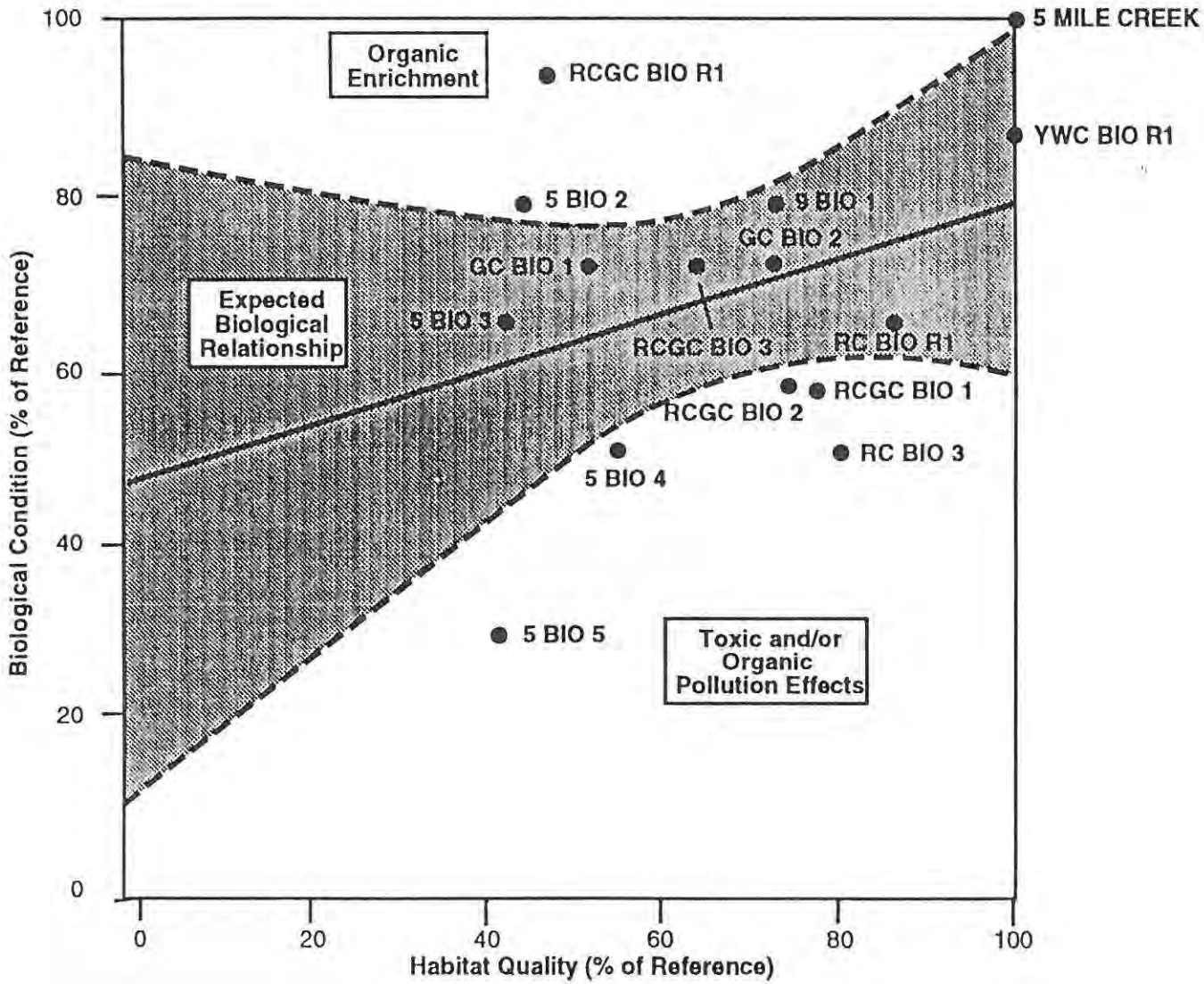

Figure 3-1. Relationship between habitat quality and biological condition from dip net samples taken at stations at Cecil Field.

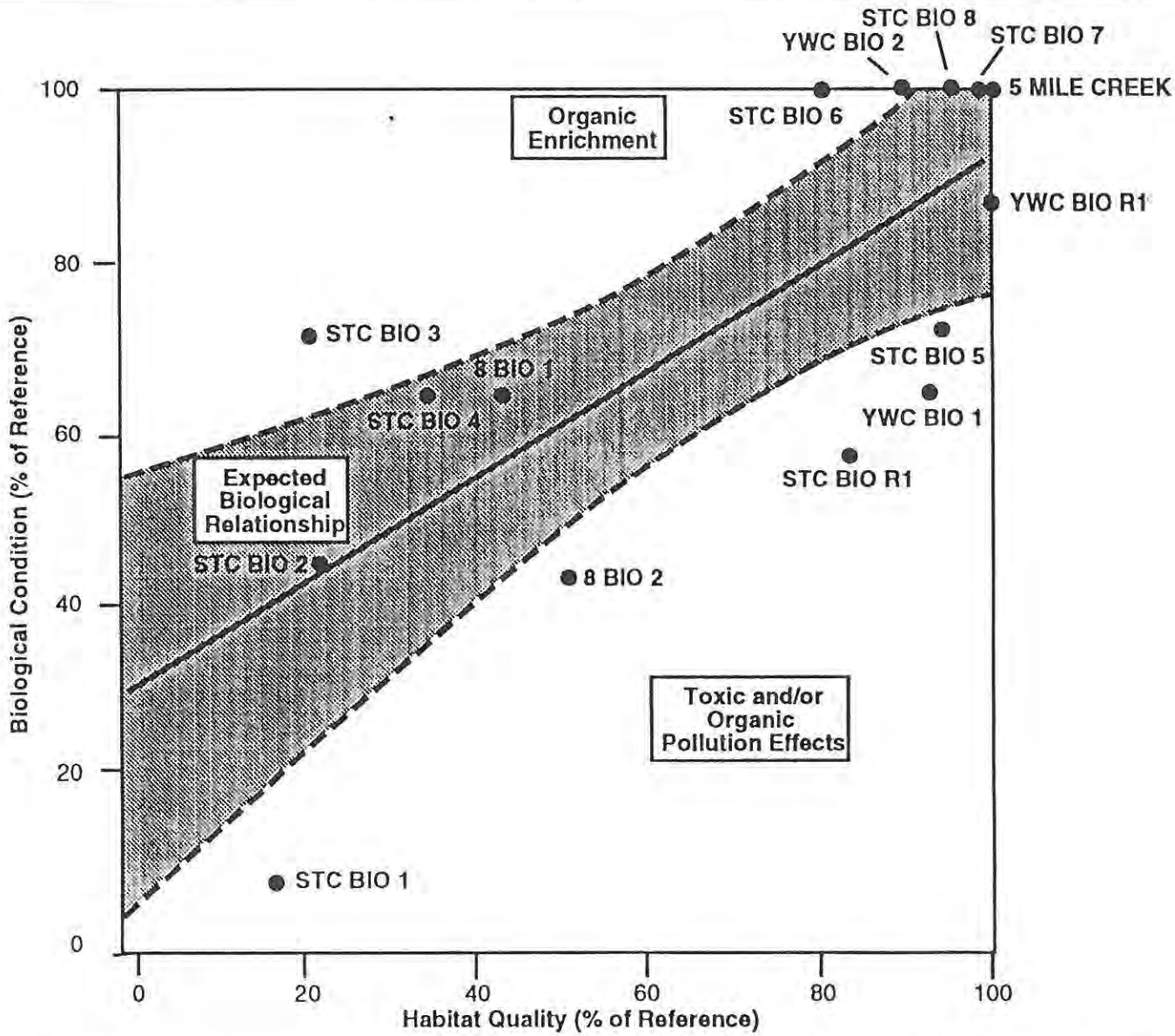

Figure 3-2. Relationship between habitat quality and biological condition from dip net samples taken at stations at Cecil Field.

5-BIO-4, and RC-BIO-3 fell below the 95 percent confidence line and could be classified as slightly impaired. Station 5-BIO-5 was classified as moderately impaired. The stations that fall below the 95 percent confidence internal line represent situations where organic pollution or toxicants could be adversely affecting the biological conditions, regardless of the quality of the habitat, which for 5-BIO-4 and 5 was fairly low. Factors possibly influencing the communities at the impaired stations as noted in this study includes very low DO at 5-BIO-4 and 5, and RC-GC-BIO-1 and 2; petroleum odor in the sediment at 5-BIO-4; chlorine odor in the water and the highest conductivity of any station at RC-BIO-3, which is downstream from the wastewater treatment plant.

In Figure 3-2, the following stations lie within the predictable conditions of the community: STC-BIO-2, 4, 7 and 8; YWC-BIO-R1; and 8-BIO-1. Stations STC-BIO-3 and 6 and YWC-BIO-2 exhibited higher benthic quality than expected. Stations STC-BIO-R1 and 5 and YWC-BIO-1 were classified as slightly impaired. Stations 8-BIO-2 was moderately impaired and STC-BIO-1 was severely impaired. Factors possibly influencing the communities at the impaired stations as noted in this study include petroleum sediment odor and water surface oily sheen at STC-BIO-1, and petroleum sediment odor at 8-BIO-2.

Hester-Dendy Samples

The benthic community that the Hester-Dendy artificial substrate samplers attract primarily consist of pioneer species that colonize the samplers during the sampling period. These organisms originate from recruitment or drift from the benthic populations established in the stream. The artificial substrates are identical in composition and surface area, and the community that colonizes them at each station occurred under the influence of environmental conditions that existed during the sampling period.

A regional reference site established by the State of Florida, Five Mile Creek, will be used to compare to the Cecil Field information in addition to the reference stations, RC-BIO-R1, RC-GC-BIO-R1, YWC-BIO-R1, and STC-BIO-R1.

Some Hester-Dendy samplers were partially exposed as a result of receding water levels. Samplers affected were at 5-BIO-2 and GC-BIO-2. These samples were processed per instructions from ABB-ES and the data are reported here. Because samplers were totally exposed or were not set at some stations, no Hester-Dendy sampler data are available at the following stations: RC-BIO-1 and 2; STC-BIO-R1, 3, and 6; 5-BIO-3, 4, and 5; 6-BIO-1; 8-BIO-1 and 2; 9-BIO-1; RC-GC-BIO-3; and LF-BIO-1 through 8. The period of

colonization and the sampler problems should be considered when evaluating station differences in macroinvertebrate community structure.

In the first station grouping compared in Figure 3-3, the total number of taxa was lowest at 5-BIO-2 (14 taxa) and GC-BIO-2 (15). The number of taxa was highest at the reference stations YWC-BIO-R1 (36) and Five Mile Creek (30). The reference stations RC-BIO-R1 (22) and RC-GC-BIO-R1 (23) were very similar to the remaining stations (21-25).

In the second station grouping in Figure 3-4, the number of taxa at STC-BIO-1 (2), STC-BIO-2 (7) and 4 (7) was much lower than all the others in the comparison. The number of taxa was highest at STC-BIO-8 (41), followed by YWC-BIO-R1 (36). The regional reference station, Five Mile Creek (30) and the remaining stations (26-31) were comparable.

The number of individuals was lowest at GC-BIO-2 (195/m^2) and at Five Mile Creek (326/m^2) in the first station grouping (Figure 3-5). Compared to the other reference stations, the number of individuals at RC-BIO-R1 (687/m^2), RC-GC-BIO-R1 (1,156/m^2), YWC-BIO-R1 (1,835/m^2), and 5-BIO-2 (498/m^2) was also low. The number of individuals at other stations was as high or higher than the reference stations, with the highest number at RC-BIO-3 (26,686/m^2).

In the second group, the number of individuals at STC-BIO-4 (74/m^2) and STC-BIO-1 (95/m^2) was much lower than all other stations (Figure 3-6). Compared to Five Mile Creek (326/m^2), the remaining stations had similar or higher numbers. Compared to YWC-BIO-R1 (1,475/m^2), the number of individuals at STC-BIO-2 (313/m^2) and STC-BIO-5 (885/m^2) was lower, but the numbers at the remaining stations were comparable.

The Florida index values were lowest at reference stations RC-BIO-R1 (3) and GC-BIO-2 (3) (Figure 3-7). Compared to Five Mile Creek (15), which had the highest value, values at all other stations were lower. The next highest value was measured at RC-BIO-3 (12). The other reference stations, RC-GC-BIO-R1 (6) and YWC-BIO-R1 (8), had slightly higher or lower values than the remaining stations.

In the second group, STC-BIO-1 and 2 both had a Florida index value of 0, followed by STC-BIO-4 with an index value of 1 (Figure 3-8). Values at all other stations were the same or higher than the value at YWC-BIO-R1 (8), and were lower than the Five Mile Creek value.

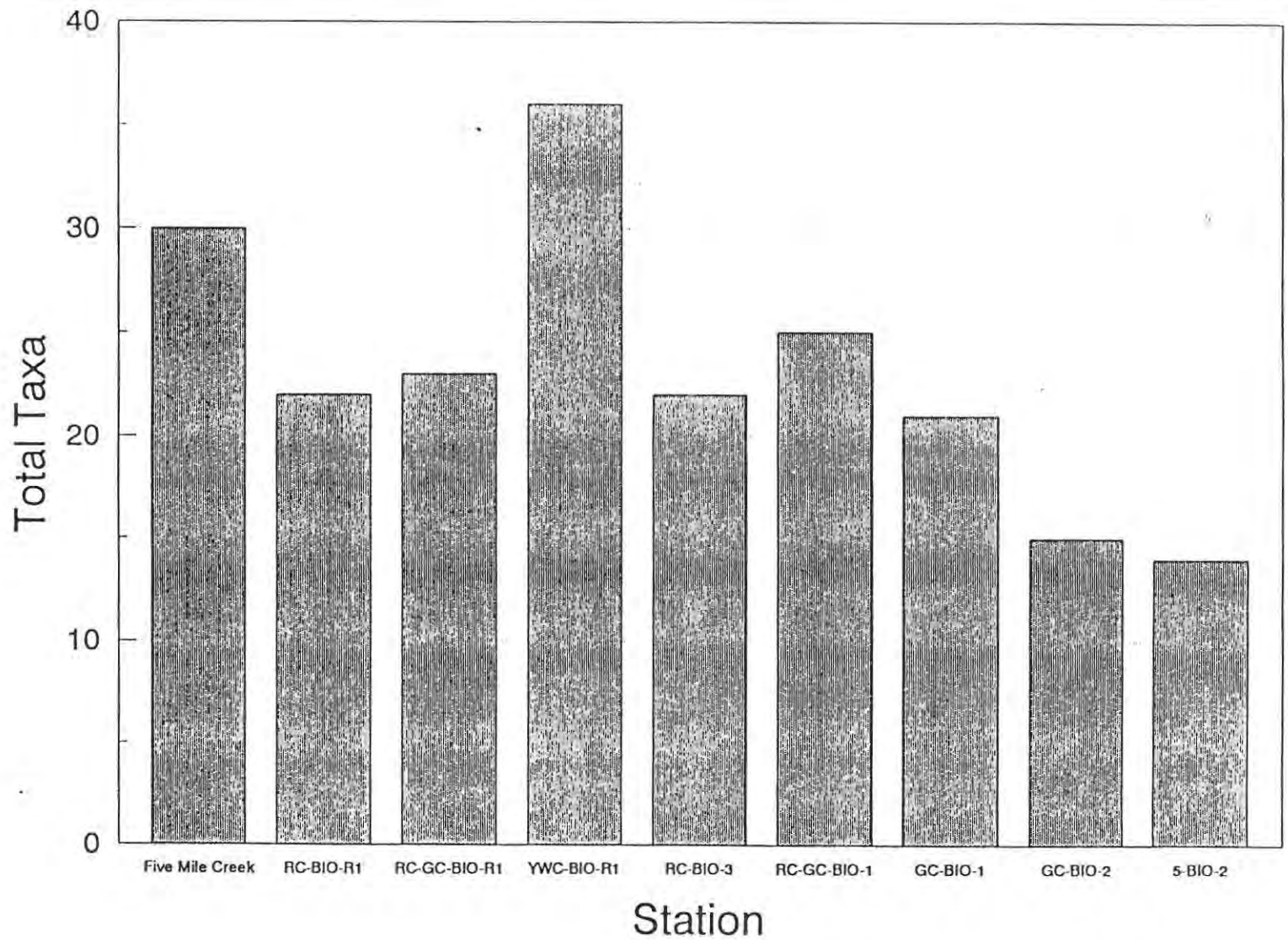

Figure 3-3. Total number of taxa collected from Hester-Dendy samples at Cecil Field.

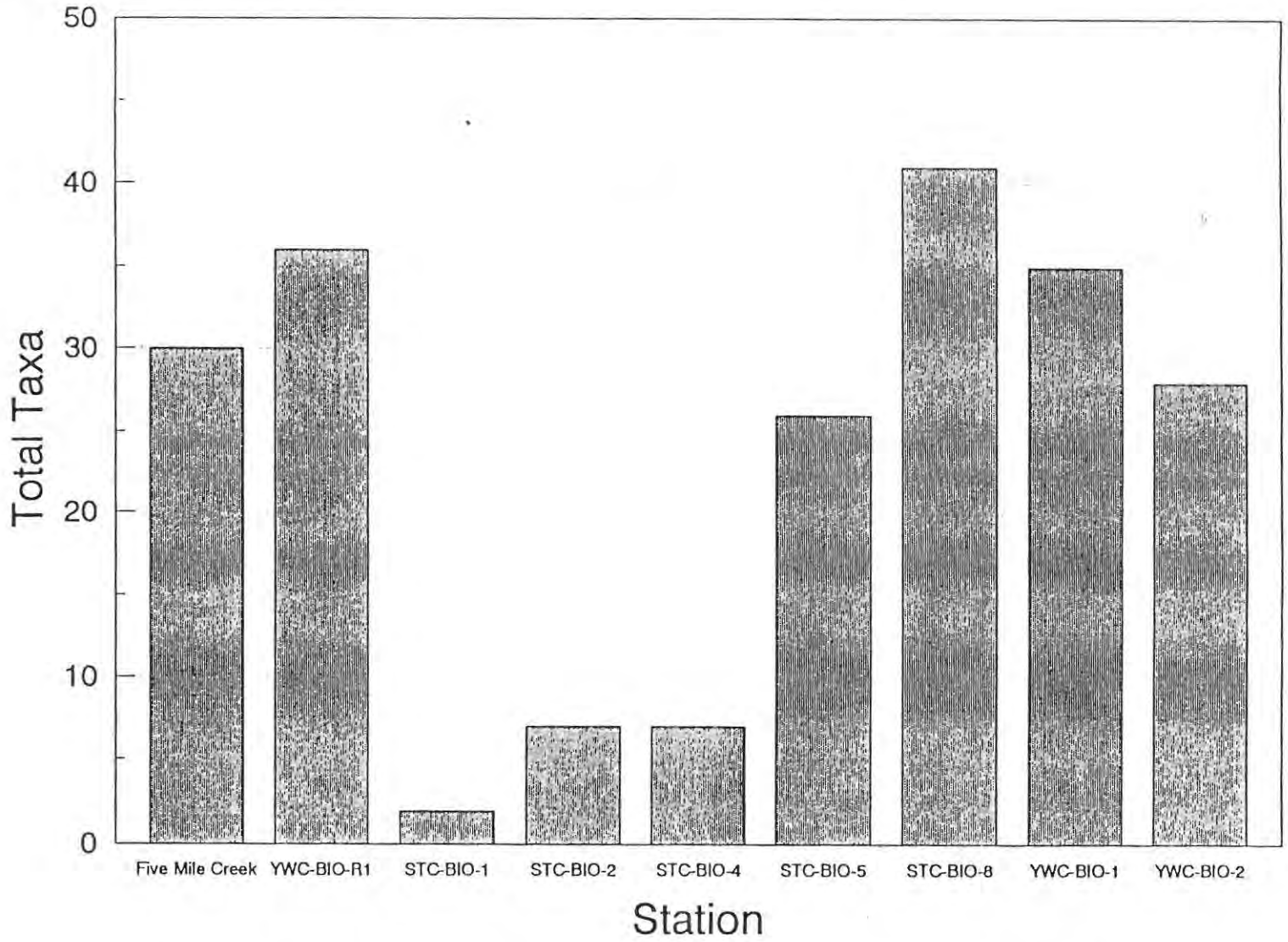

Figure 3-4. Total number of taxa collected from Hester Dendy samples at Cecil Field.

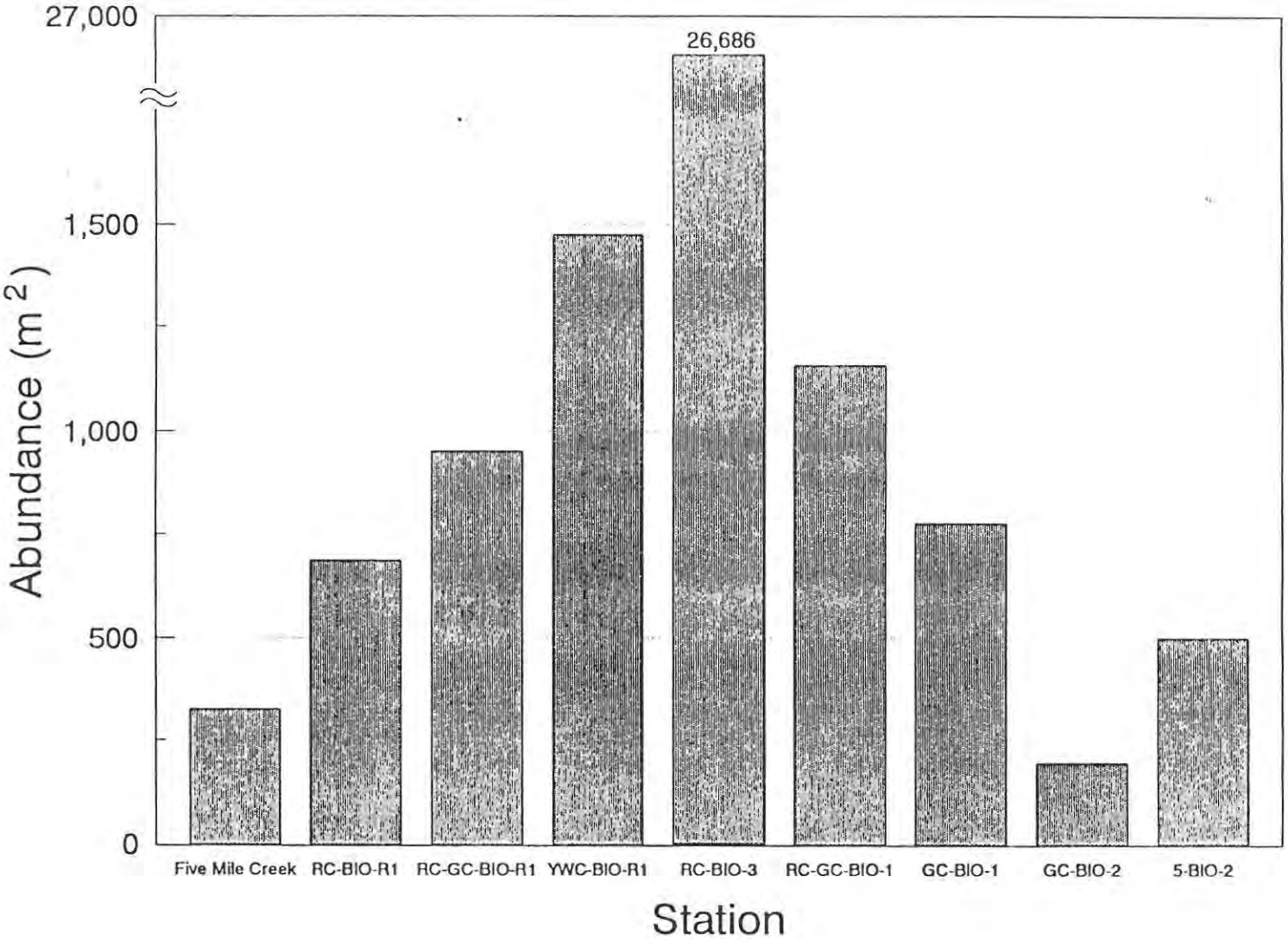

Figure 3-5. Abundance of organisms collected from Hester-Dendy samples at Cecil Field.

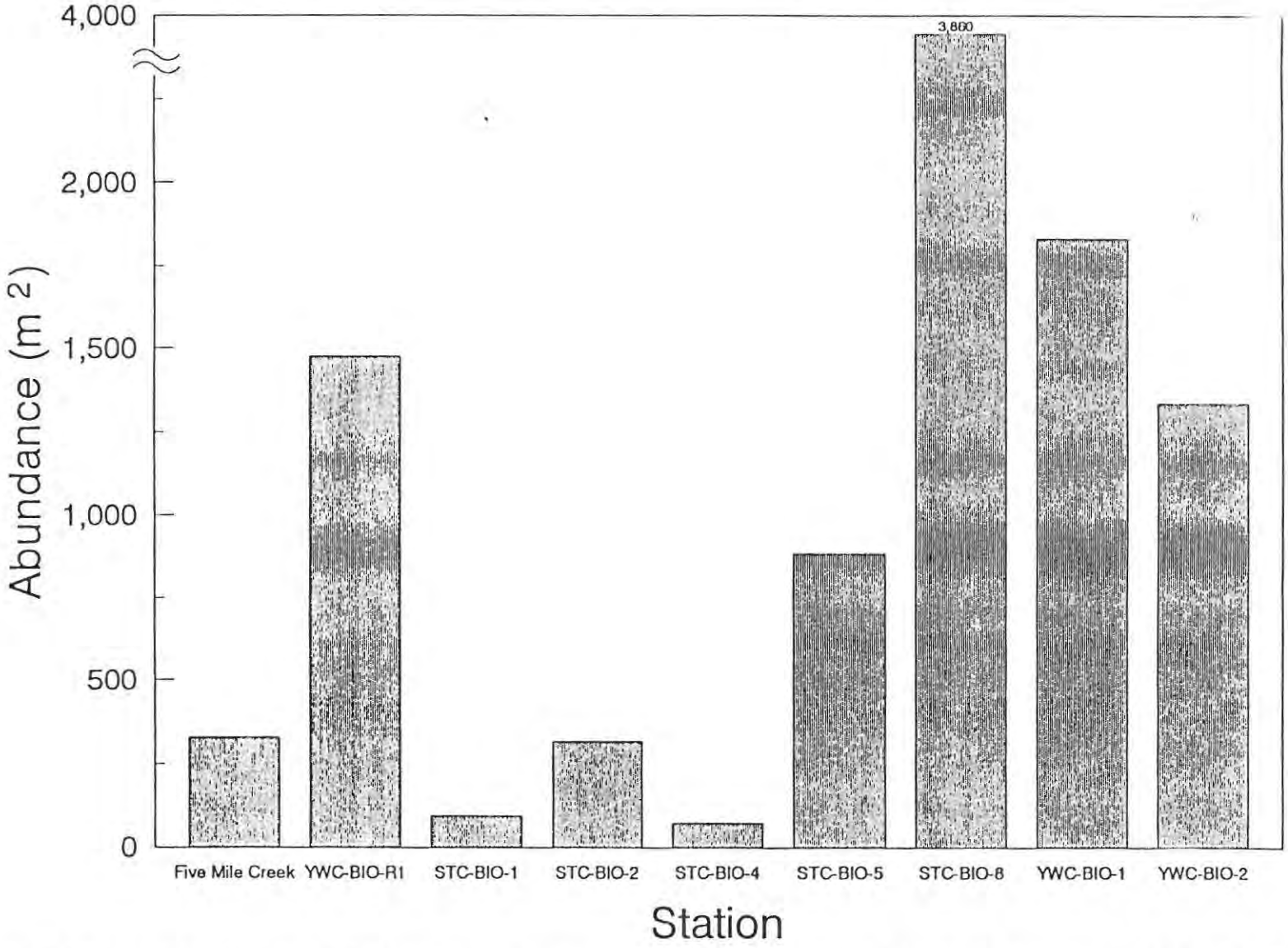

Figure 3-6. Abundance of organisms collected from Hester-Dendy samples at Cecil Field.

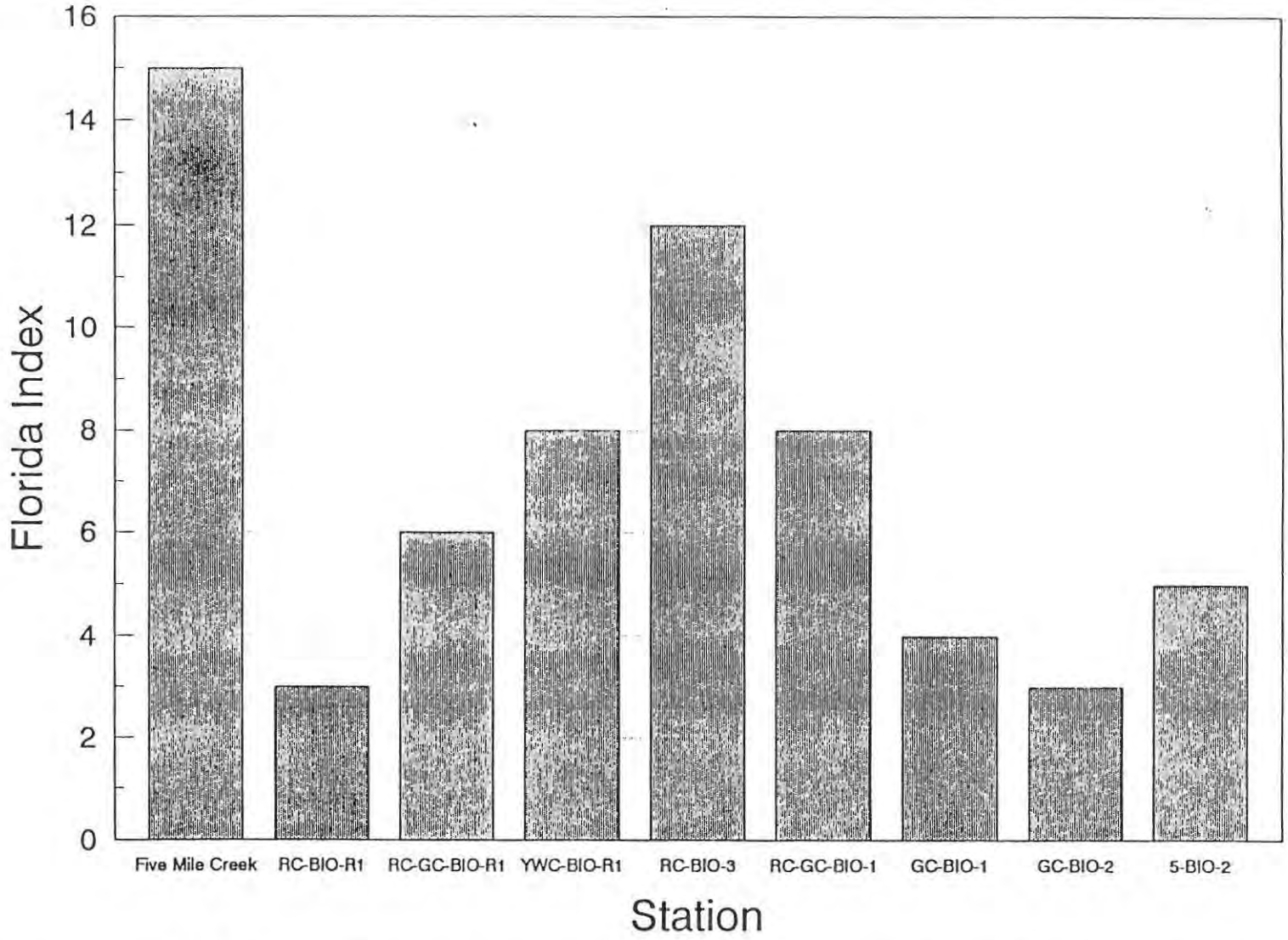

Figure 3-7. Florida Index for Hester-Dendy samples collected at Cecil Field.

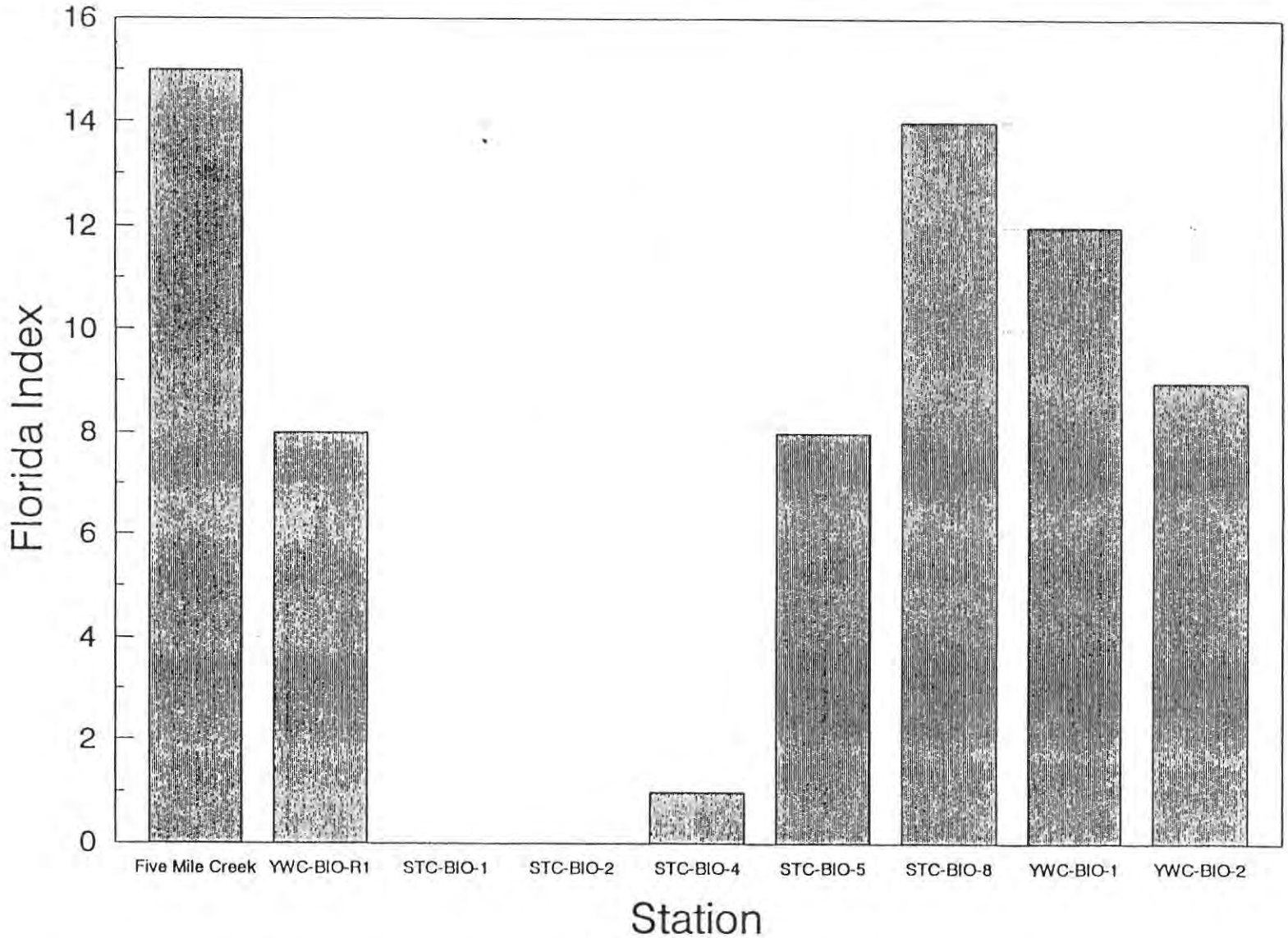

Figure 3-8. Florida Index for Hester-Dendy samples collected at Cecil Field.

The Shannon-Weaver index values were lowest at RC-BIO-3 (0.279), followed by 5-BIO-2 (1.332) (Figure 3-9). Values at all other stations were lower than Five Mile Creek (4.612), but were comparable to RC-BIO-R1 (2.529), RC-GC-BIO-R1 (2.887), and YWC-BIO-R1 (3.900).

In the second group, STC-BIO-1 (0.944) had the lowest value, followed by STC-BIO-2 (1.419) (Figure 3-10). Both reference stations, Five Mile Creek (4.612) and YWC-BIO-R1 (3.900), had higher values than all other stations.

The percent of EPT individuals, which consists of the most pollution-sensitive benthic taxa, was 0.0 at 5-BIO-2, GC-BIO-2, RC-BIO-3, and STC-BIO-1, 2, and 4 (Table 3-7). Percentages at the reference stations, Five Mile Creek (5.6 percent), RC-BIO-R1 (0.8 percent), and RC-GC-BIO-R1 (1.4 percent), were also low. The percent of EPT was highest at STC-BIO-8 (3.4.1 percent), the reference station YWC-BIO-R1 (17.5 percent), and GC-BIO-2 (12.5 percent).

The Hilsenhoff Biotic index rates the community on a scale of 1 (high quality) to 10 (low quality) (Table 3-7). The index scores ranged from a good quality score of 4.7 at STC-BIO-8 to a low score of 10 at STC-BIO-1. Many of the stations had lower quality scores (>7.0) than the reference stations, Five Mile Creek (6.4) and YWC-BIO-R1 (5.6), including the other reference stations, RC-BIO-R1 (8.7) and RC-GC-BIO-R1 (7.4).

The trends in the metric values indicate that STC-BIO-1, 2, and 4 consistently ranked lower than the reference stations and all other stations. The reference stations Five Mile Creek and YWC-BIO-R1 were among the higher ranking stations and were more suitable as reference stations than RC-BIO-R1 and RC-GC-BIO-R1, which had similar metric values to the potentially influenced stations.

Ponar Samples

The results from the Ponar samples are primarily indicative of the infaunal benthic community with some epifaunal components represented. Station-to-station differences in the community may be due to differences in substrate composition, where they exist, in addition to or instead of man-induced alteration on the population.

Since no State of Florida regional reference data exist for this gear type, all stream station data comparisons will be made to the reference stations RC-BIO-R1, RC-GC-BIO-R1, YWC-BIO-R1, and STC-BIO-R1. Since no lake reference stations were established as part

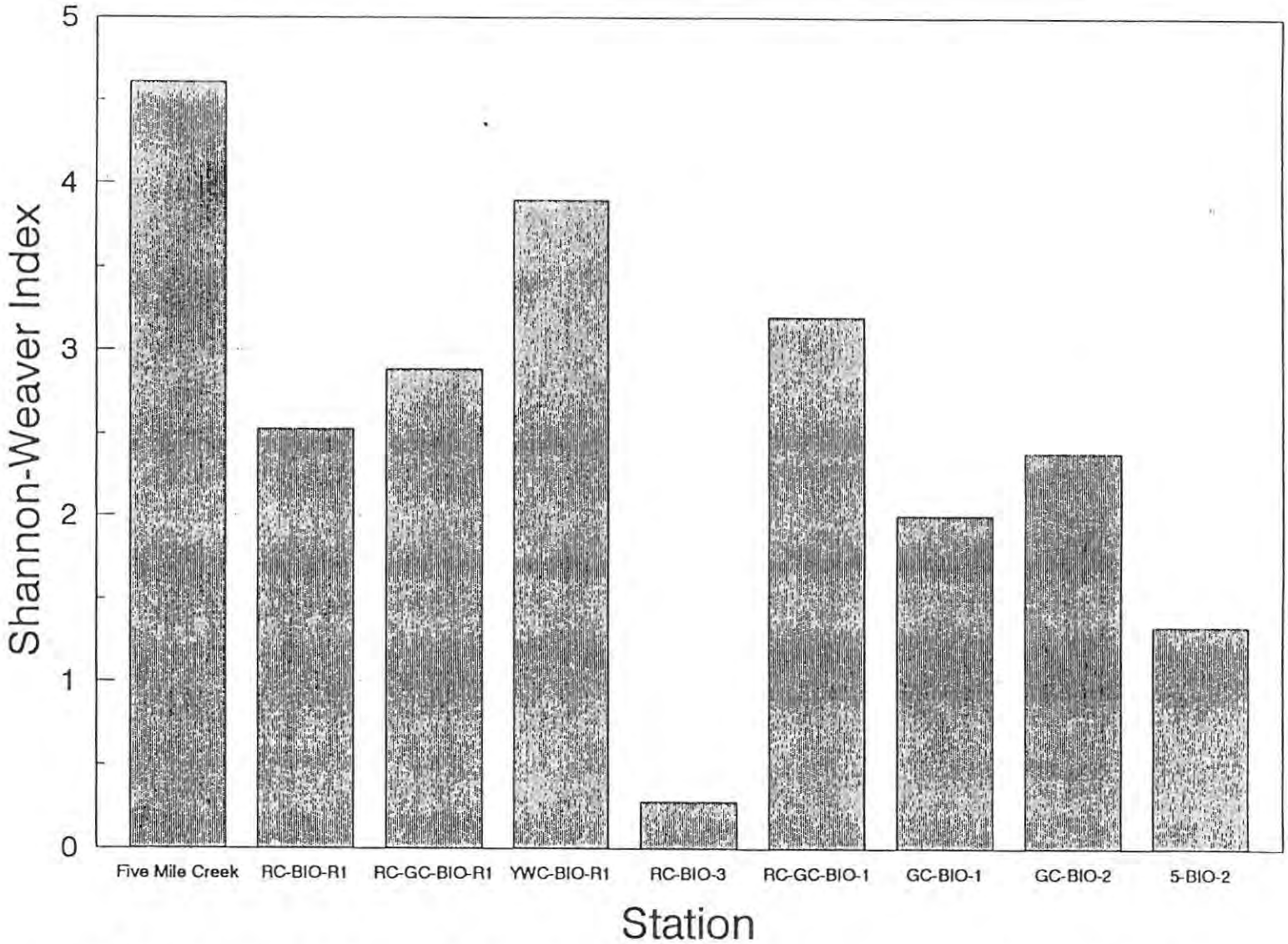

Figure 3-9. Shannon-Weaver Index for Hester-Dendy samples collected at Cecil Field.

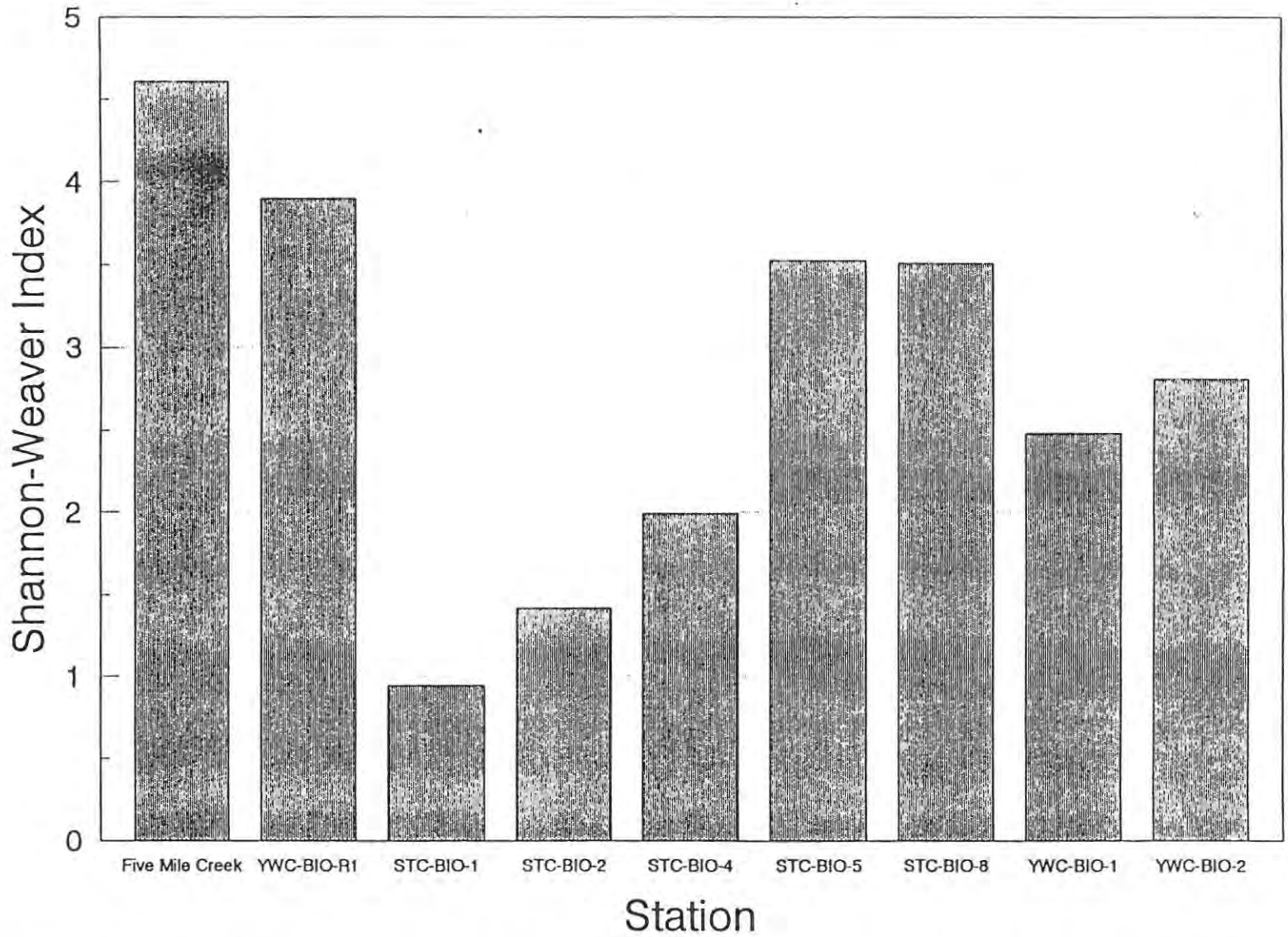

Figure 3-10. Shannon-Weaver Index for Hester-Dendy samples collected at Cecil Field.

of this study, the only suitable stations for comparisons were RC-BIO-1 and 2, located just upstream from Lake Fretwell. These stations were located in the deep, slow moving part of Rowell Creek that entered the lake and were chosen for comparisons because they were more similar to the lake than the shallow small stream stations. Three station groupings were graphed for station comparisons, including two stream station groups and the lake/pond station group.

The total number of taxa in Figure 3-11 was lowest at 5-BIO-5 (5 taxa), followed by 5-BIO-4 (10). Other stations with a number of taxa that was lower than the reference stations were 5-BIO-2 (13) and RC-BIO-3 (14). Compared to reference station RC-BIO-R1 (23), all other stations had a slightly lower or higher number of taxa. Reference stations RC-GC-BIO-R1 (42) and YWC-BIO-R1 (33) ranked higher than most stations.

In Figure 3-12, the number of taxa was lowest at STC-BIO-1 (4), followed by 8-BIO-2 (8). The number of taxa at stations STC-BIO-4 (10) and 8-BIO-1 (13) was also somewhat low. Compared to the reference stations STC-BIO-R1 (24) and YWC-BIO-R1 (33), most other stations were comparable.

The lowest number of taxa in the lake stations (Figure 3-13) was at LF-BIO-6 (8), followed by LF-BIO-5 (10). All other stations were comparable to the reference stations RC-BIO-1 (16) and RC-BIO-2 (24).

The number of individuals in Figure 3-14 was lowest at 5-BIO-5 (143/m^2) and 5-BIO-2 (702/m^2). Compared to RC-BIO-R1 (2,480/m^2), the other stations were comparable, but compared to RC-GC-BIO-R1 (11,624/m^2) and YWC-BIO-R1 (6,479/m^2), more of the stations had lower abundance.

In Figure 3-15, abundance was low at STC-BIO-1 (143/m^2), 8-BIO-1 (459/m^2), 8-BIO-2 (459/m^2), STC-BIO-4 (530/m^2), STC-BIO-3 (731/m^2), and STC-BIO-2 (1,261/m^2). Abundance at all other stations was comparable to STC-BIO-R1 (2,609/m^2), but was lower than YWC-BIO-R1 (6,479/m^2).

The lowest number of individuals in the lake stations (Figure 3-16) was at 6-BIO-1 (831/m^2), followed by LF-BIO-7 (1,433/m^2), LF-BIO-5 (1,648/m^2), and LF-BIO-6 (1,663/m^2). The other stations were comparable to the reference stations RC-BIO-1 (4,085/m^2) and RC-BIO-2 (4,042/m^2).

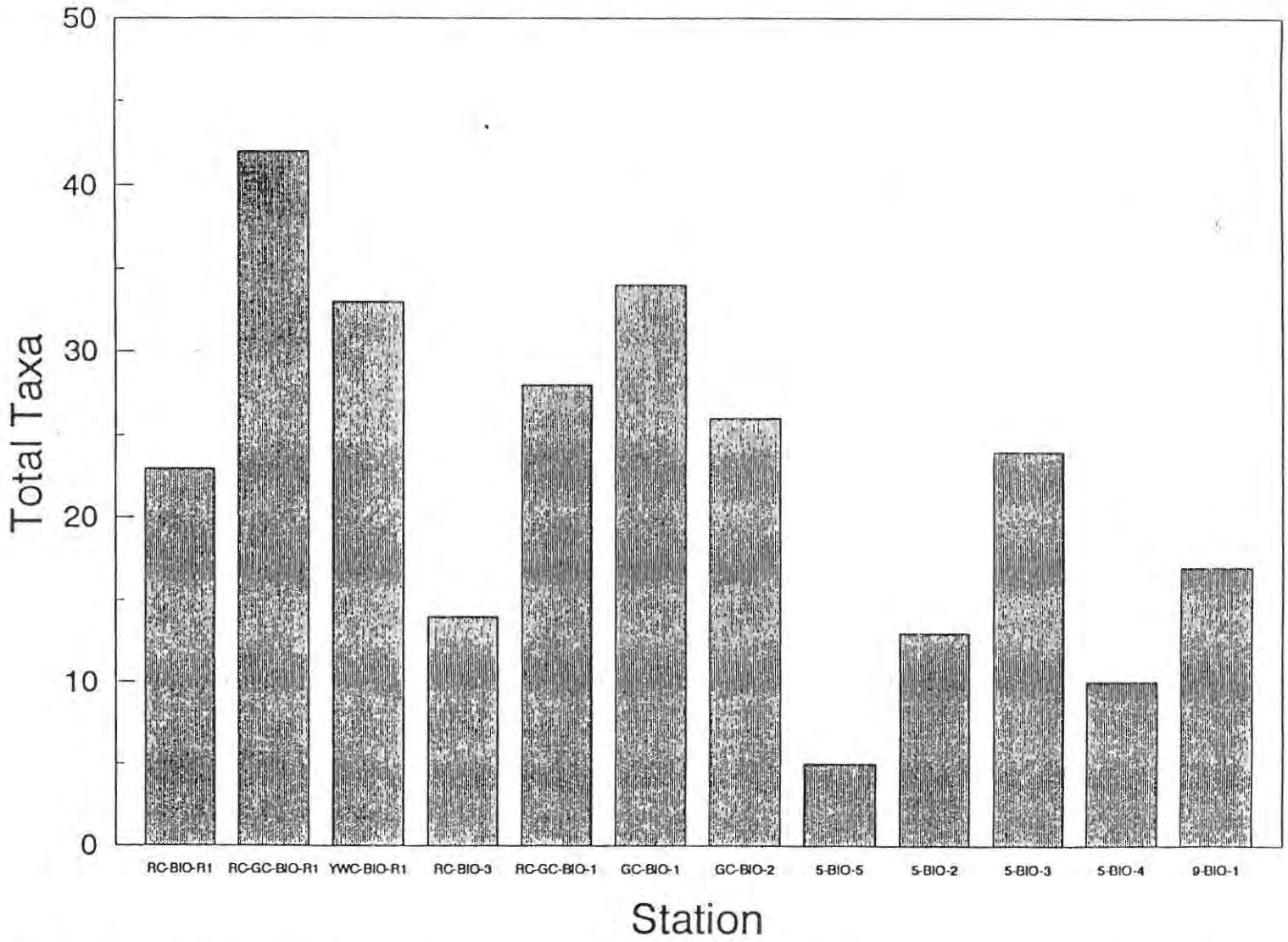

Figure 3-11. Total number of taxa collected from Ponar samples at Cecil Field.

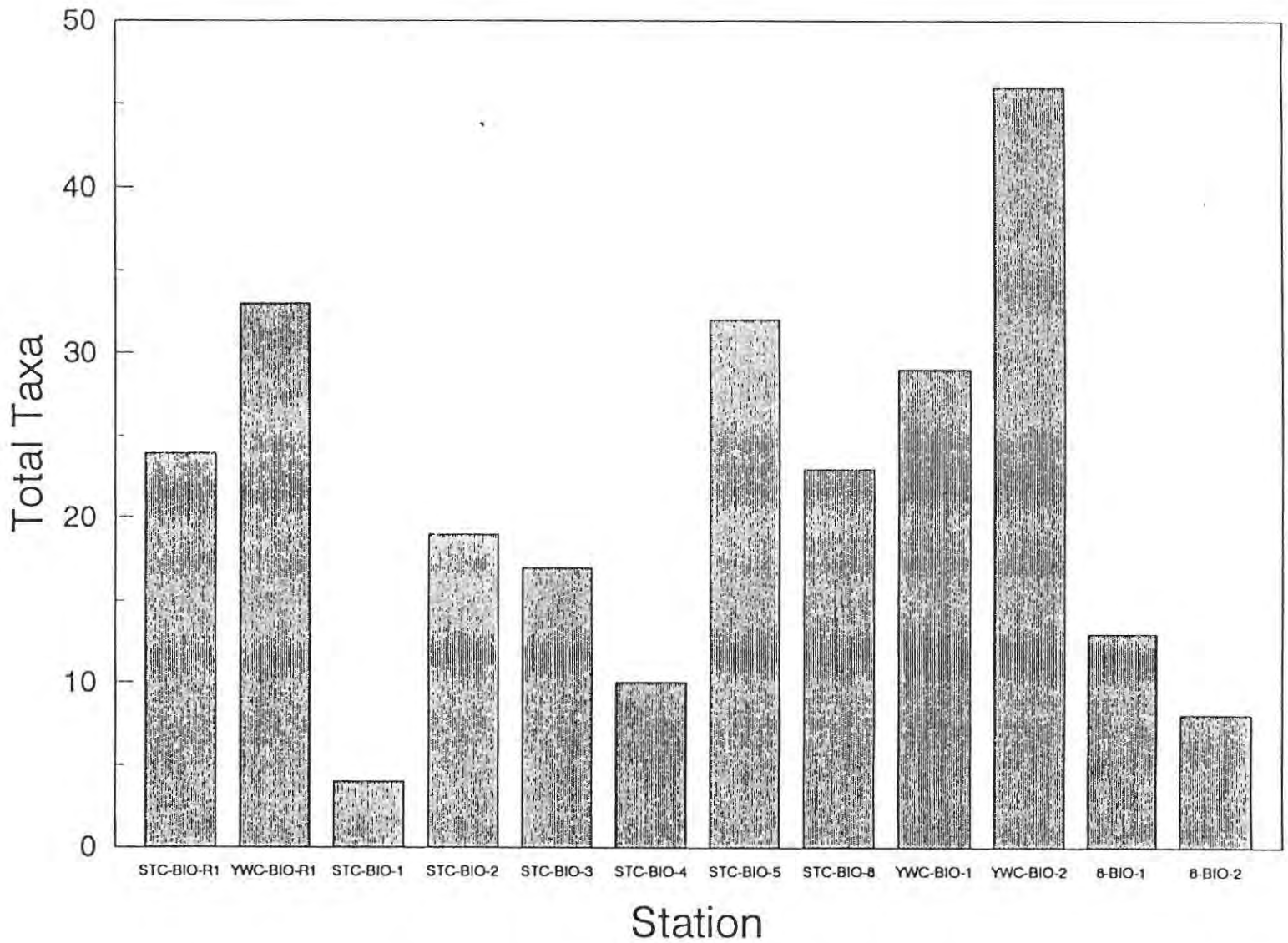

Figure 3-12. Total number of taxa collected from Ponar samples at Cecil Field.

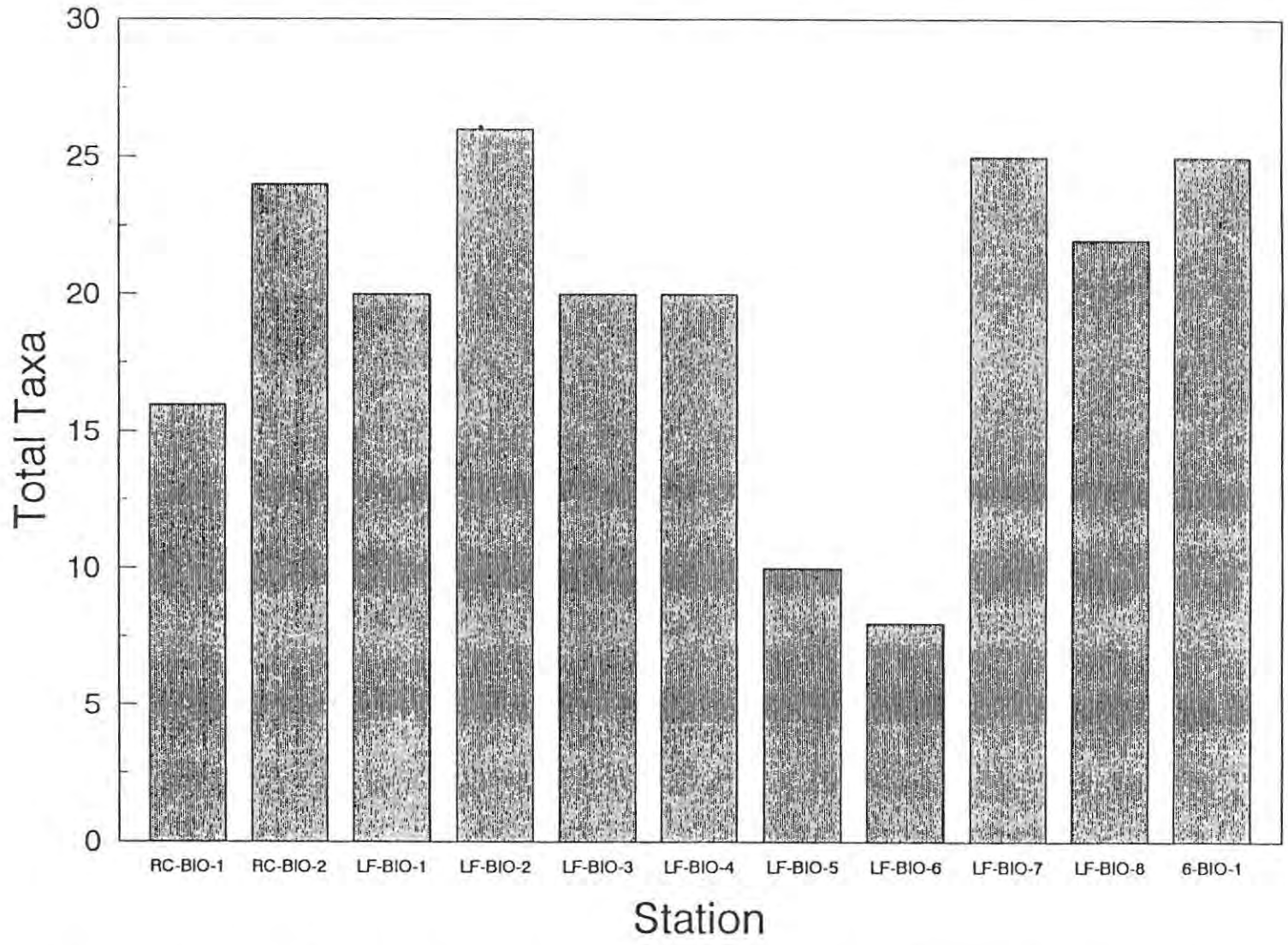

Figure 3-13. Total number of taxa collected from Ponar samples at Cecil Field.

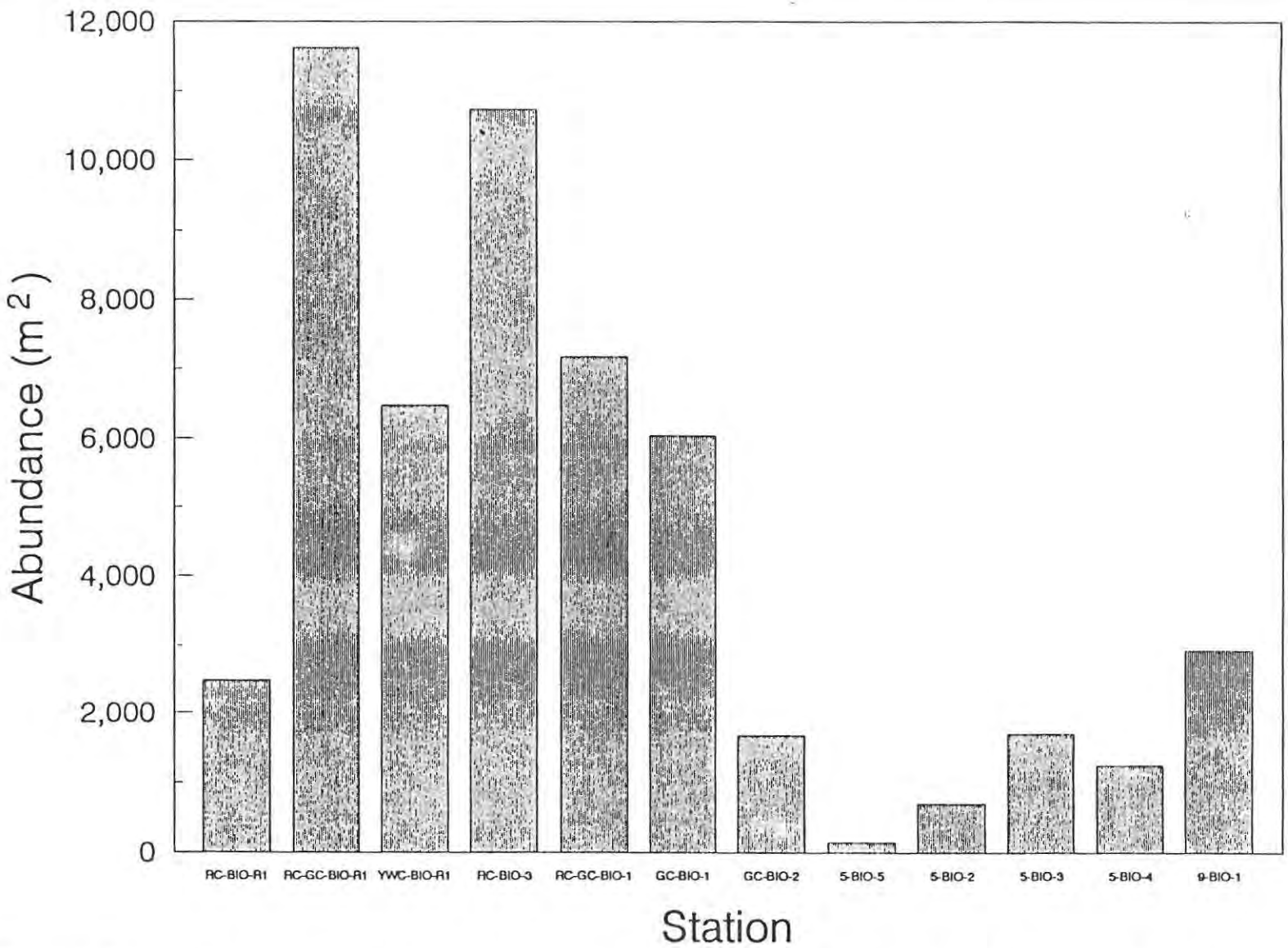

Figure 3-14. Abundance of organisms collected from Ponar samples at Cecil Field.

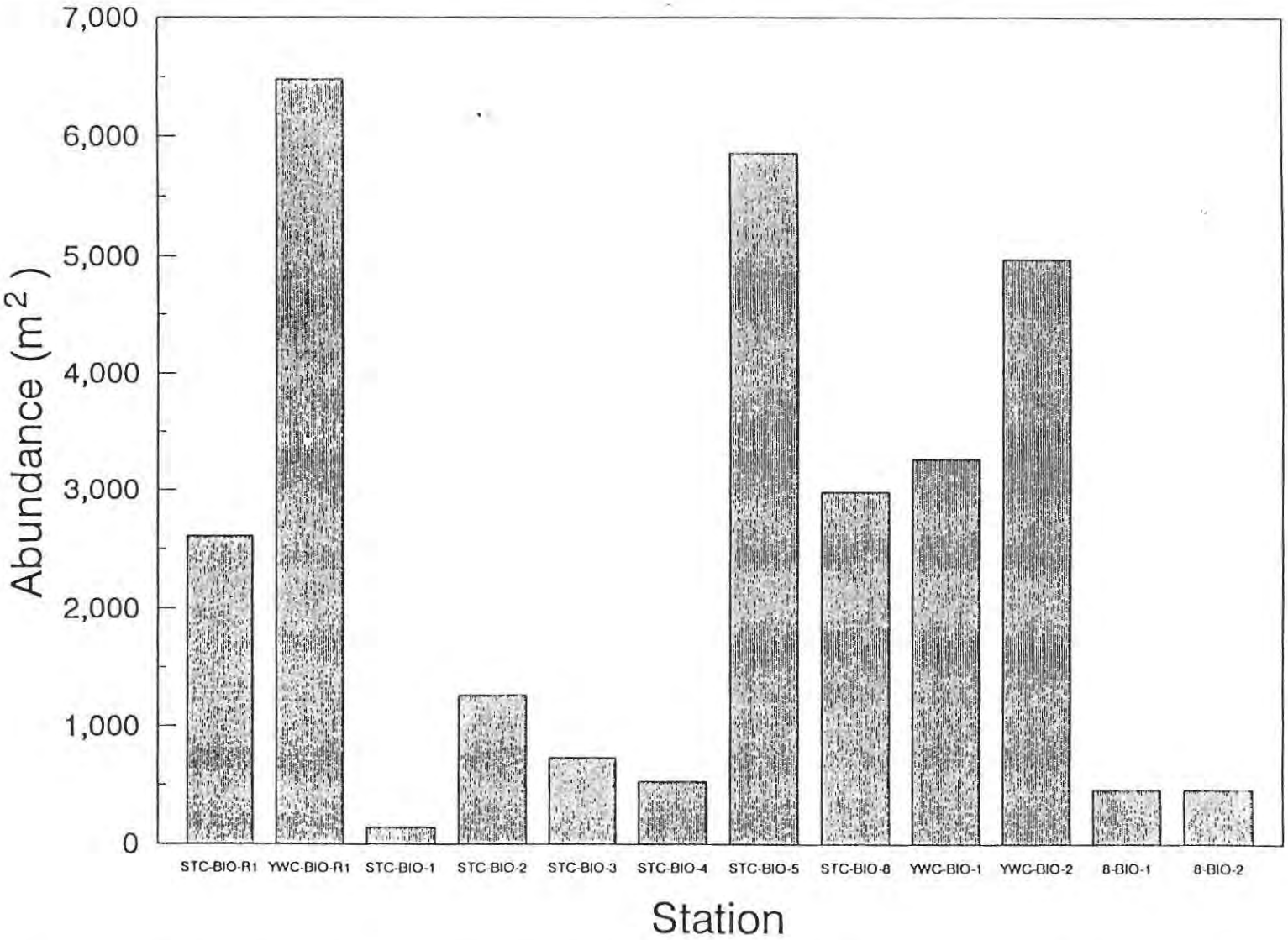

Figure 3-15. Abundance of organisms collected from Ponar samples at Cecil Field.

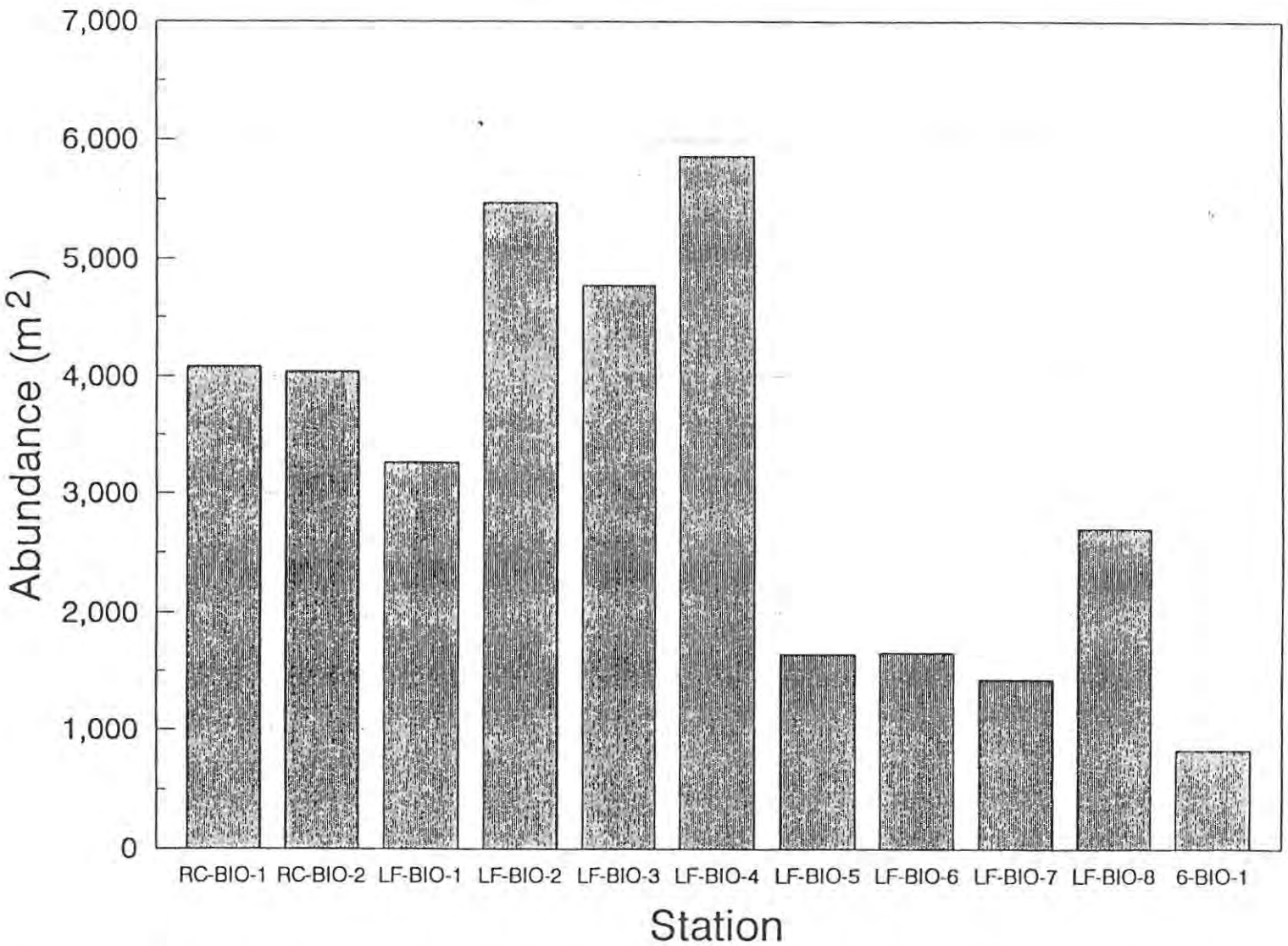

Figure 3-16. Abundance of organisms collected from Ponar samples at Cecil Field.

In Figure 3-17, the Florida index was the same or higher than RC-BIO-R1 (2) at all stations. Index values at all stations were lower than RC-GC-BIO-R1 (12). Compared to YWC-BIO-R1 (6), several stations had lower index values, especially 5-BIO-5 (2) and 5-BIO-4 (2).

The Florida index in Figure 3-18 was lowest at STC-BIO-1 (1), YWC-BIO-1 (1), and 8-BIO-2 (1). Index values at most stations were lower than the reference stations, and except for STC-BIO-3 (2), STC-BIO-4 (2), and 8-BIO-1 (3), the values were comparable.

At the lake stations (Figure 3-19), the lowest Florida index values were at LF-BIO-6 (0), LF-BIO-5 (1), and LF-BIO-8 (1). Index values at all other stations were higher than the reference stations RC-BIO-1 (3) and RC-BIO-2 (2).

The Shannon-Weaver index in Figure 3-20 was slightly lower at 5-BIO-4 (1.973), 5-BIO-5 (2.246), and RC-BIO-3 (2.434). Index values at all other stations were comparable to the reference stations RC-BIO-R1 (2.844), RC-GC-BIO-R1 (3.627), and YWC-BIO-R1 (3.531).

In Figure 3-21, the lowest Shannon-Weaver index value was at STC-BIO-1 (1.357). Index values at all other stations were comparable to the reference stations STC-BIO-R1 (3.003) and YWC-BIO-R1 (3.531).

At the lake stations (Figure 3-22), the lowest Shannon-Weaver index value was at LF-BIO-6 (1.332), followed by LF-BIO-5 (1.978). Index values at the other stations were comparable to the reference stations RC-BIO-1 (2.404) and RC-BIO-2 (3.218).

The percent of EPT individuals, which comprise the most sensitive taxa, was low at all stations, which is to be expected in the community as represented by the Ponar samples (Table 3-8). These taxa are more common on cobble/gravel substrate in riffle habitat or on woody debris than in sand or mud substrate. Most stations had 0 percent EPT and the highest percentages were at RC-BIO-R1 (9.8 percent), GC-BIO-1 (5.9 percent), and LF-BIO-2 (5.5 percent).

The Hilsenhoff Biotic index values were high at most stations, ranging from 6.3 at YWC-BIO-R1 to 9.7 at LF-BIO-4 (Table 3-8). On a scale of 1-10, with the low values indicative of a good quality community, the stations at Cecil Field are all classified as below average, based on the infaunal benthic community.

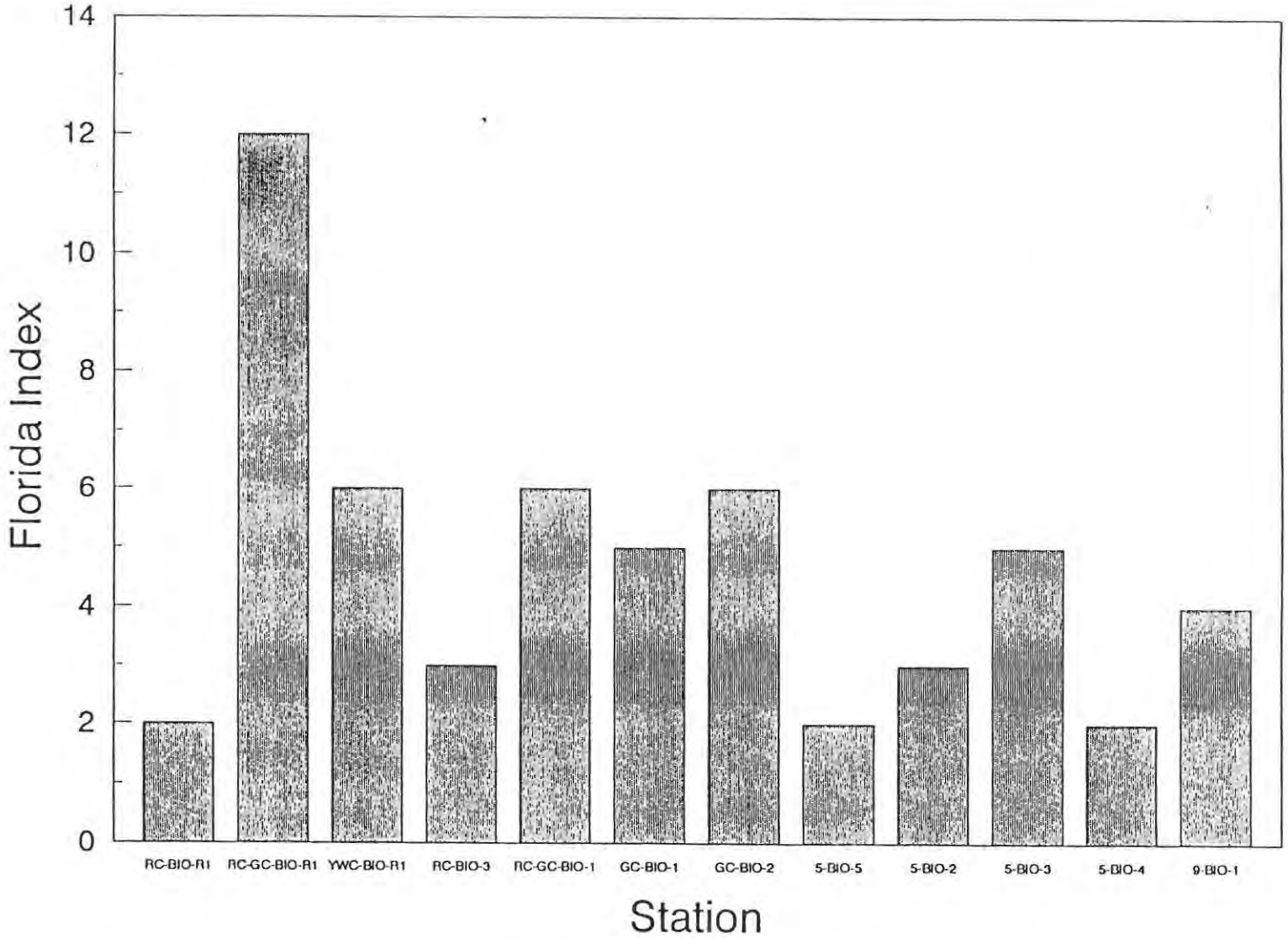

Figure 3-17. Florida Index for Ponar samples collected at Cecil Field.

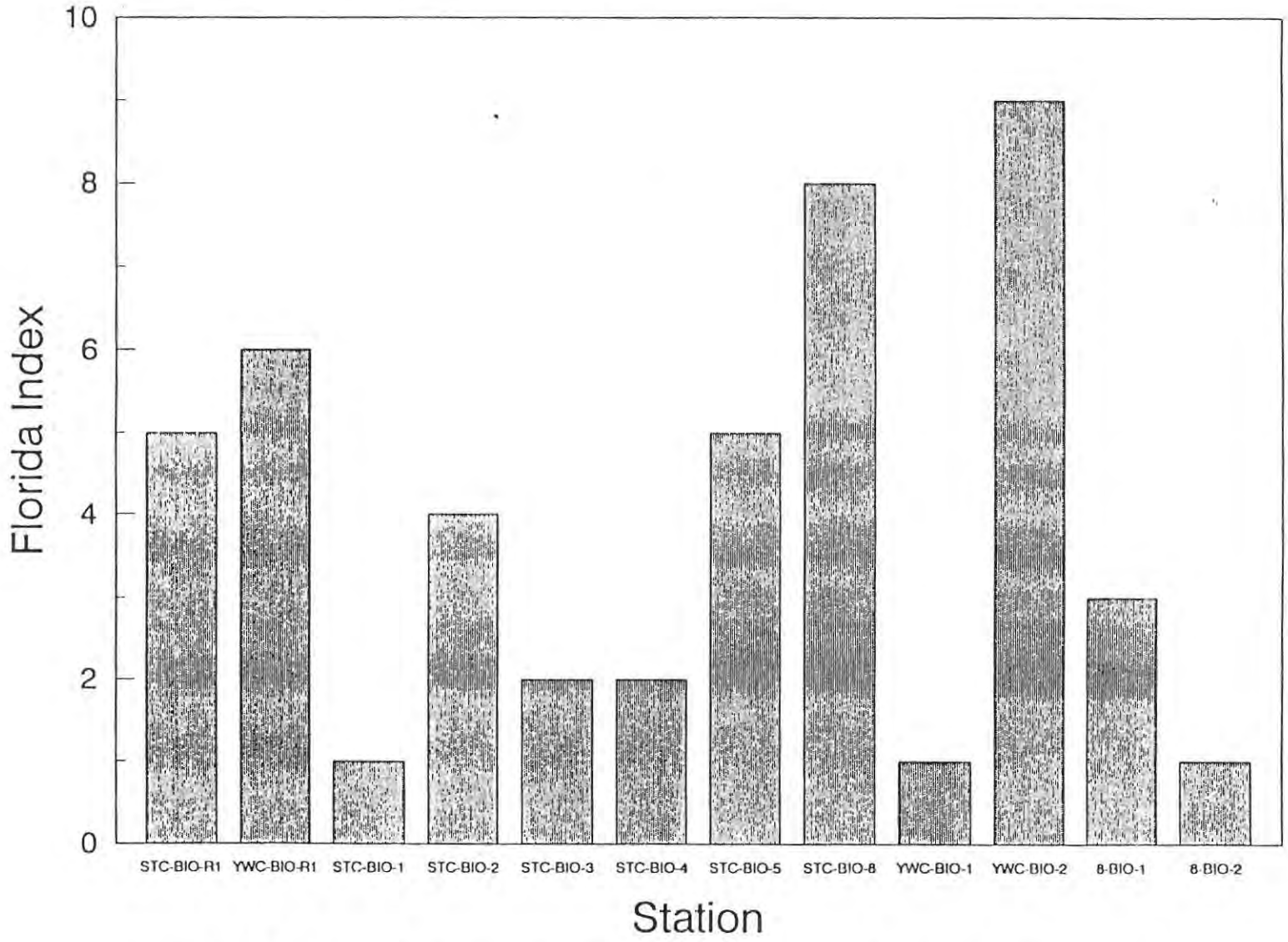

Figure 3-18. Florida Index for Ponar samples collected at Cecil Field.

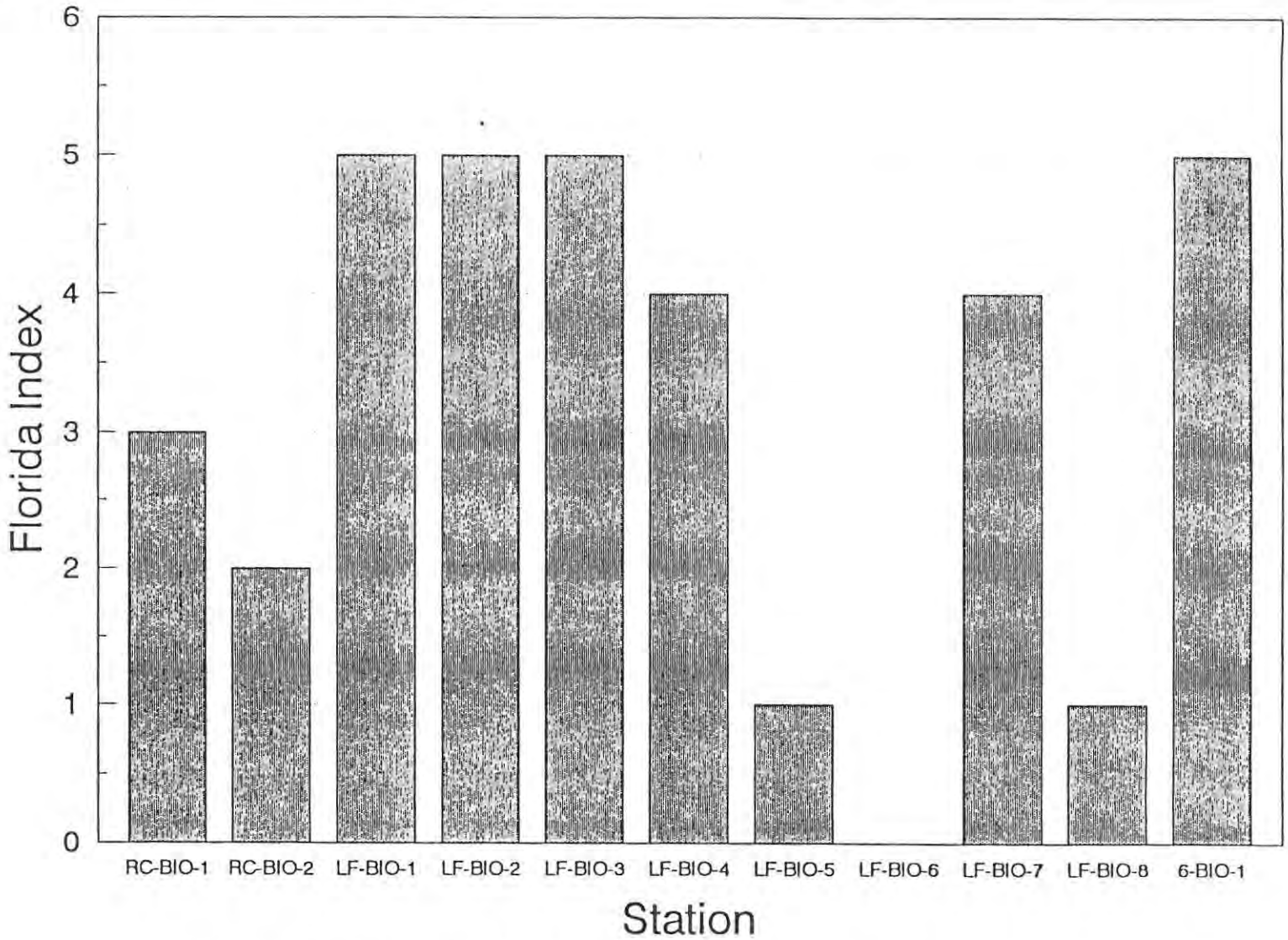

Figure 3-19. Florida Index for Ponar samples collected at Cecil Field.

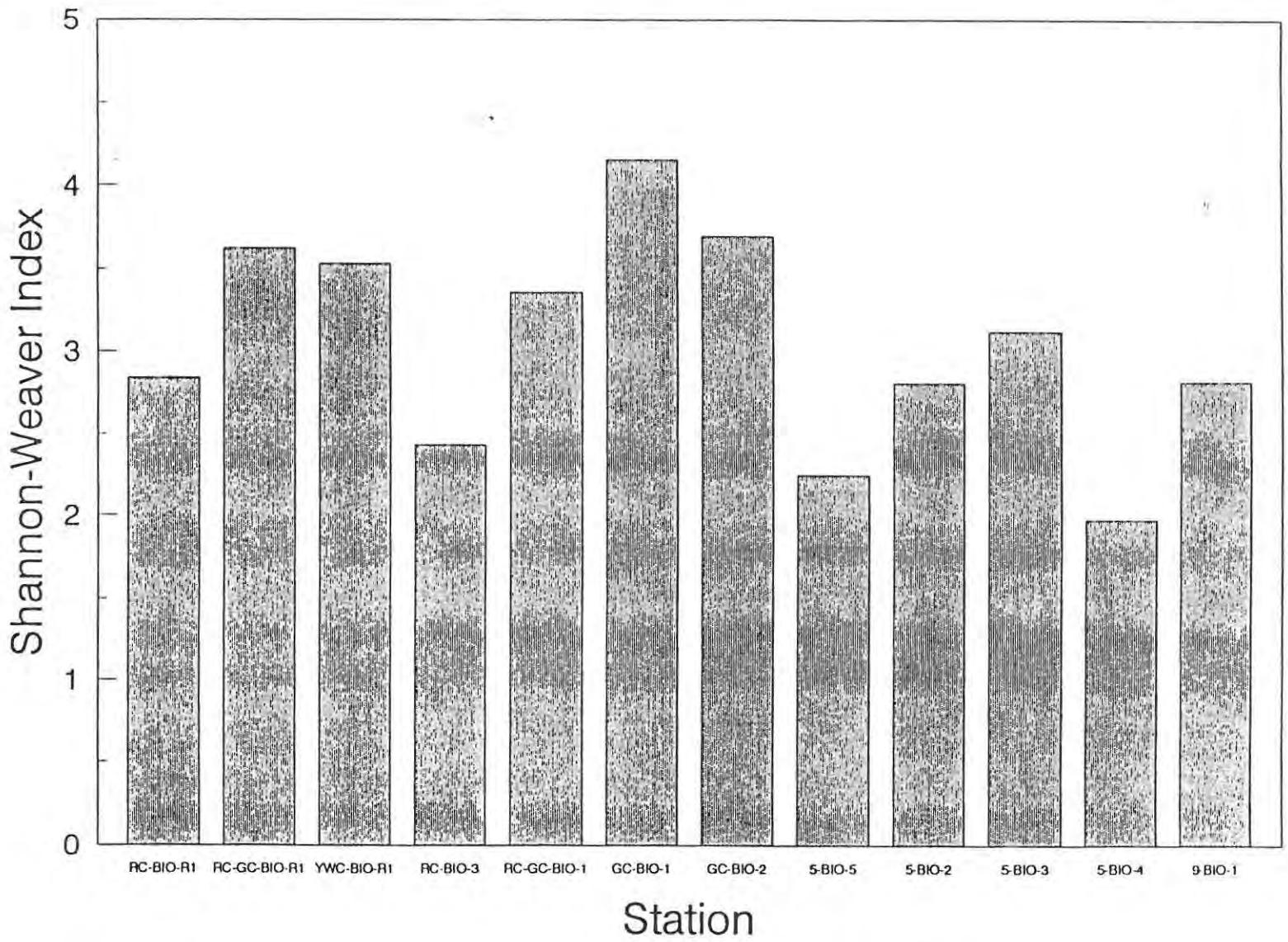

Figure 3-20. Shannon-Weaver Index for Ponar samples collected at Cecil Field.

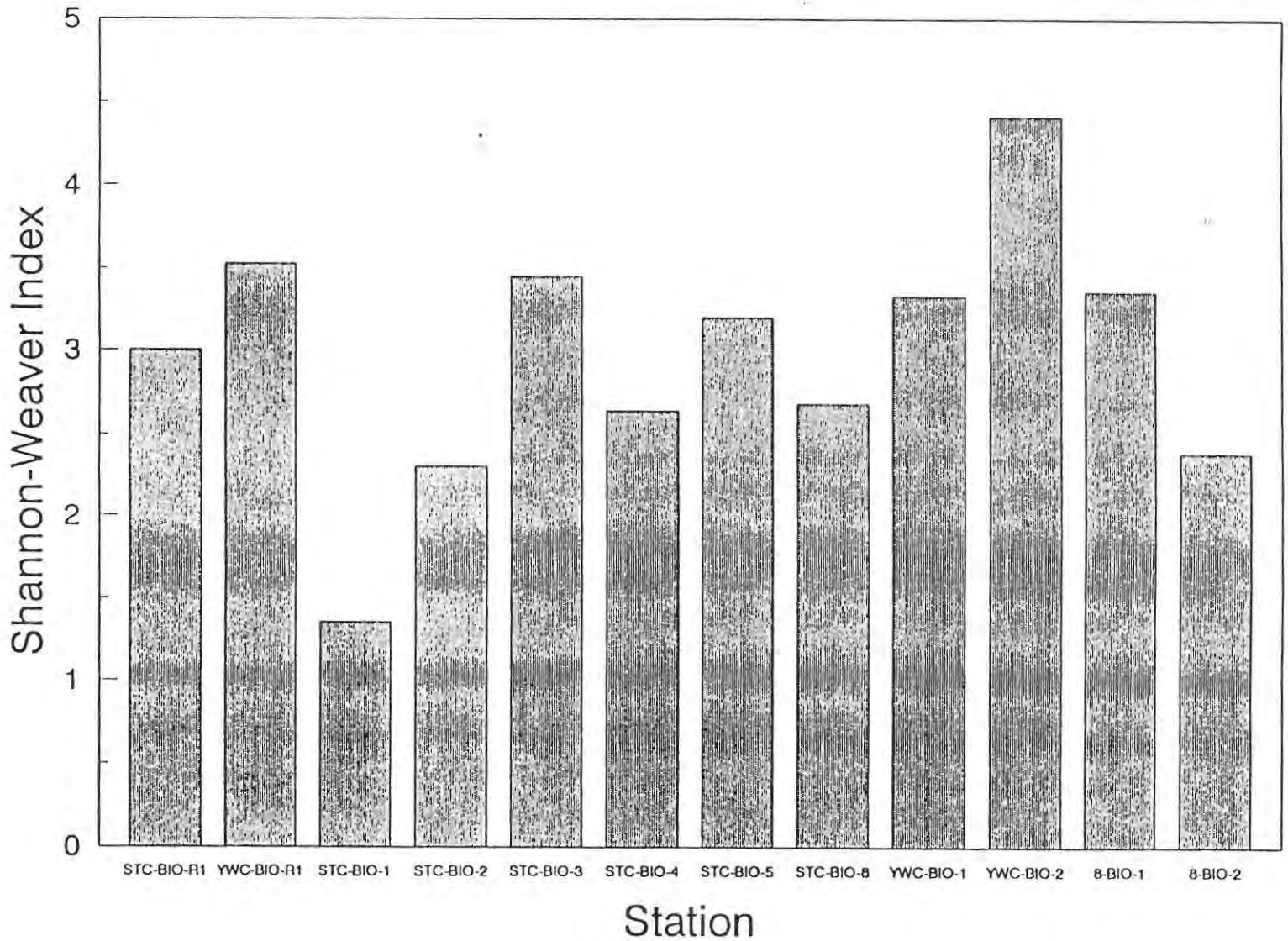

Figure 3-21. Shannon-Weaver Index for Ponar samples collected at Cecil Field.

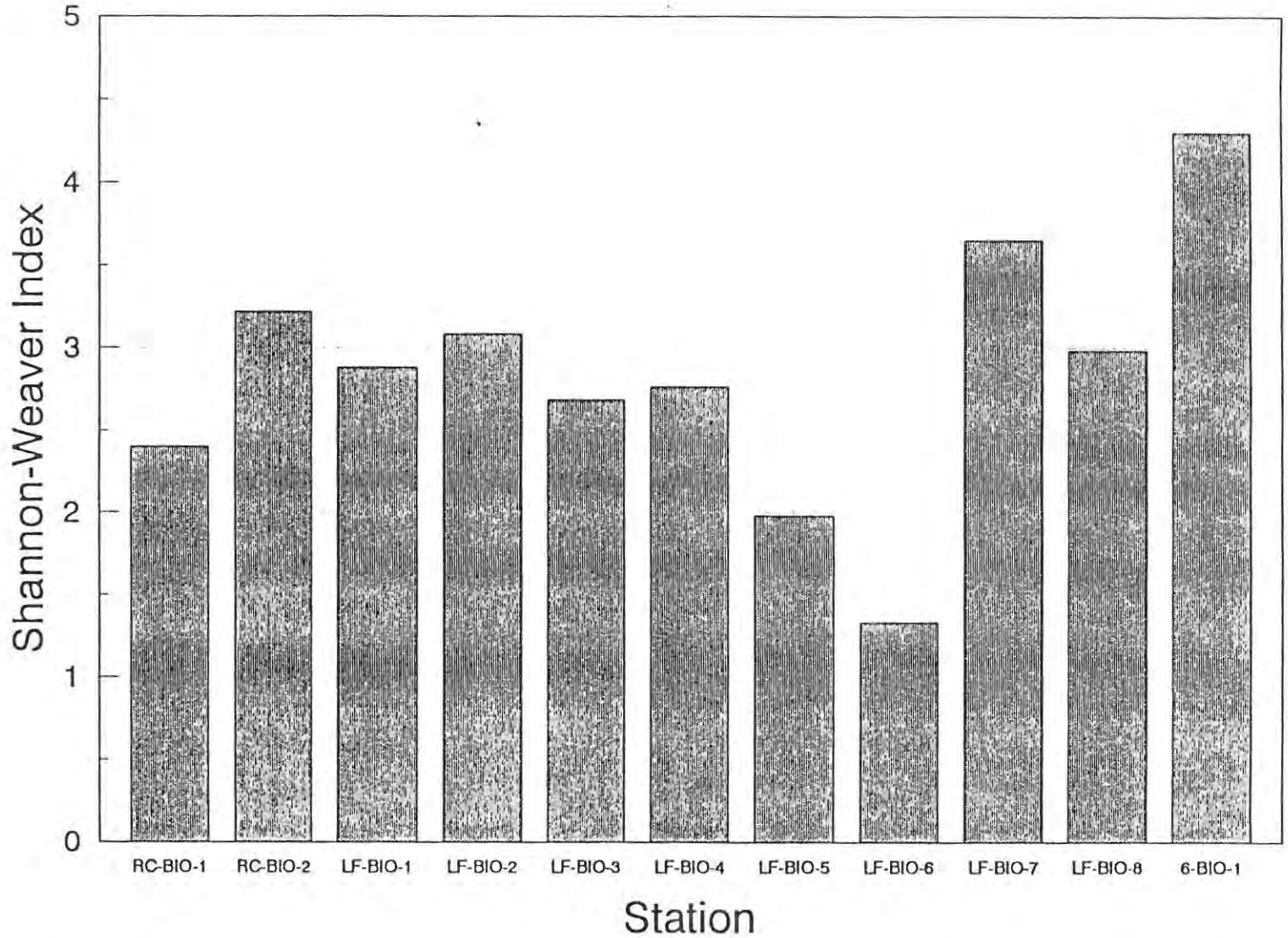

Figure 3-22. Shannon-Weaver Index for Ponar samples collected at Cecil Field.

The trends in metric values indicate that 5-BIO-5, 8-BIO-2, LF-BIO-6, STC-BIO-1, and STC-BIO-4 ranked lower for many of the key metrics compared to the reference stations and even ranked lower than the other stations. Station LF-BIO-6, the deepest station sampled in Lake Fretwell, had very low dissolved oxygen at the bottom, which may have contributed to its low metric values. Stations 5-BIO-5 and 8-BIO-2 also ranked low in the dip net samples. Station STC-BIO-1 ranked low in all three gear type samples and STC-BIO-4 ranked low in the Hester-Dendy and Ponar samples. The stream stations RC-BIO-R1, STC-BIO-R1, and YWC-BIO-R1 were suitable reference stations with high habitat assessment scores and moderate to high metric values. Station RC-GC-BIO-R1 was not representative of most stations sampled, due to low habitat quality and dense growth of aquatic macrophytes, which was not typical of most stations. However, RC-GC-BIO-R1 did score unusually high on many metrics, which may have been due to the unique habitat characteristics.

APPENDIX A

MACROINVERTEBRATE DATA LISTING

DEFINITIONS:

- REP—REPLICATE
- GEAR D—DIP NET
- GEAR H—HESTER-DENDY
- GEAR P—PONAR
- DEN—DENOMINATOR
- NUM—NUMERATOR

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
BIO-2		D	1	1	OECETIS	470628012004	3	0	0
IO-2		D	1	1	CULICIDAE	470630009	10	0	0
5-BIO-2		D	1	1	COENAGRIONIDAE	470606003	19	0	0
5-BIO-2		D	1	1	CORDULIIDAE	470605006	35	0	0
5-BIO-2		D	1	1	LACCOPHILUS	470623008024	0	0	1
5-BIO-2		D	1	1	NASIAESCHNA	470605001010	1	0	0
5-BIO-2		D	1	1	CRANGONYX	470532057001	2	0	0
5-BIO-2		D	1	1	CHIRONOMUS	470630014032	4	0	0
5-BIO-2		D	1	1	CHIRONOMIDAE	470630014	0	1	0
5-BIO-2		D	1	1	LABRUNDINIA	470630014103	4	0	0
5-BIO-2		D	1	1	AULODRILUS PIGUETI	450203004008001	1	0	0
5-BIO-2		D	1	1	SPHAERIIDAE	460507046 A	4	0	0
5-BIO-2		D	1	1	ASELLUS	470531015001	3	0	0
5-BIO-2		D	1	1	ASTACIDAE	470534093	1	0	0
5-BIO-2		D	1	1	GOMPHIDAE	470605003	2	0	0
5-BIO-2		D	1	1	PROCLADIUS	470630014004	12	0	0
5-BIO-2		D	1	1	POLYPEDILUM ILLINOENSE	470630014036031	3	0	0
5-BIO-2		D	1	1	STICTOCHIRONOMUS	470630014039	1	0	0
5-BIO-2		D	1	1	ANCYLIDAE	460108011	2	0	0
5-BIO-2	A	H	1	1	CULICIDAE	470630009	2	0	0
5-BIO-2	A	H	1	1	TABANIDAE	470630024	1	0	0
5-BIO-2	A	H	1	1	ANCYLIDAE	460108011	2	0	0
5-BIO-2	A	H	1	1	POLYPEDILUM ILLINOENSE	470630014036031	3	0	0
5-BIO-2	A	H	1	1	ABLABESMYIA	470630014042	2	0	0
5-BIO-2	A	H	1	1	LABRUNDINIA	470630014103	1	0	0
5-BIO-2	A	H	1	1	CHIRONOMUS	470630014032	60	0	0
5-BIO-2	A	H	1	1	CORDULIIDAE	470605006	1	0	0
5-BIO-2	A	H	1	1	CHIRONOMIDAE	470630014	0	2	0
IO-2	B	H	1	1	CHIRONOMIDAE	470630014	1	0	0
BIO-2	B	H	1	1	CHIRONOMUS	470630014032	30	0	0
5-BIO-2	B	H	1	1	LABRUNDINIA	470630014103	1	0	0
5-BIO-2	B	H	1	1	POLYPEDILUM ILLINOENSE	470630014036031	2	0	0
5-BIO-2	B	H	1	1	CHIRONOMIDAE	470630014	0	2	0
5-BIO-2	B	H	1	1	TABANIDAE	470630024	1	0	0
5-BIO-2	B	H	1	1	ANCYLIDAE	460108011	4	0	0
5-BIO-2	C	H	1	1	CHIRONOMUS	470630014032	63	0	0
5-BIO-2	C	H	1	1	STICTOCHIRONOMUS	470630014039	1	0	0
5-BIO-2	C	H	1	1	LABRUNDINIA	470630014103	1	0	0
5-BIO-2	C	H	1	1	THIENEMANNIMYIA	470630014119	1	0	0
5-BIO-2	C	H	1	1	CHIRONOMIDAE	470630014	0	3	0
5-BIO-2	C	H	1	1	DICROTENDIPES	470630014043	1	0	0
5-BIO-2	C	H	1	1	CORDULIIDAE	470605006	3	0	0
5-BIO-2	C	H	1	1	COENAGRIONIDAE	470606003	3	0	0
5-BIO-2	C	H	1	1	ANCYLIDAE	460108011	1	0	0
5-BIO-2	C	H	1	1	PHAENOPSECTRA	470630014152	1	0	0
5-BIO-2	C	H	1	1	POLYPEDILUM ILLINOENSE	470630014036031	3	0	0
5-BIO-2	A	P	1	1	TUBIFICIDAE IMM. W	450203004 A	2	0	0
5-BIO-2	A	P	1	1	CERATOPOGONIDAE	470630010	1	0	0
5-BIO-2	A	P	1	1	LABRUNDINIA	470630014103	2	0	0
5-BIO-2	A	P	1	1	PROCLADIUS	470630014004	8	0	0
5-BIO-2	A	P	1	1	CHIRONOMUS	470630014032	11	0	0
5-BIO-2	B	P	1	1	CORDULIIDAE	470605006	1	0	0
5-BIO-2	B	P	1	1	ANCYLIDAE	460108011	2	0	0
5-BIO-2	C	P	1	1	CRANGONYX	470532057001	1	0	0
5-BIO-2	C	P	1	1	PRISTINA OSBORNI	450203005005009	1	0	0
BIO-2	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	2	0	0
BIO-2	C	P	1	1	COENAGRIONIDAE	470606003	1	0	0
5-BIO-2	C	P	1	1	CHIRONOMUS	470630014032	2	0	0
5-BIO-2	C	P	1	1	ANCYLIDAE	460108011	1	0	0
5-BIO-2	C	P	1	1	PROCLADIUS	470630014004	7	0	0
5-BIO-2	C	P	1	1	LABRUNDINIA	470630014103	3	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
5-BIO-2	C	P	1	1	TANYTARSUS	470630014030	1	0	0
5-BIO-2	C	P	1	1	CHIRONOMUS	470630014032	2	0	[illegible]
5-BIO-2	C	P	1	1	ABLABESMYIA	470630014042	1	0	[illegible]
5-BIO-3		D	1	1	ACARINA	47021100	1	0	0
5-BIO-3		D	1	1	TRICLADIDA	350109	1	0	0
5-BIO-3		D	1	1	CRANGONYX	470532057001	2	0	0
5-BIO-3		D	1	1	DERO	450203005006	1	0	0
5-BIO-3		D	1	1	TUBIFICIDAE IMM. W/O	450203004 B	1	0	0
5-BIO-3		D	1	1	STICTOCHIRONOMUS	470630014039	1	0	0
5-BIO-3		D	1	1	CHIRONOMIDAE	470630014	0	1	0
5-BIO-3		D	1	1	ANCYLIDAE	460108011	28	0	0
5-BIO-3		D	1	1	CULICIDAE	470630009	3	0	0
5-BIO-3		D	1	1	PROCLADIUS	470630014004	16	0	0
5-BIO-3		D	1	1	CHIRONOMUS	470630014032	19	0	0
5-BIO-3		D	1	1	POLYPEDILUM ILLINOENSE	470630014036031	4	0	0
5-BIO-3		D	1	1	PHAENOPSECTRA	470630014152	4	0	0
5-BIO-3		D	1	1	COENAGRIONIDAE	470606003	8	0	0
5-BIO-3		D	1	1	ASELLUS	470531015001	7	0	0
5-BIO-3		D	1	1	CORDULIIDAE	470605006	8	0	0
5-BIO-3		D	1	1	DUBIRAPHIA	470623050002	1	0	0
5-BIO-3		D	1	1	CERATOPOGONIDAE	470630010	1	0	0
5-BIO-3		D	1	1	DICROTENDIPES	470630014043	1	0	0
5-BIO-3	A	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
5-BIO-3	A	P	1	1	CHIRONOMUS	470630014032	3	0	0
5-BIO-3	A	P	1	1	NAIDIDAE	450203005	1	0	0
5-BIO-3	A	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
5-BIO-3	A	P	1	1	COENAGRIONIDAE	470606003	1	0	0
5-BIO-3	A	P	1	1	ASTACIDAE	470534093	1	0	0
5-BIO-3	A	P	1	1	PROCLADIUS	470630014004	3	0	0
5-BIO-3	A	P	1	1	CHIRONOMUS	470630014032	2	0	
5-BIO-3	A	P	1	1	COLLEMBOLA	470602	1	0	0
5-BIO-3	A	P	1	1	DYTISCIDAE	470623008	0	0	1
5-BIO-3	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	29	0	0
5-BIO-3	B	P	1	1	CULICIDAE	470630009	1	0	0
5-BIO-3	B	P	1	1	PROCLADIUS	470630014004	12	0	0
5-BIO-3	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	7	0	0
5-BIO-3	B	P	1	1	CRANGONYX	470532057001	1	0	0
5-BIO-3	B	P	1	1	ANISOPTERA	47060500	1	0	0
5-BIO-3	B	P	1	1	AULODRILUS PIGUETI	450203004008001	1	0	0
5-BIO-3	B	P	1	1	CHIRONOMUS	470630014032	6	0	0
5-BIO-3	B	P	1	1	ANCYLIDAE	460108011	4	0	0
5-BIO-3	B	P	1	1	SPHAERIIDAE	460507046 A	2	0	0
5-BIO-3	B	P	1	1	ACARINA	47021100	2	0	0
5-BIO-3	B	P	1	1	ASELLUS	470531015001	1	0	0
5-BIO-3	C	P	1	1	SPHAERIIDAE	460507046 A	1	0	0
5-BIO-3	C	P	1	1	LABRUNDINIA	470630014103	1	0	0
5-BIO-3	C	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	2	0	0
5-BIO-3	C	P	1	1	DERO	450203005006	1	0	0
5-BIO-3	C	P	1	1	DIPTERA	470630	1	0	0
5-BIO-3	C	P	1	1	ANISOPTERA	47060500	2	0	0
5-BIO-3	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	2	0	0
5-BIO-3	C	P	1	1	ABLABESMYIA	470630014042	1	0	0
5-BIO-3	C	P	1	1	CHIRONOMUS	470630014032	5	0	0
5-BIO-3	C	P	1	1	AULODRILUS PIGUETI	450203004008001	1	0	0
5-BIO-3	C	P	1	1	PROCLADIUS	470630014004	16	0	0
5-BIO-3	C	P	1	1	ASELLUS	470531015001	1	0	0
5-BIO-3	C	P	1	1	CRANGONYX	470532057001	1	0	
5-BIO-3	C	P	1	1	CORDULIIDAE	470605006	1	0	
5-BIO-4		D	3	28	STICTOCHIRONOMUS	470630014039	10	0	0
5-BIO-4		D	3	28	NAIDIDAE	450203005	2	0	0
5-BIO-4		D	3	28	CHIRONOMUS	470630014032	38	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
-BIO-4		D	3	28	OMISUS	470630014088	1	0	0
-IO-4		D	3	28	CHIRONOMINI	47063001401	1	0	0
5-BIO-4		D	3	28	PHAENOPSECTRA	470630014152	6	0	0
5-BIO-4		D	3	28	TUBIFICIDAE IMM. W/O	450203004 B	10	0	0
5-BIO-4		D	3	28	ZAVRELIELLA	470630014090	1	0	0
5-BIO-4		D	3	28	PROCLADIUS	470630014004	10	0	0
5-BIO-4		D	3	28	DIPTERA	470630	1	0	0
5-BIO-4		D	3	28	TABANIDAE	470630024	1	0	0
5-BIO-4		D	3	28	ASELLUS	470531015001	14	0	0
5-BIO-4		D	3	28	ANCYLIDAE	460108011	1	0	0
5-BIO-4		D	3	28	LUMBRICULIDAE	450201001	1	0	0
5-BIO-4		D	3	28	SPHAERIIDAE	460507046 A	1	0	0
5-BIO-4		D	3	28	POLYPEDILUM ILLINOENSE	470630014036031	5	0	0
5-BIO-4	A	P	1	1	CRANGONYX	470532057001	2	0	0
5-BIO-4	A	P	1	1	SPHAERIIDAE	460507046 A	1	0	0
5-BIO-4	A	P	1	1	DIPTERA	470630	1	0	0
5-BIO-4	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	12	0	0
5-BIO-4	A	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	2	0	0
5-BIO-4	A	P	1	1	PROCLADIUS	470630014004	7	0	0
5-BIO-4	A	P	1	1	AULODRILUS PIGUETI	450203004008001	1	0	0
5-BIO-4	A	P	1	1	TUBIFICIDAE IMM. W	450203004 A	2	0	0
5-BIO-4	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	3	0	0
5-BIO-4	B	P	1	1	CLADOPELMA	470630014159	1	0	0
5-BIO-4	B	P	1	1	PROCLADIUS	470630014004	3	0	0
5-BIO-4	B	P	1	1	CHIRONOMUS	470630014032	1	0	0
5-BIO-4	B	P	1	1	DIPTERA	470630	1	0	0
5-BIO-4	C	P	1	1	CHIRONOMUS	470630014032	4	0	0
5-BIO-4	C	P	1	1	PROCLADIUS	470630014004	4	0	0
BIO-4	C	P	1	1	DIPTERA	470630	1	0	0
-BIO-4	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	38	0	0
5-BIO-4	C	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	3	0	0
5-BIO-5		D	1	1	THIENEMANNIMYIA	470630014119	1	0	0
5-BIO-5		D	1	1	CULICIDAE	470630009	2	0	0
5-BIO-5		D	1	1	DERO	450203005006	1	0	0
5-BIO-5		D	1	1	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
5-BIO-5		D	1	1	ASELLUS	470531015001	4	0	0
5-BIO-5		D	1	1	CHIRONOMUS	470630014032	3	0	0
5-BIO-5		D	1	1	ANCYLIDAE	460108011	53	0	0
5-BIO-5		D	1	1	ANISOPTERA	47060500	7	0	0
5-BIO-5		D	1	1	COENAGRIONIDAE	470606003	18	0	0
5-BIO-5		D	1	1	STENELMIS	470623050001	1	0	0
5-BIO-5	A	P	1	1	ANCYLIDAE	460108011	2	0	0
5-BIO-5	C	P	1	1	COENAGRIONIDAE	470606003	1	0	0
5-BIO-5	C	P	1	1	CHIRONOMUS	470630014032	2	0	0
5-BIO-5	C	P	1	1	ANISOPTERA	47060500	2	0	0
5-BIO-5	C	P	1	1	CULICIDAE	470630009	3	0	0
6-BIO-1		D	2	28	DERO FLABELLIGER	450203005006002	87	0	0
6-BIO-1		D	2	28	DIPTERA	470630	2	0	0
6-BIO-1		D	2	28	PROCLADIUS	470630014004	1	0	0
6-BIO-1		D	2	28	STRATIOMYIDAE	470630025	3	0	0
6-BIO-1		D	2	28	DICROTENDIPES	470630014043	1	0	0
6-BIO-1		D	2	28	CULICIDAE	470630009	6	0	0
6-BIO-1		D	2	28	PSEUDOCHIRONOMUS	470630014037	1	0	0
6-BIO-1		D	2	28	PLANORBIDAE	460108012	1	0	0
6-BIO-1		D	2	28	TANYTARSUS	470630014030	1	0	0
-BIO-1		D	2	28	LYMNAEIDAE	460108010	5	0	0
-BIO-1		D	2	28	ABLABESMYIA	470630014042	9	0	0
6-BIO-1		D	2	28	PHYSELLA	460108013003	1	0	0
6-BIO-1		D	2	28	CULICIDAE	470630009	0	2	0
6-BIO-1		D	2	28	PELECYPODA	4605 A	1	0	0
6-BIO-1		D	2	28	POLYPEDILUM ILLINOENSE	470630014036031	6	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
6-BIO-1		D	2	28	LIBELLULIDAE	470605004	8	0	0
6-BIO-1		D	2	28	ENDOCHIRONOMUS	470630014086	6	0	[illegible]
6-BIO-1		D	2	28	CENTROPTILUM	470604002007	2	0	0
6-BIO-1		D	2	28	NEMERTEA	38	1	0	0
6-BIO-1		D	2	28	TANYTARSUS EPLER F	470630014030025	4	0	0
6-BIO-1		D	2	28	CHIRONOMUS	470630014032	12	0	0
6-BIO-1		D	2	28	COENAGRIONIDAE	470606003	29	0	0
6-BIO-1		D	2	28	COLEOPTERA	470623	0	0	3
6-BIO-1		D	2	28	HYDROPHILIDAE	470623016	0	0	1
6-BIO-1		D	2	28	HEMIPTERA	470621	3	0	0
6-BIO-1		D	2	28	CURCULIONIDAE	470623104	0	0	7
6-BIO-1	A	P	1	1	STRATIOMYIDAE	470630025	1	0	0
6-BIO-1	A	P	1	1	PELECYPODA	4605 A	1	0	0
6-BIO-1	A	P	1	1	ENDOCHIRONOMUS	470630014086	4	0	0
6-BIO-1	A	P	1	1	TANYPUS	470630014033	2	0	0
6-BIO-1	A	P	1	1	OXYETHIRA	470628005005	1	0	0
6-BIO-1	A	P	1	1	DERO	450203005006	1	0	0
6-BIO-1	A	P	1	1	NAIDIDAE	450203005	1	0	0
6-BIO-1	A	P	1	1	CORIXIDAE	470621001	1	0	0
6-BIO-1	A	P	1	1	PALAEMONETES PALUDOSUS	470534015003002	1	0	0
6-BIO-1	A	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	2	0	0
6-BIO-1	A	P	1	1	CHIRONOMUS	470630014032	3	0	0
6-BIO-1	A	P	1	1	CHIRONOMINI	47063001401	2	0	0
6-BIO-1	A	P	1	1	TANYTARSUS	470630014030	1	0	0
6-BIO-1	A	P	1	1	DICROTENDIPES	470630014043	1	0	0
6-BIO-1	A	P	1	1	BAETIDAE	470604002	1	0	0
6-BIO-1	A	P	1	1	TANYPODINAE	470630014 C	3	0	0
6-BIO-1	B	P	1	1	LYMNAEIDAE	460108010	1	0	0
6-BIO-1	B	P	1	1	PELECYPODA	4605 A	5	0	
6-BIO-1	B	P	1	1	COLEOPTERA	470623	0	0	[illegible]
6-BIO-1	B	P	1	1	DERO	450203005006	1	0	0
6-BIO-1	B	P	1	1	NAIDIDAE	450203005	2	0	0
6-BIO-1	B	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	2	0	0
6-BIO-1	B	P	1	1	CHIRONOMUS	470630014032	1	0	0
6-BIO-1	B	P	1	1	DIPTERA	470630	1	0	0
6-BIO-1	B	P	1	1	TABANIDAE	470630024	1	0	0
6-BIO-1	C	P	1	1	TANYPUS	470630014033	2	0	0
6-BIO-1	C	P	1	1	CURCULIONIDAE	470623104	0	0	1
6-BIO-1	C	P	1	1	CERATOPOGONIDAE	470630010	3	0	0
6-BIO-1	C	P	1	1	DERO	450203005006	1	0	0
6-BIO-1	C	P	1	1	HYDROPHILIDAE	470623016	0	0	1
6-BIO-1	C	P	1	1	PELECYPODA	4605 A	1	0	0
6-BIO-1	C	P	1	1	CENTROPTILUM	470604002007	1	0	0
6-BIO-1	C	P	1	1	LYMNAEIDAE	460108010	1	0	0
6-BIO-1	C	P	1	1	CHAOBORUS	470630009001	6	0	0
8-BIO-1		D	1	1	DUBIRAPHIA	470623050002	1	0	0
8-BIO-1		D	1	1	ASTACIDAE	470534093	17	0	0
8-BIO-1		D	1	1	TRIBELOS	470630014117	1	0	0
8-BIO-1		D	1	1	PROCLADIUS	470630014004	6	0	0
8-BIO-1		D	1	1	POLYPEDILUM ILLINOENSE	470630014036031	2	0	0
8-BIO-1		D	1	1	CORIXIDAE	470621001	16	0	0
8-BIO-1		D	1	1	DICROTENDIPES	470630014043	1	0	0
8-BIO-1		D	1	1	DIPTERA	470630	1	0	0
8-BIO-1		D	1	1	LIBELLULIDAE	470605004	3	0	0
8-BIO-1		D	1	1	COENAGRIONIDAE	470606003	13	0	0
8-BIO-1		D	1	1	TROPISTERNUS	470623016012	0	0	
8-BIO-1		D	1	1	DYTISCIDAE	470623008	0	0	
8-BIO-1	A	P	1	1	ASTACIDAE	470534093	1	0	0
8-BIO-1	A	P	1	1	CORIXIDAE	470621001	2	0	0
8-BIO-1	A	P	1	1	PROCLADIUS	470630014004	3	0	0
8-BIO-1	A	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
[illegible]-1	A	P	1	1	DICROTENDIPES	470630014043	1	0	0
[illegible]-1	B	P	1	1	TRIBELOS	470630014117	4	0	0
8-BIO-1	B	P	1	1	DICROTENDIPES	470630014043	2	0	0
8-BIO-1	B	P	1	1	PROCLADIUS	470630014004	2	0	0
8-BIO-1	C	P	1	1	CORIXIDAE	470621001	1	0	0
8-BIO-1	C	P	1	1	DUBIRAPHIA	470623050002	5	0	0
8-BIO-1	C	P	1	1	PELECYPODA	4605 A	2	0	0
8-BIO-1	C	P	1	1	ASELLUS	470531015001	1	0	0
8-BIO-1	C	P	1	1	PROCLADIUS	470630014004	1	0	0
8-BIO-1	C	P	1	1	TRIBELOS	470630014117	1	0	0
8-BIO-1	C	P	1	1	NEMATODA	4301	1	0	0
8-BIO-1	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	1	0	0
8-BIO-1	C	P	1	1	LUMBRICULIDAE	450201001	1	0	0
8-BIO-1	C	P	1	1	LIBELLULIDAE	470605004	2	0	0
8-BIO-2		D	1	1	NOTONECTIDAE	470621002	1	0	0
8-BIO-2		D	1	1	THIENEMANNIMYIA	470630014119	1	0	0
8-BIO-2		D	1	1	ABLABESMYIA	470630014042	1	0	0
8-BIO-2		D	1	1	ACARINA	47021100	1	0	0
8-BIO-2		D	1	1	ASTACIDAE	470534093	8	0	0
8-BIO-2		D	1	1	LIBELLULIDAE	470605004	9	0	0
8-BIO-2		D	1	1	COENAGRIONIDAE	470606003	9	0	0
8-BIO-2		D	1	1	DYTISCIDAE	470623008	0	0	8
8-BIO-2	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	2	0	0
8-BIO-2	A	P	1	1	TRIBELOS	470630014117	1	0	0
8-BIO-2	A	P	1	1	DICROTENDIPES	470630014043	1	0	0
8-BIO-2	A	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
8-BIO-2	A	P	1	1	PROCLADIUS	470630014004	2	0	0
8-BIO-2	B	P	1	1	ASTACIDAE	470534093	1	0	0
[illegible]-2	B	P	1	1	DYTISCIDAE	470623008	0	0	1
8-BIO-2	B	P	1	1	DICROTENDIPES	470630014043	1	0	0
8-BIO-2	B	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	2	0	0
8-BIO-2	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	6	0	0
8-BIO-2	C	P	1	1	PROCLADIUS	470630014004	6	0	0
8-BIO-2	C	P	1	1	DICROTENDIPES	470630014043	1	0	0
8-BIO-2	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	4	0	0
8-BIO-2	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	2	0	0
8-BIO-2	C	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
9-BIO-1		D	1	1	BOYERIA	470605001007	2	0	0
9-BIO-1		D	1	1	HEMERODROMIA	470630041004	4	0	0
9-BIO-1		D	1	1	ASTACIDAE	470534093	11	0	0
9-BIO-1		D	1	1	PELECYPODA	4605 A	12	0	0
9-BIO-1		D	1	1	LYMNAEIDAE	460108010	3	0	0
9-BIO-1		D	1	1	NOTONECTIDAE	470621002	4	0	0
9-BIO-1		D	1	1	PLANORBIDAE	460108012	36	0	0
9-BIO-1		D	1	1	PROCLADIUS	470630014004	7	0	0
9-BIO-1		D	1	1	TRIBELOS	470630014117	14	0	0
9-BIO-1		D	1	1	CHIRONOMUS	470630014032	15	0	0
9-BIO-1		D	1	1	TANYTARSUS	470630014030	5	0	0
9-BIO-1		D	1	1	CHIRONOMINI	47063001401	3	0	0
9-BIO-1		D	1	1	POLYPEDILUM ILLINOENSE	470630014036031	24	0	0
9-BIO-1		D	1	1	PHAENOPSECTRA	470630014152	6	0	0
9-BIO-1		D	1	1	POLYPEDILUM SCALAENUM	470630014036038	1	0	0
9-BIO-1		D	1	1	THIENEMANNIMYIA	470630014119	4	0	0
9-BIO-1		D	1	1	AULODRILUS PIGUETI	450203004008001	38	0	0
9-BIO-1		D	1	1	LIBELLULIDAE	470605004	5	0	0
[illegible]IO-1		D	1	1	PARATANYTARSUS	470630014091	1	0	0
[illegible]BIO-1		D	1	1	COELOTANYPUS	470630014002	2	0	0
9-BIO-1		D	1	1	SLAVINA APPENDICULATA	450203005001001	6	0	0
9-BIO-1	A	P	1	1	PELECYPODA	4605 A	1	0	0
9-BIO-1	A	P	1	1	SIALIS	470627001001	1	0	0
9-BIO-1	A	P	1	1	PROGOMPHUS	470605003003	3	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
9-BIO-1	A	P	1	1	TRIBELOS	470630014117	7	0	0
9-BIO-1	A	P	1	1	CHIRONOMUS	470630014032	4	0	
9-BIO-1	A	P	1	1	PROCLADIUS	470630014004	4	0	0
9-BIO-1	A	P	1	1	AULODRILUS PIGUETI	450203004008001	5	0	0
9-BIO-1	A	P	1	1	HYDROBIIDAE	460102013	1	0	0
9-BIO-1	B	P	1	1	TRIBELOS	470630014117	64	0	0
9-BIO-1	B	P	1	1	NAIDIDAE	450203005	1	0	0
9-BIO-1	B	P	1	1	THIENEMANNIMYIA	470630014119	15	0	0
9-BIO-1	B	P	1	1	PLANORBIDAE	460108012	15	0	0
9-BIO-1	B	P	1	1	SIALIS	470627001001	1	0	0
9-BIO-1	B	P	1	1	PROCLADIUS	470630014004	10	0	0
9-BIO-1	B	P	1	1	DYTISCIDAE	470623008	0	0	2
9-BIO-1	B	P	1	1	PELECYPODA	4605 A	1	0	0
9-BIO-1	B	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	2	0	0
9-BIO-1	B	P	1	1	DICROTENDIPES	470630014043	1	0	0
9-BIO-1	B	P	1	1	ABLABESMYIA	470630014042	1	0	0
9-BIO-1	B	P	1	1	CHIRONOMUS	470630014032	5	0	0
9-BIO-1	B	P	1	1	AULODRILUS PIGUETI	450203004008001	26	0	0
9-BIO-1	C	P	1	1	CHIRONOMUS	470630014032	1	0	0
9-BIO-1	C	P	1	1	PROGOMPHUS	470605003003	2	0	0
9-BIO-1	C	P	1	1	PROCLADIUS	470630014004	1	0	0
9-BIO-1	C	P	1	1	TABANIDAE	470630024	1	0	0
9-BIO-1	C	P	1	1	PELECYPODA	4605 A	3	0	0
9-BIO-1	C	P	1	1	TRIBELOS	470630014117	7	0	0
9-BIO-1	C	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
9-BIO-1	C	P	1	1	PLANORBIDAE	460108012	3	0	0
9-BIO-1	C	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	2	0	0
9-BIO-1	C	P	1	1	AULODRILUS PIGUETI	450203004008001	13	0	0
GC-BIO-01		D	1	28	PALAEMONETES PALUDOSUS	470534015003002	8	0	
GC-BIO-01		D	1	28	NAIS COMMUNIS	450203005008003	2	0	
GC-BIO-01		D	1	28	HEMIPTERA	470621	4	0	0
GC-BIO-01		D	1	28	CURCULIONIDAE	470623104	0	0	2
GC-BIO-01		D	1	28	CHIRONOMIDAE	470630014	0	1	0
GC-BIO-01		D	1	28	CORIXIDAE	470621001	2	0	0
GC-BIO-01		D	1	28	TRICLADIDA	350109	2	0	0
GC-BIO-01		D	1	28	TANYTARSUS	470630014030	3	0	0
GC-BIO-01		D	1	28	HYDROPTILIDAE	470628005	1	0	0
GC-BIO-01		D	1	28	BELOSTOMATIDAE	470621005	1	0	0
GC-BIO-01		D	1	28	DICROTENDIPES	470630014043	9	0	0
GC-BIO-01		D	1	28	POLYPEDILUM ILLINOENSE	470630014036031	4	0	0
GC-BIO-01		D	1	28	PSEUDOCHIRONOMUS	470630014037	1	0	0
GC-BIO-01		D	1	28	CERATOPOGONIDAE	470630010	1	0	0
GC-BIO-01		D	1	28	PARATANYTARSUS	470630014091	1	0	0
GC-BIO-01		D	1	28	CLADOTANYTARSUS	470630014041	1	0	0
GC-BIO-01		D	1	28	DERO	450203005006	5	0	0
GC-BIO-01		D	1	28	PLANORBIDAE	460108012	2	0	0
GC-BIO-01		D	1	28	LYMNAEIDAE	460108010	6	0	0
GC-BIO-01		D	1	28	CENTROPTILUM	470604002007	19	0	0
GC-BIO-01		D	1	28	NAIS	450203005008	6	0	0
GC-BIO-01		D	1	28	CAENIS	470604011002	37	0	0
GC-BIO-01		D	1	28	LIBELLULIDAE	470605004	3	0	0
GC-BIO-01		D	1	28	COENAGRIONIDAE	470606003	25	0	0
GC-BIO-1	A	H	1	1	ANCYLIDAE	460108011	8	0	0
GC-BIO-1	A	H	1	1	CAENIS	470604011002	22	0	0
GC-BIO-1	A	H	1	1	LIBELLULIDAE	470605004	2	0	0
GC-BIO-1	A	H	1	1	ASTACIDAE	470534093	1	0	0
GC-BIO-1	A	H	1	1	TRICLADIDA	350109	2	0	
GC-BIO-1	A	H	1	1	NEMERTEA	38	1	0	0
GC-BIO-1	A	H	1	1	GLOSSIPHONIIDAE	450205002	2	0	0
GC-BIO-1	A	H	1	1	CERATOPOGONIDAE	470630010	1	0	0
GC-BIO-1	A	H	1	1	TANYTARSUS	470630014030	1	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
]IO-1	A	H	1	1	PROCLADIUS	470630014004	1	0	0
.IO-1	A	H	1	1	CRYPTOCHIRONOMUS	470630014035	2	0	0
GC-BIO-1	A	H	1	1	CLINOTANYPUS	470630014001	1	0	0
GC-BIO-1	A	H	1	1	DERO DERO	450203005006007	58	0	0
GC-BIO-1	A	H	1	1	DERO AULOPHORUS	450203005006 A	1	0	0
GC-BIO-1	B	H	1	1	OLIGOCHAETA	4502	1	0	0
GC-BIO-1	B	H	1	1	CAENIS	470604011002	5	0	0
GC-BIO-1	B	H	1	1	ANCYLIDAE	460108011	5	0	0
GC-BIO-1	B	H	1	1	PLANORBIDAE	460108012	4	0	0
GC-BIO-1	B	H	1	1	CURCULIONIDAE	470623104	0	0	1
GC-BIO-1	B	H	1	1	GLOSSIPHONIIDAE	450205002	1	0	0
GC-BIO-1	B	H	1	1	DICROTENDIPES	470630014043	2	0	0
GC-BIO-1	B	H	1	1	LIBELLULIDAE	470605004	2	0	0
GC-BIO-1	B	H	1	1	DERO DERO	450203005006007	69	0	0
GC-BIO-1	B	H	1	1	CRYPTOCHIRONOMUS	470630014035	2	0	0
GC-BIO-1	B	H	1	1	TANYTARSUS	470630014030	1	0	0
GC-BIO-1	C	H	1	1	CAENIS	470604011002	10	0	0
GC-BIO-1	C	H	1	1	ANCYLIDAE	460108011	3	0	0
GC-BIO-1	C	H	1	1	COENAGRIONIDAE	470606003	1	0	0
GC-BIO-1	C	H	1	1	CERATOPOGONIDAE	470630010	1	0	0
GC-BIO-1	C	H	1	1	PROCLADIUS	470630014004	2	0	0
GC-BIO-1	C	H	1	1	CRYPTOCHIRONOMUS	470630014035	1	0	0
GC-BIO-1	C	H	1	1	PLANORBIDAE	460108012	4	0	0
GC-BIO-1	C	H	1	1	LIBELLULIDAE	470605004	3	0	0
GC-BIO-1	C	H	1	1	TANYPODINAE	470630014 C	2	0	0
GC-BIO-1	C	H	1	1	ABLABESMYIA	470630014042	1	0	0
GC-BIO-1	C	H	1	1	TANYTARSUS	470630014030	2	0	0
GC-BIO-1	C	H	1	1	DERO DERO	450203005006007	69	0	0
3IO-1	A	P	1	1	CHIRONOMIDAE	470630014	0	6	0
-BIO-1	A	P	1	1	TRICLADIDA	350109	5	0	0
GC-BIO-1	A	P	1	1	ASTACIDAE	470534093	1	0	0
GC-BIO-1	A	P	1	1	PALAEMONETES PALUDOSUS	470534015003002	1	0	0
GC-BIO-1	A	P	1	1	LYMNAEIDAE	460108010	4	0	0
GC-BIO-1	A	P	1	1	ACARINA	47021100	1	0	0
GC-BIO-1	A	P	1	1	CERATOPOGONIDAE	470630010	30	0	0
GC-BIO-1	A	P	1	1	CAENIS	470604011002	2	0	0
GC-BIO-1	A	P	1	1	BAETIDAE	470604002	2	0	0
GC-BIO-1	A	P	1	1	DIPTERA	470630	0	4	0
GC-BIO-1	A	P	1	1	PLANORBIDAE	460108012	2	0	0
GC-BIO-1	A	P	1	1	LIBELLULIDAE	470605004	12	0	0
GC-BIO-1	A	P	1	1	COENAGRIONIDAE	470606003	11	0	0
GC-BIO-1	A	P	1	1	ABLABESMYIA	470630014042	6	0	0
GC-BIO-1	A	P	1	1	PARATANYTARSUS	470630014091	5	0	0
GC-BIO-1	A	P	1	1	DICROTENDIPES	470630014043	11	0	0
GC-BIO-1	A	P	1	1	TANYTARSINI	470630014008	10	0	0
GC-BIO-1	A	P	1	1	TANYTARSUS	470630014030	4	0	0
GC-BIO-1	A	P	1	1	PSEUDOCHIRONOMUS	470630014037	17	0	0
GC-BIO-1	A	P	1	1	CLINOTANYPUS	470630014001	1	0	0
GC-BIO-1	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	15	0	0
GC-BIO-1	A	P	1	1	TANYPODINAE	470630014 C	3	0	0
GC-BIO-1	A	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
GC-BIO-1	A	P	1	1	DERO	450203005006	6	0	0
GC-BIO-1	A	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	12	0	0
GC-BIO-1	A	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	7	0	0
GC-BIO-1	A	P	1	1	NEMATODA	4301	1	0	0
-BIO-1	A	P	1	1	ILYODRILUS TEMPLETONI	450203004006002	1	0	0
-BIO-1	B	P	1	1	LUMBRICULIDAE	450201001	1	0	0
GC-BIO-1	B	P	1	1	CHIRONOMIDAE	470630014	0	6	0
GC-BIO-1	B	P	1	1	DIPTERA	470630	0	3	0
GC-BIO-1	B	P	1	1	PALAEMONETES PALUDOSUS	470534015003002	1	0	0
GC-BIO-1	B	P	1	1	PSEUDOCHIRONOMUS	470630014037	6	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
GC-BIO-1	B	P	1	1	COENAGRIONIDAE	470606003	12	0	0
GC-BIO-1	B	P	1	1	LIBELLULIDAE	470605004	3	0	[illegible]
GC-BIO-1	B	P	1	1	LEPIDOPTERA	470629	3	0	0
GC-BIO-1	B	P	1	1	CERATOPOGONIDAE	470630010	9	0	0
GC-BIO-1	B	P	1	1	DICROTENDIPES	470630014043	10	0	0
GC-BIO-1	B	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	6	0	0
GC-BIO-1	B	P	1	1	TANYTARSINI	470630014008	4	0	0
GC-BIO-1	B	P	1	1	ABLABESMYIA	470630014042	4	0	0
GC-BIO-1	B	P	1	1	PARACHIRONOMUS	470630014052	2	0	0
GC-BIO-1	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	8	0	0
GC-BIO-1	B	P	1	1	DERO	450203005006	1	0	0
GC-BIO-1	B	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	8	0	[illegible]
GC-BIO-1	B	P	1	1	CORIXIDAE	470621001	2	0	0
GC-BIO-1	B	P	1	1	NEMATODA	4301	1	0	0
GC-BIO-1	B	P	1	1	CENTROPTILUM	470604002007	4	0	0
GC-BIO-1	B	P	1	1	CLINOTANYPUS	470630014001	1	0	0
GC-BIO-1	B	P	1	1	CAENIS	470604011002	6	0	0
GC-BIO-1	C	P	1	1	ABLABESMYIA	470630014042	3	0	0
GC-BIO-1	C	P	1	1	DICROTENDIPES	470630014043	20	0	0
GC-BIO-1	C	P	1	1	CERATOPOGONIDAE	470630010	31	0	0
GC-BIO-1	C	P	1	1	TANYTARSINI	470630014008	12	0	0
GC-BIO-1	C	P	1	1	COENAGRIONIDAE	470606003	11	0	0
GC-BIO-1	C	P	1	1	PARATANYTARSUS	470630014091	5	0	0
GC-BIO-1	C	P	1	1	CENTROPTILUM	470604002007	5	0	0
GC-BIO-1	C	P	1	1	PARACHIRONOMUS	470630014052	6	0	0
GC-BIO-1	C	P	1	1	ACARINA	47021100	1	0	0
GC-BIO-1	C	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	4	0	0
GC-BIO-1	C	P	1	1	CHIRONOMIDAE	470630014	0	5	0
GC-BIO-1	C	P	1	1	CHIRONOMINI	47063001401	1	0	[illegible]
GC-BIO-1	C	P	1	1	NEMATODA	4301	1	0	
GC-BIO-1	C	P	1	1	TANYTARSUS	470630014030	1	0	0
GC-BIO-1	C	P	1	1	CAENIS	470604011002	6	0	0
GC-BIO-1	C	P	1	1	DIPTERA	470630	0	7	0
GC-BIO-1	C	P	1	1	PSEUDOCHIRONOMUS	470630014037	15	0	0
GC-BIO-1	C	P	1	1	LIBELLULIDAE	470605004	8	0	0
GC-BIO-1	C	P	1	1	PALAEMONETES PALUDOSUS	470534015003002	5	0	0
GC-BIO-1	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	17	0	0
GC-BIO-1	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	2	0	0
GC-BIO-1	C	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
GC-BIO-1	C	P	1	1	DERO	450203005006	2	0	0
GC-BIO-1	C	P	1	1	ILYODRILUS TEMPLETONI	450203004006002	1	0	0
GC-BIO-2		D	3	28	CHIRONOMIDAE	470630014	0	4	0
GC-BIO-2		D	3	28	GOMPHIDAE	470605003	1	0	0
GC-BIO-2		D	3	28	ANCYLIDAE	460108011	4	0	0
GC-BIO-2		D	3	28	LIBELLULIDAE	470605004	2	0	0
GC-BIO-2		D	3	28	NAIS	450203005008	1	0	0
GC-BIO-2		D	3	28	DERO FLABELLIGER	450203005006002	26	0	0
GC-BIO-2		D	3	28	TRICLADIDA	350109	1	0	0
GC-BIO-2		D	3	28	CHIRONOMIDAE	470630014	1	0	0
GC-BIO-2		D	3	28	POLYPEDILUM SCALAENUM	470630014036038	1	0	0
GC-BIO-2		D	3	28	CHIRONOMUS	470630014032	1	0	0
GC-BIO-2		D	3	28	STENOCHIRONOMUS	470630014029	9	0	0
GC-BIO-2		D	3	28	NEMERTEA	38	1	0	0
GC-BIO-2		D	3	28	PELECYPODA	4605 A	2	0	0
GC-BIO-2		D	3	28	TANYTARSUS	470630014030	7	0	0
GC-BIO-2		D	3	28	PHYSELLA	460108013003	3	0	0
GC-BIO-2		D	3	28	LYMNAEIDAE	460108010	1	0	
GC-BIO-2		D	3	28	PLANORBIDAE	460108012	10	0	0
GC-BIO-2		D	3	28	ERPOBDELLIDAE	450205006	1	0	0
GC-BIO-2		D	3	28	OXYETHIRA	470628005005	3	0	0
GC-BIO-2		D	3	28	CULICIDAE	470630009	1	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
-BIO-2		D	3	28	CERATOPOGONIDAE	470630010	2	0	0
BIO-2		D	3	28	COENAGRIONIDAE	470606003	4	0	0
GC-BIO-2		D	3	28	PHAENOPSECTRA	470630014152	1	0	0
GC-BIO-2		D	3	28	DICROTENDIPES	470630014043	6	0	0
GC-BIO-2		D	3	28	POLYPEDILUM ILLINOENSE	470630014036031	6	0	0
GC-BIO-2	A	H	1	1	COLEOPTERA	470623	0	0	2
GC-BIO-2	A	H	1	1	CHIRONOMINI	47063001401	1	0	0
GC-BIO-2	A	H	1	1	PHYSELLA	460108013003	3	0	0
GC-BIO-2	A	H	1	1	DERO AULOPHORUS	450203005006 A	2	0	0
GC-BIO-2	A	H	1	1	PLANORBIDAE	460108012	10	0	0
GC-BIO-2	A	H	1	1	COENAGRIONIDAE	470606003	1	0	0
GC-BIO-2	A	H	1	1	LIBELLULIDAE	470605004	1	0	0
GC-BIO-2	A	H	1	1	POLYPEDILUM ILLINOENSE	470630014036031	4	0	0
GC-BIO-2	A	H	1	1	LYMNAEIDAE	460108010	3	0	0
GC-BIO-2	A	H	1	1	TRICLADIDA	350109	4	0	0
GC-BIO-2	B	H	1	1	DIPTERA	470630	0	1	0
GC-BIO-2	B	H	1	1	PHYSELLA	460108013003	4	0	0
GC-BIO-2	B	H	1	1	PLANORBIDAE	460108012	19	0	0
GC-BIO-2	B	H	1	1	ANCYLIDAE	460108011	1	0	0
GC-BIO-2	B	H	1	1	CERATOPOGONIDAE	470630010	1	0	0
GC-BIO-2	B	H	1	1	DICROTENDIPES	470630014043	1	0	0
GC-BIO-2	B	H	1	1	TRICLADIDA	350109	1	0	0
GC-BIO-2	B	H	1	1	CHIRONOMIDAE	470630014	0	1	0
GC-BIO-2	C	H	1	1	PHYSELLA	460108013003	4	0	0
GC-BIO-2	C	H	1	1	DIPTERA	470630	0	1	0
GC-BIO-2	C	H	1	1	PLANORBIDAE	460108012	11	0	0
GC-BIO-2	C	H	1	1	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
GC-BIO-2	A	P	1	1	THIENEMANNIMYIA	470630014119	1	0	0
-BIO-2	A	P	1	1	ABLABESMYIA	470630014042	2	0	0
C-BIO-2	A	P	1	1	DICROTENDIPES	470630014043	1	0	0
GC-BIO-2	A	P	1	1	CRYPTOCHIRONOMUS	470630014035	2	0	0
GC-BIO-2	A	P	1	1	PARACHIRONOMUS	470630014052	1	0	0
GC-BIO-2	A	P	1	1	TUBIFICIDAE IMM. W	450203004 A	2	0	0
GC-BIO-2	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	12	0	0
GC-BIO-2	A	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	4	0	0
GC-BIO-2	A	P	1	1	TRIBELOS	470630014117	8	0	0
GC-BIO-2	A	P	1	1	LYMNAEIDAE	460108010	1	0	0
GC-BIO-2	A	P	1	1	PHYSELLA	460108013003	2	0	0
GC-BIO-2	A	P	1	1	COENAGRIONIDAE	470606003	1	0	0
GC-BIO-2	A	P	1	1	HALIPLUS	470623006001	1	0	0
GC-BIO-2	A	P	1	1	CERATOPOGONIDAE	470630010	2	0	0
GC-BIO-2	A	P	1	1	PROCLADIUS	470630014004	1	0	0
GC-BIO-2	A	P	1	1	STENOCHIRONOMUS	470630014029	2	0	0
GC-BIO-2	A	P	1	1	CHIRONOMINI	47063001401	1	0	0
GC-BIO-2	A	P	1	1	TANYTARSUS	470630014030	1	0	0
GC-BIO-2	A	P	1	1	LUMBRICULIDAE	450201001	7	0	0
GC-BIO-2	A	P	1	1	PELECYPODA	4605 A	9	0	0
GC-BIO-2	B	P	1	1	GOMPHIDAE	470605003	1	0	0
GC-BIO-2	B	P	1	1	CERATOPOGONIDAE	470630010	1	0	0
GC-BIO-2	B	P	1	1	TRIBELOS	470630014117	16	0	0
GC-BIO-2	B	P	1	1	TANYTARSUS	470630014030	1	0	0
GC-BIO-2	B	P	1	1	ABLABESMYIA	470630014042	1	0	0
GC-BIO-2	B	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
GC-BIO-2	B	P	1	1	HYDROPHILIDAE	470623016	0	0	1
GC-BIO-2	C	P	1	1	CERATOPOGONIDAE	470630010	1	0	0
C-BIO-2	C	P	1	1	TANYTARSUS	470630014030	3	0	0
C-BIO-2	C	P	1	1	TRIBELOS	470630014117	2	0	0
GC-BIO-2	C	P	1	1	PHYSELLA	460108013003	3	0	0
GC-BIO-2	C	P	1	1	CAENIS	470604011002	1	0	0
GC-BIO-2	C	P	1	1	GOMPHIDAE	470605003	1	0	0
GC-BIO-2	C	P	1	1	PELECYPODA	4605 A	12	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
GC-BIO-2	C	P	1	1	PLANORBIDAE	460108012	1	0	0
GC-BIO-2	C	P	1	1	ABLABESMYIA	470630014042	1	0	
GC-BIO-2	C	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	1	0	0
GC-BIO-2	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	5	0	0
GC-BIO-2	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
GC-BIO-2	C	P	1	1	LUMBRICULIDAE	450201001	1	0	0
LF-BIO-1	A	P	1	1	CLADOPELMA	470630014159	2	0	0
LF-BIO-1	A	P	1	1	ERPOBDELLIDAE	450205006	1	0	0
LF-BIO-1	A	P	1	1	DERO DERO	450203005006007	3	0	0
LF-BIO-1	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	9	0	0
LF-BIO-1	A	P	1	1	OXYETHIRA	470628005005	1	0	0
LF-BIO-1	A	P	1	1	TANYTARSUS	470630014030	9	0	0
LF-BIO-1	A	P	1	1	CHIRONOMUS	470630014032	6	0	0
LF-BIO-1	A	P	1	1	PLANORBIDAE	460108012	3	0	0
LF-BIO-1	A	P	1	1	DICROTENDIPES	470630014043	5	0	0
LF-BIO-1	A	P	1	1	PROCLADIUS	470630014004	4	0	0
LF-BIO-1	A	P	1	1	OECETIS	470628012004	1	0	0
LF-BIO-1	A	P	1	1	ENDOCHIRONOMUS	470630014086	1	0	0
LF-BIO-1	A	P	1	1	TANYPODINAE	470630014 C	1	0	0
LF-BIO-1	A	P	1	1	CRYPTOCHIRONOMUS	470630014035	1	0	0
LF-BIO-1	B	P	1	1	PLANORBIDAE	460108012	4	0	0
LF-BIO-1	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	11	0	0
LF-BIO-1	B	P	1	1	DERO DERO	450203005006007	2	0	0
LF-BIO-1	B	P	1	1	TANYTARSUS	470630014030	5	0	0
LF-BIO-1	B	P	1	1	CRYPTOCHIRONOMUS	470630014035	1	0	0
LF-BIO-1	B	P	1	1	CHIRONOMUS	470630014032	4	0	0
LF-BIO-1	B	P	1	1	CLADOPELMA	470630014159	3	0	0
LF-BIO-1	B	P	1	1	PROCLADIUS	470630014004	1	0	0
LF-BIO-1	C	P	1	1	CHAOBORUS	470630009001	0	1	
LF-BIO-1	C	P	1	1	CHIRONOMIDAE	470630014	0	4	
LF-BIO-1	C	P	1	1	DERO	450203005006	4	0	0
LF-BIO-1	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	2	0	0
LF-BIO-1	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	13	0	0
LF-BIO-1	C	P	102	130	CLADOPELMA	470630014159	17	0	0
LF-BIO-1	C	P	102	130	CHIRONOMUS	470630014032	13	0	0
LF-BIO-1	C	P	102	130	TANYTARSUS	470630014030	62	0	0
LF-BIO-1	C	P	1	1	CHAOBORUS	470630009001	1	0	0
LF-BIO-1	C	P	102	130	ABLABESMYIA	470630014042	1	0	0
LF-BIO-1	C	P	102	130	CRYPTOCHIRONOMUS	470630014035	3	0	0
LF-BIO-1	C	P	102	130	CHIRONOMINI	47063001401	4	0	0
LF-BIO-1	C	P	102	130	PROCLADIUS	470630014004	2	0	0
LF-BIO-2	A	P	1	1	PROCLADIUS	470630014004	1	0	0
LF-BIO-2	A	P	1	1	CAENIS	470604011002	5	0	0
LF-BIO-2	A	P	1	1	CRYPTOCHIRONOMUS	470630014035	4	0	0
LF-BIO-2	A	P	1	1	COENAGRIONIDAE	470606003	5	0	0
LF-BIO-2	A	P	1	1	DICROTENDIPES	470630014043	6	0	0
LF-BIO-2	A	P	1	1	PLANORBIDAE	460108012	1	0	0
LF-BIO-2	A	P	1	1	GLYPTOTENDIPES	470630014038	3	0	0
LF-BIO-2	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	7	0	0
LF-BIO-2	A	P	1	1	CHIRONOMIDAE	470630014	0	2	0
LF-BIO-2	A	P	1	1	OECETIS	470628012004	5	0	0
LF-BIO-2	A	P	1	1	CERATOPOGONIDAE	470630010	1	0	0
LF-BIO-2	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	4	0	0
LF-BIO-2	B	P	1	1	DINEUTUS	470623010003	1	0	0
LF-BIO-2	B	P	1	1	CAENIS	470604011002	5	0	0
LF-BIO-2	B	P	1	1	ACARINA	47021100	1	0	0
LF-BIO-2	B	P	1	1	OECETIS	470628012004	6	0	
LF-BIO-2	B	P	1	1	TANYTARSUS	470630014030	30	0	0
LF-BIO-2	B	P	1	1	DICROTENDIPES	470630014043	21	0	0
LF-BIO-2	B	P	1	1	PELECYPODA	4605 A	3	0	0
LF-BIO-2	B	P	1	1	CHIRONOMIDAE	470630014	0	5	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
BIO-2	B	P	1	1	ENDOCHIRONOMUS	470630014086	28	0	0
BIO-2	B	P	1	1	LIBELLULIDAE	470605004	1	0	0
LF-BIO-2	B	P	1	1	PLANORBIDAE	460108012	3	0	0
LF-BIO-2	B	P	1	1	CHIRONOMUS	470630014032	3	0	0
LF-BIO-2	B	P	1	1	TANYTARSUS	470630014030	1	0	0
LF-BIO-2	B	P	1	1	CRYPTOCHIRONOMUS	470630014035	3	0	0
LF-BIO-2	B	P	1	1	ABLABESMYIA	470630014042	1	0	0
LF-BIO-2	B	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	1	0	0
LF-BIO-2	C	P	102	196	TANYTARSUS	470630014030	22	0	0
LF-BIO-2	C	P	102	196	ENDOCHIRONOMUS	470630014086	3	0	0
LF-BIO-2	C	P	102	196	CHIRONOMUS	470630014032	6	0	0
LF-BIO-2	C	P	1	1	DERO	450203005006	7	0	0
LF-BIO-2	C	P	102	196	CRYPTOTENDIPES	470630014143	3	0	0
LF-BIO-2	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	25	0	0
LF-BIO-2	C	P	102	196	TANYPUS	470630014033	1	0	0
LF-BIO-2	C	P	1	1	AULODRILUS PIGUETI	450203004008001	2	0	0
LF-BIO-2	C	P	1	1	TUBIFICIDAE IMM. W	450203004 A	2	0	0
LF-BIO-2	C	P	102	196	CRYPTOCHIRONOMUS	470630014035	2	0	0
LF-BIO-2	C	P	102	196	PROCLADIUS	470630014004	5	0	0
LF-BIO-2	C	P	102	196	DICROTENDIPES	470630014043	8	0	0
LF-BIO-2	C	P	102	196	TANYTARSUS	470630014030	48	0	0
LF-BIO-2	C	P	102	196	CLADOPELMA	470630014159	4	0	0
LF-BIO-2	C	P	1	1	CHIRONOMIDAE	470630014	0	16	0
LF-BIO-3	A	P	1	1	TANYTARSUS	470630014030	5	0	0
LF-BIO-3	A	P	1	1	CLADOPELMA	470630014159	1	0	0
LF-BIO-3	A	P	1	1	DICROTENDIPES	470630014043	17	0	0
LF-BIO-3	A	P	1	1	DERO	450203005006	1	0	0
LF-BIO-3	A	P	1	1	TANYTARSUS	470630014030	63	0	0
BIO-3	A	P	1	1	CRYPTOCHIRONOMUS	470630014035	3	0	0
LF-BIO-3	A	P	1	1	CHIRONOMUS	470630014032	3	0	0
LF-BIO-3	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	2	0	0
LF-BIO-3	A	P	1	1	ENDOCHIRONOMUS	470630014086	1	0	0
LF-BIO-3	A	P	1	1	PROCLADIUS	470630014004	4	0	0
LF-BIO-3	A	P	1	1	ACARINA	47021100	2	0	0
LF-BIO-3	A	P	1	1	PLANORBIDAE	460108012	3	0	0
LF-BIO-3	A	P	1	1	CHIRONOMIDAE	470630014	0	3	0
LF-BIO-3	A	P	1	1	OECETIS	470628012004	3	0	0
LF-BIO-3	A	P	1	1	OXYETHIRA	470628005005	1	0	0
LF-BIO-3	B	P	1	1	GLOSSIPHONIIDAE	450205002	1	0	0
LF-BIO-3	B	P	1	1	OECETIS	470628012004	1	0	0
LF-BIO-3	B	P	1	1	PROCLADIUS	470630014004	9	0	0
LF-BIO-3	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	27	0	0
LF-BIO-3	B	P	1	1	ACARINA	47021100	1	0	0
LF-BIO-3	B	P	1	1	PLANORBIDAE	460108012	3	0	0
LF-BIO-3	B	P	1	1	PARACHIRONOMUS	470630014052	1	0	0
LF-BIO-3	B	P	1	1	CAENIS	470604011002	1	0	0
LF-BIO-3	B	P	1	1	TANYTARSUS	470630014030	44	0	0
LF-BIO-3	B	P	1	1	CLADOPELMA	470630014159	7	0	0
LF-BIO-3	B	P	1	1	CHIRONOMUS	470630014032	7	0	0
LF-BIO-3	B	P	1	1	CRYPTOCHIRONOMUS	470630014035	2	0	0
LF-BIO-3	B	P	1	1	OXYETHIRA	470628005005	0	1	0
LF-BIO-3	B	P	1	1	TRIBELOS	470630014117	1	0	0
LF-BIO-3	B	P	1	1	CHIRONOMIDAE	470630014	1	0	0
LF-BIO-3	B	P	1	1	DICROTENDIPES	470630014043	14	0	0
LF-BIO-3	B	P	1	1	DERO	450203005006	7	0	0
F-BIO-3	B	P	1	1	OXYETHIRA	470628005005	2	0	0
LF-BIO-3	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	3	0	0
LF-BIO-3	C	P	1	1	CRYPTOCHIRONOMUS	470630014035	1	0	0
LF-BIO-3	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	31	0	0
LF-BIO-3	C	P	1	1	DERO	450203005006	1	0	0
LF-BIO-3	C	P	1	1	PARACHIRONOMUS	470630014052	1	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
LF-BIO-3	C	P	1	1	AULODRILUS PIGUETI	450203004008001	1	0	0
LF-BIO-3	C	P	1	1	DICROTENDIPES	470630014043	5	0	[illegible]
LF-BIO-3	C	P	1	1	ENDOCHIRONOMUS	470630014086	1	0	0
LF-BIO-3	C	P	1	1	TANYTARSUS	470630014030	42	0	0
LF-BIO-3	C	P	1	1	CHIRONOMUS	470630014032	1	0	0
LF-BIO-3	C	P	1	1	PROCLADIUS	470630014004	6	0	0
LF-BIO-3	C	P	1	1	OECETIS	470628012004	2	0	0
LF-BIO-4	A	P	1	1	PLANORBIDAE	460108012	6	0	0
LF-BIO-4	A	P	1	1	CHIRONOMIDAE	470630014	0	10	0
LF-BIO-4	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	4	0	0
LF-BIO-4	A	P	102	179	CHIRONOMUS	470630014032	22	0	0
LF-BIO-4	A	P	102	179	TANYTARSUS	470630014030	68	0	0
LF-BIO-4	A	P	102	179	DICROTENDIPES	470630014043	6	0	0
LF-BIO-4	A	P	102	179	PROCLADIUS	470630014004	1	0	0
LF-BIO-4	A	P	102	179	ENDOCHIRONOMUS	470630014086	1	0	0
LF-BIO-4	A	P	102	179	CLADOPELMA	470630014159	4	0	0
LF-BIO-4	A	P	1	1	DERO	450203005006	17	0	0
LF-BIO-4	B	P	1	1	TANYTARSUS	470630014030	29	0	0
LF-BIO-4	B	P	1	1	CAENIS	470604011002	7	0	0
LF-BIO-4	B	P	1	1	DICROTENDIPES	470630014043	26	0	0
LF-BIO-4	B	P	1	1	PLANORBIDAE	460108012	3	0	0
LF-BIO-4	B	P	1	1	PROCLADIUS	470630014004	14	0	0
LF-BIO-4	B	P	1	1	CHIRONOMIDAE	470630014	0	2	0
LF-BIO-4	B	P	1	1	CHIRONOMUS	470630014032	12	0	0
LF-BIO-4	B	P	1	1	DERO	450203005006	6	0	0
LF-BIO-4	B	P	1	1	TRICLADIDA	350109	1	0	0
LF-BIO-4	B	P	1	1	PHYSELLA	460108013003	1	0	0
LF-BIO-4	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	17	0	0
LF-BIO-4	B	P	1	1	BOTHRIONEURUM VEJDOVSKYANUM	450203004028001	1	0	[illegible]
LF-BIO-4	B	P	1	1	CLADOPELMA	470630014159	2	0	
LF-BIO-4	B	P	1	1	PARACHIRONOMUS	470630014052	1	0	0
LF-BIO-4	B	P	1	1	CRYPTOCHIRONOMUS	470630014035	1	0	0
LF-BIO-4	B	P	1	1	CHIRONOMINI	47063001401	1	0	0
LF-BIO-4	C	P	1	1	ACARINA	47021100	1	0	0
LF-BIO-4	C	P	1	1	CLADOPELMA	470630014159	1	0	0
LF-BIO-4	C	P	1	1	CRYPTOCHIRONOMUS	470630014035	3	0	0
LF-BIO-4	C	P	1	1	CHIRONOMINI	47063001401	2	0	0
LF-BIO-4	C	P	1	1	CHIRONOMIDAE	470630014	1	0	0
LF-BIO-4	C	P	1	1	OXYETHIRA	470628005005	1	0	0
LF-BIO-4	C	P	1	1	PROCLADIUS	470630014004	4	0	0
LF-BIO-4	C	P	1	1	CHIRONOMIDAE	470630014	0	8	0
LF-BIO-4	C	P	1	1	TANYTARSUS	470630014030	30	0	0
LF-BIO-4	C	P	1	1	CAENIS	470604011002	2	0	0
LF-BIO-4	C	P	1	1	PLANORBIDAE	460108012	3	0	0
LF-BIO-4	C	P	1	1	DICROTENDIPES	470630014043	11	0	0
LF-BIO-4	C	P	1	1	TANYTARSUS	470630014030	1	0	0
LF-BIO-4	C	P	1	1	ENDOCHIRONOMUS	470630014086	1	0	0
LF-BIO-4	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	18	0	0
LF-BIO-4	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
LF-BIO-4	C	P	1	1	DERO	450203005006	1	0	0
LF-BIO-5	A	P	1	1	CLADOPELMA	470630014159	4	0	0
LF-BIO-5	A	P	1	1	PROCLADIUS	470630014004	2	0	0
LF-BIO-5	A	P	1	1	CHIRONOMUS	470630014032	4	0	0
LF-BIO-5	A	P	1	1	CHIRONOMINI	47063001401	2	0	0
LF-BIO-5	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	9	0	0
LF-BIO-5	B	P	1	1	CHIRONOMUS	470630014032	4	0	0
LF-BIO-5	B	P	1	1	CLADOPELMA	470630014159	2	0	
LF-BIO-5	B	P	1	1	PROCLADIUS	470630014004	1	0	0
LF-BIO-5	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	16	0	0
LF-BIO-5	B	P	1	1	DERO	450203005006	1	0	0
LF-BIO-5	B	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
IO-5	C	P	1	1	CHIRONOMUS	470630014032	23	0	0
O-5	C	P	1	1	TANYPUS	470630014033	1	0	0
-BIO-5	C	P	1	1	CLADOPELMA	470630014159	2	0	0
LF-BIO-5	C	P	1	1	NEMATODA	4301	1	0	0
LF-BIO-5	C	P	1	1	CHIRONOMINI	47063001401	1	0	0
LF-BIO-5	C	P	1	1	PROCLADIUS	470630014004	2	0	0
LF-BIO-5	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
LF-BIO-5	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	36	0	0
LF-BIO-5	C	P	1	1	CHAOBORUS	470630009001	2	0	0
LF-BIO-6	A	P	1	1	CHAOBORUS	470630009001	19	0	0
LF-BIO-6	A	P	1	1	CHAOBORUS	470630009001	0	2	0
LF-BIO-6	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	7	0	0
LF-BIO-6	A	P	1	1	AULODRILUS PIGUETI	450203004008001	1	0	0
LF-BIO-6	A	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
LF-BIO-6	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	10	0	0
LF-BIO-6	B	P	1	1	CHAOBORUS	470630009001	18	0	0
LF-BIO-6	B	P	1	1	CHAOBORUS	470630009001	0	7	0
LF-BIO-6	B	P	1	1	DICROTENDIPES	470630014043	1	0	0
LF-BIO-6	C	P	1	1	CHAOBORUS	470630009001	37	0	0
LF-BIO-6	C	P	1	1	NEMATODA	4301	1	0	0
LF-BIO-6	C	P	1	1	CHAOBORUS	470630009001	0	2	0
LF-BIO-6	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	18	0	0
LF-BIO-6	C	P	1	1	AULODRILUS PIGUETI	450203004008001	1	0	0
LF-BIO-6	C	P	1	1	CHIRONOMINI	47063001401	1	0	0
LF-BIO-6	C	P	1	1	TANYTARSUS	470630014030	1	0	0
LF-BIO-7	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	2	0	0
LF-BIO-7	A	P	1	1	ANCYLIDAE	460108011	1	0	0
-BIO-7	A	P	1	1	PLANORBIDAE	460108012	1	0	0
3IO-7	A	P	1	1	CHIRONOMINI	47063001401	1	0	0
-BIO-7	A	P	1	1	TANYPUS	470630014033	1	0	0
LF-BIO-7	A	P	1	1	CERATOPOGONIDAE	470630010	2	0	0
LF-BIO-7	A	P	1	1	CLADOPELMA	470630014159	6	0	0
LF-BIO-7	A	P	1	1	CHIRONOMUS	470630014032	1	0	0
LF-BIO-7	A	P	1	1	TANYTARSINI	470630014008	26	0	0
LF-BIO-7	A	P	1	1	PELECYPODA	4605 A	1	0	0
LF-BIO-7	A	P	1	1	CHIRONOMIDAE	470630014	0	4	0
LF-BIO-7	A	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	1	0	0
LF-BIO-7	A	P	1	1	TANYPODINAE	470630014 C	1	0	0
LF-BIO-7	A	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
LF-BIO-7	A	P	1	1	PROCLADIUS	470630014004	13	0	0
LF-BIO-7	A	P	1	1	DERO	450203005006	1	0	0
LF-BIO-7	B	P	1	1	TANYTARSUS	470630014030	7	0	0
LF-BIO-7	B	P	1	1	PROCLADIUS	470630014004	2	0	0
LF-BIO-7	B	P	1	1	LIBELLULIDAE	470605004	1	0	0
LF-BIO-7	B	P	1	1	PHYSELLA	460108013003	3	0	0
LF-BIO-7	B	P	1	1	CHIRONOMIDAE	470630014	0	3	0
LF-BIO-7	B	P	1	1	CHIRONOMUS	470630014032	1	0	0
LF-BIO-7	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	3	0	0
LF-BIO-7	B	P	1	1	DICROTENDIPES	470630014043	4	0	0
LF-BIO-7	B	P	1	1	CHIRONOMINI	47063001401	1	0	0
LF-BIO-7	C	P	1	1	PHYSELLA	460108013003	1	0	0
LF-BIO-7	C	P	1	1	PLANORBIDAE	460108012	3	0	0
LF-BIO-7	C	P	1	1	ACARINA	47021100	1	0	0
LF-BIO-7	C	P	1	1	OXYETHIRA	470628005005	1	0	0
LF-BIO-7	C	P	1	1	DICROTENDIPES	470630014043	2	0	0
-BIO-7	C	P	1	1	CLADOPELMA	470630014159	1	0	0
-BIO-7	C	P	1	1	PROCLADIUS	470630014004	1	0	0
LF-BIO-7	C	P	1	1	CHIRONOMINI	47063001401	1	0	0
LF-BIO-7	C	P	1	1	ENDOCHIRONOMUS	470630014086	1	0	0
LF-BIO-7	C	P	1	1	THIENEMANNIMYIA	470630014119	1	0	0
LF-BIO-7	C	P	1	1	TANYTARSUS	470630014030	2	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
LF-BIO-7	C	P	1	1	ZAVRELIELLA	470630014090	1	0	0
LF-BIO-7	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	3	0	
LF-BIO-8	A	P	1	1	PLANORBIDAE	460108012	2	0	
LF-BIO-8	A	P	1	1	DERO	450203005006	7	0	0
LF-BIO-8	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	6	0	0
LF-BIO-8	A	P	1	1	TANYTARSUS	470630014030	14	0	0
LF-BIO-8	A	P	1	1	PROCLADIUS	470630014004	3	0	0
LF-BIO-8	A	P	1	1	DICROTENDIPES	470630014043	1	0	0
LF-BIO-8	A	P	1	1	CHIRONOMUS	470630014032	1	0	0
LF-BIO-8	B	P	1	1	CERATOPOGONIDAE	470630010	3	0	0
LF-BIO-8	B	P	1	1	PLANORBIDAE	460108012	1	0	0
LF-BIO-8	B	P	1	1	ACARINA	47021100	1	0	0
LF-BIO-8	B	P	1	1	CHIRONOMIDAE	470630014	0	2	0
LF-BIO-8	B	P	1	1	CRYPTOCHIRONOMUS	470630014035	4	0	0
LF-BIO-8	B	P	1	1	CLADOPELMA	470630014159	2	0	0
LF-BIO-8	B	P	1	1	THIENEMANNIMYIA	470630014119	2	0	0
LF-BIO-8	B	P	1	1	TANYPUS	470630014033	2	0	0
LF-BIO-8	B	P	1	1	PROCLADIUS	470630014004	4	0	0
LF-BIO-8	B	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	1	0	0
LF-BIO-8	B	P	1	1	TANYTARSUS	470630014030	12	0	0
LF-BIO-8	B	P	1	1	DICROTENDIPES	470630014043	1	0	0
LF-BIO-8	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	15	0	0
LF-BIO-8	B	P	1	1	AULODRILUS PIGUETI	450203004008001	2	0	0
LF-BIO-8	B	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
LF-BIO-8	B	P	1	1	DERO	450203005006	1	0	0
LF-BIO-8	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	9	0	0
LF-BIO-8	C	P	1	1	CHIRONOMINI	47063001401	1	0	0
LF-BIO-8	C	P	1	1	PLANORBIDAE	460108012	2	0	0
LF-BIO-8	C	P	1	1	CLADOPELMA	470630014159	3	0	0
LF-BIO-8	C	P	1	1	DICROTENDIPES	470630014043	4	0	
LF-BIO-8	C	P	1	1	PHAENOPSECTRA	470630014152	1	0	0
LF-BIO-8	C	P	1	1	CHIRONOMUS	470630014032	1	0	0
LF-BIO-8	C	P	1	1	DERO DERO	450203005006007	24	0	0
LF-BIO-8	C	P	1	1	TANYTARSUS	470630014030	52	0	0
LF-BIO-8	C	P	1	1	ANCYLIDAE	460108011	1	0	0
LF-BIO-8	C	P	1	1	CHIRONOMIDAE	470630014	0	1	0
LF-BIO-8	C	P	1	1	AULODRILUS PIGUETI	450203004008001	2	0	0
LF-BIO-8	C	P	1	1	SLAVINA APPENDICULATA	450203005001001	1	0	0
LF-BIO-8	C	P	1	1	PROCLADIUS	470630014004	2	0	0
RC-BIO-1		D	2	28	TUBIFICIDAE IMM. W/O	450203004 B	2	0	0
RC-BIO-1		D	2	28	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
RC-BIO-1		D	2	28	DERO AULOPHORUS	450203005006 A	2	0	0
RC-BIO-1		D	2	28	ABLABESMYIA	470630014042	1	0	0
RC-BIO-1		D	2	28	CHIRONOMINI	47063001401	4	0	0
RC-BIO-1		D	2	28	PROCLADIUS	470630014004	1	0	0
RC-BIO-1		D	2	28	DICROTENDIPES	470630014043	1	0	0
RC-BIO-1		D	2	28	STENOCHIRONOMUS	470630014029	12	0	0
RC-BIO-1		D	2	28	ENDOCHIRONOMUS	470630014086	6	0	0
RC-BIO-1		D	2	28	POLYPEDILUM SCALAENUM	470630014036038	5	0	0
RC-BIO-1		D	2	28	PLANORBIDAE	460108012	7	0	0
RC-BIO-1		D	2	28	TANYTARSUS	470630014030	16	0	0
RC-BIO-1		D	2	28	ACARINA	47021100	3	0	0
RC-BIO-1		D	2	28	PELECYPODA	4605 A	1	0	0
RC-BIO-1		D	2	28	PHYSELLA	460108013003	21	0	0
RC-BIO-1		D	2	28	ANCYLIDAE	460108011	3	0	0
RC-BIO-1		D	2	28	CHAOBORUS	470630009001	3	0	0
RC-BIO-1		D	2	28	LIBELLULIDAE	470605004	4	0	
RC-BIO-1		D	2	28	COENAGRIONIDAE	470606003	4	0	
RC-BIO-1		D	2	28	CHIRONOMIDAE	470630014	0	5	0
RC-BIO-1	A	P	1	1	DERO DERO	450203005006007	31	0	0
RC-BIO-1	A	P	1	1	AULODRILUS PIGUETI	450203004008001	2	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
[illegible]IO-1	A	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	2	0	0
[illegible]IO-1	A	P	1	1	CHAOBORUS	470630009001	0	1	0
RC-BIO-1	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	62	0	0
RC-BIO-1	A	P	1	1	NEMATODA	4301	1	0	0
RC-BIO-1	A	P	1	1	CHAOBORUS	470630009001	20	0	0
RC-BIO-1	B	P	1	1	CHAOBORUS	470630009001	1	0	0
RC-BIO-1	B	P	1	1	DERO DERO	450203005006007	12	0	0
RC-BIO-1	B	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
RC-BIO-1	B	P	1	1	PROCLADIUS	470630014004	2	0	0
RC-BIO-1	B	P	1	1	SPHAERIIDAE	460507046 A	3	0	0
RC-BIO-1	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	20	0	0
RC-BIO-1	B	P	1	1	CHAOBORUS	470630009001	0	2	0
RC-BIO-1	B	P	1	1	PLANORBIDAE	460108012	3	0	0
RC-BIO-1	B	P	1	1	TUBIFICIDAE IMM. W	450203004 A	3	0	0
RC-BIO-1	B	P	1	1	CHIRONOMUS	470630014032	3	0	0
RC-BIO-1	B	P	1	1	TANYTARSUS	470630014030	2	0	0
RC-BIO-1	B	P	1	1	PARACHIRONOMUS	470630014052	1	0	0
RC-BIO-1	B	P	1	1	DICROTENDIPES	470630014043	1	0	0
RC-BIO-1	C	P	1	1	DICROTENDIPES	470630014043	1	0	0
RC-BIO-1	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	71	0	0
RC-BIO-1	C	P	1	1	TANYTARSUS	470630014030	16	0	0
RC-BIO-1	C	P	1	1	NEMATODA	4301	1	0	0
RC-BIO-1	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	3	0	0
RC-BIO-1	C	P	1	1	AULODRILUS PIGUETI	450203004008001	2	0	0
RC-BIO-1	C	P	1	1	DERO DERO	450203005006007	3	0	0
RC-BIO-1	C	P	1	1	PLANORBIDAE	460108012	1	0	0
RC-BIO-1	C	P	1	1	STENOCHIRONOMUS	470630014029	2	0	0
RC-BIO-1	C	P	1	1	PROCLADIUS	470630014004	2	0	0
[illegible]BIO-1	C	P	1	1	PARACHIRONOMUS	470630014052	1	0	0
[illegible]-BIO-1	C	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	2	0	0
RC-BIO-1	C	P	1	1	SPHAERIIDAE	460507046 A	10	0	0
RC-BIO-2		D	1	28	PLANORBIDAE	460108012	20	0	0
RC-BIO-2		D	1	28	PARACHIRONOMUS	470630014052	1	0	0
RC-BIO-2		D	1	28	PHYSELLA	460108013003	19	0	0
RC-BIO-2		D	1	28	CHIRONOMIDAE	470630014	1	0	0
RC-BIO-2		D	1	28	ANCYLIDAE	460108011	3	0	0
RC-BIO-2		D	1	28	DERO	450203005006	1	0	0
RC-BIO-2		D	1	28	ASELLUS	470531015001	2	0	0
RC-BIO-2		D	1	28	AULODRILUS PIGUETI	450203004008001	1	0	0
RC-BIO-2		D	1	28	PELECYPODA	4605 A	3	0	0
RC-BIO-2		D	1	28	POLYPEDILUM ILLINOENSE	470630014036031	2	0	0
RC-BIO-2		D	1	28	COENAGRIONIDAE	470606003	4	0	0
RC-BIO-2		D	1	28	PARATANYTARSUS	470630014091	2	0	0
RC-BIO-2		D	1	28	LIBELLULIDAE	470605004	4	0	0
RC-BIO-2		D	1	28	ENDOCHIRONOMUS	470630014086	10	0	0
RC-BIO-2		D	1	28	CAENIS	470604011002	4	0	0
RC-BIO-2		D	1	28	CHIRONOMINI	47063001401	1	0	0
RC-BIO-2		D	1	28	ANCYRONYX VARIEGATA	470623050009001	0	0	1
RC-BIO-2		D	1	28	DERO AULOPHORUS	450203005006 A	1	0	0
RC-BIO-2		D	1	28	HYDROPHILIDAE	470623016	0	0	1
RC-BIO-2		D	1	28	POLYPEDILUM SCALAENUM	470630014036038	4	0	0
RC-BIO-2		D	1	28	TRICLADIDA	350109	4	0	0
RC-BIO-2		D	1	28	DERO FLABELLIGER	450203005006002	5	0	0
RC-BIO-2		D	1	28	STENOCHIRONOMUS	470630014029	2	0	0
RC-BIO-2		D	1	28	CLADOTANYTARSUS	470630014041	1	0	0
[illegible]-BIO-2		D	1	28	CURCULIONIDAE	470623104	0	0	1
[illegible]-BIO-2		D	1	28	DUBIRAPHIA	470623050002	2	0	0
RC-BIO-2		D	1	28	LEPTOCERIDAE	470628012	1	0	0
RC-BIO-2		D	1	28	HYDROPTILIDAE	470628005	0	1	0
RC-BIO-2		D	1	28	CHIRONOMIDAE	470630014	0	3	0
RC-BIO-2		D	1	28	TANYTARSUS	470630014030	7	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
RC-BIO-2		D	1	28	PROCLADIUS	470630014004	1	0	0
RC-BIO-2	A	P	1	1	PLANORBIDAE	460108012	6	0	
RC-BIO-2	A	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	
RC-BIO-2	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	8	0	0
RC-BIO-2	A	P	1	1	AULODRILUS PIGUETI	450203004008001	6	0	0
RC-BIO-2	A	P	1	1	DERO DERO	450203005006007	7	0	0
RC-BIO-2	B	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
RC-BIO-2	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	32	0	0
RC-BIO-2	B	P	1	1	DERO DERO	450203005006007	64	0	0
RC-BIO-2	B	P	1	1	PLANORBIDAE	460108012	27	0	0
RC-BIO-2	B	P	1	1	PHYSELLA	460108013003	8	0	0
RC-BIO-2	B	P	1	1	CHIRONOMINI	47063001401	1	0	0
RC-BIO-2	B	P	1	1	PARATANYTARSUS	470630014091	2	0	0
RC-BIO-2	B	P	1	1	DICROTENDIPES	470630014043	4	0	0
RC-BIO-2	B	P	1	1	CLADOPELMA	470630014159	3	0	0
RC-BIO-2	B	P	1	1	MESOSMITTIA	470630014187	1	0	0
RC-BIO-2	B	P	1	1	CHIRONOMUS	470630014032	3	0	0
RC-BIO-2	B	P	1	1	TANYTARSUS	470630014030	20	0	0
RC-BIO-2	B	P	1	1	PROCLADIUS	470630014004	1	0	0
RC-BIO-2	C	P	1	1	CERATOPOGONIDAE	470630010	1	0	0
RC-BIO-2	C	P	1	1	PLANORBIDAE	460108012	6	0	0
RC-BIO-2	C	P	1	1	PHYSELLA	460108013003	6	0	0
RC-BIO-2	C	P	1	1	DUBIRAPHIA	470623050002	1	0	0
RC-BIO-2	C	P	1	1	ANCYLIDAE	460108011	2	0	0
RC-BIO-2	C	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	25	0	0
RC-BIO-2	C	P	1	1	CAENIS	470604011002	3	0	0
RC-BIO-2	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
RC-BIO-2	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	17	0	0
RC-BIO-2	C	P	1	1	TANYTARSUS	470630014030	14	0	
RC-BIO-2	C	P	1	1	LIBELLULIDAE	470605004	1	0	
RC-BIO-2	C	P	1	1	ENDOCHIRONOMUS	470630014086	1	0	0
RC-BIO-2	C	P	1	1	PROCLADIUS	470630014004	6	0	0
RC-BIO-2	C	P	1	1	DICROTENDIPES	470630014043	1	0	0
RC-BIO-2	C	P	1	1	TRIBELOS	470630014117	1	0	0
RC-BIO-2	C	P	1	1	CHIRONOMUS	470630014032	1	0	0
RC-BIO-2	C	P	1	1	CHIRONOMIDAE	470630014	0	2	0
RC-BIO-3		D	1	28	HYDROPHILIDAE	470623016	0	0	1
RC-BIO-3		D	100	366	CHIRONOMUS	470630014032	1	0	0
RC-BIO-3		D	100	366	POLYPEDILUM ILLINOENSE	470630014036031	96	0	0
RC-BIO-3		D	1	28	TUBIFICIDAE IMM. W/O	450203004 B	1	0	0
RC-BIO-3		D	1	28	NEMERTEA	38	2	0	0
RC-BIO-3		D	100	366	CHIRONOMINI	47063001401	2	0	0
RC-BIO-3		D	1	28	STENELMIS	470623050001	0	0	1
RC-BIO-3		D	1	28	COENAGRIONIDAE	470606003	1	0	0
RC-BIO-3		D	1	28	PLANORBIDAE	460108012	1	0	0
RC-BIO-3		D	1	28	PELECYPODA	4605 A	1	0	0
RC-BIO-3		D	1	28	CHIRONOMIDAE	470630014	0	15	0
RC-BIO-3		D	100	366	POLYPEDILUM SCALAENUM	470630014036038	1	0	0
RC-BIO-3	A	H	1	1	ANCYRONYX VARIEGATA	470623050009001	6	0	0
RC-BIO-3	A	H	1	1	CHIRONOMIDAE	470630014	0	239	0
RC-BIO-3	A	H	1	1	STENELMIS	470623050001	3	0	0
RC-BIO-3	A	H	1	1	CORYDALIDAE	470627002	1	0	0
RC-BIO-3	A	H	1	1	PHYSELLA	460108013003	1	0	0
RC-BIO-3	A	H	1	1	NEMERTEA	38	3	0	0
RC-BIO-3	A	H	1	1	CHEUMATOPSYCHE	470628004002	1	0	0
RC-BIO-3	A	H	1	1	PLANORBIDAE	460108012	1	0	0
RC-BIO-3	A	H	1	1	DERO DERO	450203005006007	2	0	
RC-BIO-3	A	H	1	1	NAIDIDAE	450203005	1	0	
RC-BIO-3	A	H	1	28	POLYPEDILUM ILLINOENSE	470630014036031	102	0	0
RC-BIO-3	B	H	1	1	NEMERTEA	38	4	0	0
RC-BIO-3	B	H	1	1	POLYCENTROPUS	470628018002	1	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
BIO-3	B	H	1	28	POLYPEDILUM ILLINOENSE	470630014036031	158	0	0
IO-3	B	H	1	1	ANCYRONYX VARIEGATA	470623050009001	5	0	0
RC-BIO-3	B	H	1	28	POLYPEDILUM FALLAX	470630014036003	3	0	0
RC-BIO-3	B	H	1	1	DERO DERO	450203005006007	5	0	0
RC-BIO-3	B	H	1	1	NAIS	450203005008	1	0	0
RC-BIO-3	B	H	1	1	CHIRONOMIDAE	470630014	0	253	0
RC-BIO-3	B	H	1	1	ARGIA	470606003009	2	0	0
RC-BIO-3	B	H	1	1	TUBIFICIDAE IMM. W/O	450203004 B	1	0	0
RC-BIO-3	C	H	1	1	COENAGRIONIDAE	470606003	3	0	0
RC-BIO-3	C	H	2	28	CHIRONOMINI	47063001401	2	0	0
RC-BIO-3	C	H	1	1	STENELMIS	470623050001	0	0	2
RC-BIO-3	C	H	2	28	ABLABESMYIA	470630014042	4	0	0
RC-BIO-3	C	H	1	1	SLAVINA APPENDICULATA	450203005001001	4	0	0
RC-BIO-3	C	H	2	28	POLYPEDILUM FALLAX	470630014036003	2	0	0
RC-BIO-3	C	H	1	1	CHIRONOMIDAE	470630014	0	174	0
RC-BIO-3	C	H	1	1	DERO DERO	450203005006007	2	0	0
RC-BIO-3	C	H	2	28	POLYPEDILUM SCALAENUM	470630014036038	4	0	0
RC-BIO-3	C	H	2	28	POLYPEDILUM ILLINOENSE	470630014036031	182	0	0
RC-BIO-3	C	H	1	1	CORYDALIDAE	470627002	1	0	0
RC-BIO-3	C	H	1	1	HEMERODROMIA	470630041004	1	0	0
RC-BIO-3	C	H	1	1	NEMERTEA	38	3	0	0
RC-BIO-3	A	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	15	0	0
RC-BIO-3	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	41	0	0
RC-BIO-3	A	P	1	1	SPHAERIIDAE	460507046 A	2	0	0
RC-BIO-3	A	P	102	169	POLYPEDILUM ILLINOENSE	470630014036031	55	0	0
RC-BIO-3	A	P	102	169	CHIRONOMUS	470630014032	22	0	0
RC-BIO-3	A	P	1	1	CHIRONOMIDAE	470630014	0	5	0
RC-BIO-3	A	P	102	169	CHIRONOMINI	47063001401	1	0	0
IO-3	A	P	102	169	CRYPTOCHIRONOMUS	470630014035	5	0	0
BIO-3	A	P	102	169	POLYPEDILUM SCALAENUM	470630014036038	19	0	0
RC-BIO-3	B	P	1	1	BOTHRIONEURUM VEJDOVSKYANUM	450203004028001	1	0	0
RC-BIO-3	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	17	0	0
RC-BIO-3	B	P	101	129	CHIRONOMUS	470630014032	31	0	0
RC-BIO-3	B	P	1	1	NEMATODA	4301	1	0	0
RC-BIO-3	B	P	1	1	DUBIRAPHIA	470623050002	2	0	0
RC-BIO-3	B	P	1	1	CHIRONOMIDAE	470630014	0	5	0
RC-BIO-3	B	P	101	129	POLYPEDILUM ILLINOENSE	470630014036031	47	0	0
RC-BIO-3	B	P	101	129	POLYPEDILUM SCALAENUM	470630014036038	14	0	0
RC-BIO-3	B	P	1	1	SPHAERIIDAE	460507046 A	5	0	0
RC-BIO-3	B	P	101	129	CHIRONOMINI	47063001401	1	0	0
RC-BIO-3	B	P	101	129	CRYPTOCHIRONOMUS	470630014035	8	0	0
RC-BIO-3	B	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	22	0	0
RC-BIO-3	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	44	0	0
RC-BIO-3	C	P	1	1	CHIRONOMIDAE	470630014	0	4	0
RC-BIO-3	C	P	1	1	DUBIRAPHIA	470623050002	1	0	0
RC-BIO-3	C	P	1	1	SPHAERIIDAE	460507046 A	4	0	0
RC-BIO-3	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	15	0	0
RC-BIO-3	C	P	1	1	COENAGRIONIDAE	470606003	1	0	0
RC-BIO-3	C	P	102	280	CRYPTOCHIRONOMUS	470630014035	5	0	0
RC-BIO-3	C	P	102	280	POLYPEDILUM ILLINOENSE	470630014036031	60	0	0
RC-BIO-3	C	P	102	280	CHIRONOMUS	470630014032	22	0	0
RC-BIO-3	C	P	102	280	HARNISCHIA	470630014162	1	0	0
RC-BIO-3	C	P	102	280	CHIRONOMIDAE	470630014	1	0	0
RC-BIO-3	C	P	102	280	POLYPEDILUM SCALAENUM	470630014036038	13	0	0
RC-GC-BIO-01	A	H	1	1	COENAGRIONIDAE	470606003	1	0	0
GC-BIO-01	A	H	99	128	POLYPEDILUM ILLINOENSE	470630014036031	14	0	0
GC-BIO-01	A	H	1	1	DUBIRAPHIA	470623050002	1	0	0
RC-GC-BIO-01	A	H	99	128	CHIRONOMUS	470630014032	25	0	0
RC-GC-BIO-01	A	H	1	1	CHIRONOMIDAE	470630014	0	5	0
RC-GC-BIO-01	A	H	99	128	PHAENOPSECTRA	470630014152	4	0	0
RC-GC-BIO-01	A	H	1	1	ANCYLIDAE	460108011	2	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
RC-GC-BIO-01	A	H	99	128	ABLABESMYIA	470630014042	19	0	0
RC-GC-BIO-01	A	H	1	1	TRICLADIDA	350109	1	0	
RC-GC-BIO-01	A	H	1	1	DUBIRAPHIA	470623050002	0	0	
RC-GC-BIO-01	A	H	1	1	ARGIA	470606003009	4	0	0
RC-GC-BIO-01	A	H	1	1	CAENIS	470604011002	1	0	0
RC-GC-BIO-01	A	H	1	1	DERO DERO	450203005006007	14	0	0
RC-GC-BIO-01	A	H	99	128	TANYTARSUS	470630014030	3	0	0
RC-GC-BIO-01	A	H	99	128	DICROTENDIPES	470630014043	20	0	0
RC-GC-BIO-01	A	H	99	128	TRIBELOS	470630014117	9	0	0
RC-GC-BIO-01	A	H	99	128	CHIRONOMINI	47063001401	4	0	0
RC-GC-BIO-01	A	H	99	128	LABRUNDINIA	470630014103	1	0	0
RC-GC-BIO-01	B	H	102	130	CHIRONOMUS	470630014032	26	0	0
RC-GC-BIO-01	B	H	102	130	POLYPEDILUM ILLINOENSE	470630014036031	9	0	0
RC-GC-BIO-01	B	H	102	130	TRIBELOS	470630014117	23	0	0
RC-GC-BIO-01	B	H	1	1	PARALEPTOPHLEBIA	470604002009	1	0	0
RC-GC-BIO-01	B	H	102	130	ABLABESMYIA	470630014042	23	0	0
RC-GC-BIO-01	B	H	1	1	ANCYLIDAE	460108011	1	0	0
RC-GC-BIO-01	B	H	1	1	CHIRONOMIDAE	470630014	0	3	0
RC-GC-BIO-01	B	H	1	1	STENONEMA	470604001004	1	0	0
RC-GC-BIO-01	B	H	102	130	DICROTENDIPES	470630014043	12	0	0
RC-GC-BIO-01	B	H	102	130	PHAENOPSECTRA	470630014152	6	0	0
RC-GC-BIO-01	B	H	102	130	TANYTARSUS	470630014030	2	0	0
RC-GC-BIO-01	B	H	102	130	POLYPEDILUM FALLAX	470630014036003	1	0	0
RC-GC-BIO-01	B	H	1	1	DERO DERO	450203005006007	12	0	0
RC-GC-BIO-01	C	H	1	1	DERO AULOPHORUS	450203005006 A	1	0	0
RC-GC-BIO-01	C	H	1	1	CHIRONOMIDAE	470630014	0	2	0
RC-GC-BIO-01	C	H	1	1	ANCYLIDAE	460108011	3	0	0
RC-GC-BIO-01	C	H	1	1	TRIBELOS	470630014117	15	0	0
RC-GC-BIO-01	C	H	1	1	CAENIS	470604011002	1	0	[illegible]
RC-GC-BIO-01	C	H	1	1	DICROTENDIPES	470630014043	25	0	
RC-GC-BIO-01	C	H	1	1	DUBIRAPHIA	470623050002	1	0	0
RC-GC-BIO-01	C	H	1	1	PHAENOPSECTRA	470630014152	1	0	0
RC-GC-BIO-01	C	H	1	1	ERPOBDELLIDAE	450205006	1	0	0
RC-GC-BIO-01	C	H	1	1	CHIRONOMUS	470630014032	32	0	0
RC-GC-BIO-01	C	H	1	1	STENACRON	470604001017	1	0	0
RC-GC-BIO-01	C	H	1	1	LIBELLULIDAE	470605004	1	0	0
RC-GC-BIO-01	C	H	1	1	POLYPEDILUM ILLINOENSE	470630014036031	15	0	0
RC-GC-BIO-01	C	H	1	1	TANYTARSUS	470630014030	1	0	0
RC-GC-BIO-01	C	H	1	1	ABLABESMYIA	470630014042	8	0	0
RC-GC-BIO-01	C	H	1	1	CHIRONOMINI	47063001401	1	0	0
RC-GC-BIO-01	C	H	1	1	POLYPEDILUM SCALAENUM	470630014036038	1	0	0
RC-GC-BIO-01	C	H	1	1	DERO DERO	450203005006007	33	0	0
RC-GC-BIO-1		D	3	28	PHAENOPSECTRA	470630014152	5	0	0
RC-GC-BIO-1		D	3	28	LIBELLULIDAE	470605004	17	0	0
RC-GC-BIO-1		D	3	28	BOYERIA	470605001007	1	0	0
RC-GC-BIO-1		D	3	28	CHIRONOMIDAE	470630014	0	4	0
RC-GC-BIO-1		D	3	28	DERO FLABELLIGER	450203005006002	3	0	0
RC-GC-BIO-1		D	3	28	ANCYLIDAE	460108011	6	0	0
RC-GC-BIO-1		D	3	28	ANCYRONYX VARIEGATA	470623050009001	0	0	1
RC-GC-BIO-1		D	3	28	ACARINA	47021100	2	0	0
RC-GC-BIO-1		D	3	28	ANCYRONYX VARIEGATA	470623050009001	4	0	0
RC-GC-BIO-1		D	3	28	ABLABESMYIA	470630014042	3	0	0
RC-GC-BIO-1		D	3	28	CAENIS	470604011002	9	0	0
RC-GC-BIO-1		D	3	28	POLYPEDILUM ILLINOENSE	470630014036031	5	0	0
RC-GC-BIO-1		D	3	28	DERO	450203005006	2	0	0
RC-GC-BIO-1		D	3	28	DUBIRAPHIA	470623050002	0	0	12
RC-GC-BIO-1		D	3	28	ELMIDAE	470623050	1	0	
RC-GC-BIO-1		D	3	28	COENAGRIONIDAE	470606003	16	0	[illegible]
RC-GC-BIO-1		D	3	28	DUBIRAPHIA	470623050002	10	0	0
RC-GC-BIO-1		D	3	28	PARATANYTARSUS	470630014091	2	0	0
RC-GC-BIO-1		D	3	28	TRIBELOS	470630014117	3	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
[illegible]-BIO-1		D	3	28	CHIRONOMUS	470630014032	3	0	0
[illegible]-BIO-1		D	3	28	DERO AULOPHORUS	450203005006 A	2	0	0
RC-GC-BIO-1	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	26	0	0
RC-GC-BIO-1	A	P	1	1	GLOSSIPHONIIDAE	450205002	1	0	0
RC-GC-BIO-1	A	P	1	1	DUBIRAPHIA	470623050002	22	0	0
RC-GC-BIO-1	A	P	1	1	COENAGRIONIDAE	470606003	1	0	0
RC-GC-BIO-1	A	P	1	1	LIBELLULIDAE	470605004	1	0	0
RC-GC-BIO-1	A	P	1	1	CHIRONOMIDAE	470630014	0	1	0
RC-GC-BIO-1	A	P	1	1	ANCYLIDAE	460108011	2	0	0
RC-GC-BIO-1	A	P	1	1	ELMIDAE	470623050	1	0	0
RC-GC-BIO-1	A	P	1	1	DERO DERO	450203005006007	20	0	0
RC-GC-BIO-1	A	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	3	0	0
RC-GC-BIO-1	A	P	102	165	DICROTENDIPES	470630014043	8	0	0
RC-GC-BIO-1	A	P	102	165	TRIBELOS	470630014117	31	0	0
RC-GC-BIO-1	A	P	102	165	CHIRONOMUS	470630014032	47	0	0
RC-GC-BIO-1	A	P	102	165	ABLABESMYIA	470630014042	4	0	0
RC-GC-BIO-1	A	P	102	165	POLYPEDILUM ILLINOENSE	470630014036031	3	0	0
RC-GC-BIO-1	A	P	1	1	PHYLOCENTROPUS	470628018006	2	0	0
RC-GC-BIO-1	A	P	102	165	PROCLADIUS	470630014004	8	0	0
RC-GC-BIO-1	A	P	1	1	DUBIRAPHIA	470623050002	0	0	1
RC-GC-BIO-1	A	P	102	165	STENOCHIRONOMUS	470630014029	1	0	0
RC-GC-BIO-1	B	P	1	1	DERO	450203005006	9	0	0
RC-GC-BIO-1	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	14	0	0
RC-GC-BIO-1	B	P	1	1	DUBIRAPHIA	470623050002	0	0	1
RC-GC-BIO-1	B	P	1	1	DUBIRAPHIA	470623050002	11	0	0
RC-GC-BIO-1	B	P	1	1	AULODRILUS PIGUETI	450203004008001	2	0	0
RC-GC-BIO-1	B	P	99	140	CHIRONOMUS	470630014032	21	0	0
RC-GC-BIO-1	B	P	99	140	ABLABESMYIA	470630014042	18	0	0
[illegible]C-BIO-1	B	P	99	140	TRIBELOS	470630014117	46	0	0
RC-GC-BIO-1	B	P	99	140	DICROTENDIPES	470630014043	9	0	0
RC-GC-BIO-1	B	P	99	140	POLYPEDILUM ILLINOENSE	470630014036031	2	0	0
RC-GC-BIO-1	B	P	99	140	PARATANYTARSUS	470630014091	3	0	0
RC-GC-BIO-1	B	P	1	1	LIBELLULIDAE	470605004	1	0	0
RC-GC-BIO-1	B	P	1	1	CHIRONOMIDAE	470630014	0	1	0
RC-GC-BIO-1	B	P	1	1	CAENIS	470604011002	1	0	0
RC-GC-BIO-1	B	P	1	1	STENELMIS	470623050001	1	0	0
RC-GC-BIO-1	C	P	1	1	PLANORBIDAE	460108012	2	0	0
RC-GC-BIO-1	C	P	1	1	ANCYLIDAE	460108011	10	0	0
RC-GC-BIO-1	C	P	1	1	CHIRONOMIDAE	470630014	0	1	0
RC-GC-BIO-1	C	P	1	1	COENAGRIONIDAE	470606003	1	0	0
RC-GC-BIO-1	C	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
RC-GC-BIO-1	C	P	1	1	DICROTENDIPES	470630014043	2	0	0
RC-GC-BIO-1	C	P	1	1	PARATANYTARSUS	470630014091	1	0	0
RC-GC-BIO-1	C	P	1	1	LIBELLULIDAE	470605004	1	0	0
RC-GC-BIO-1	C	P	1	1	CHIRONOMUS	470630014032	10	0	0
RC-GC-BIO-1	C	P	1	1	CHIRONOMINI	47063001401	1	0	0
RC-GC-BIO-1	C	P	1	1	ACARINA	47021100	2	0	0
RC-GC-BIO-1	C	P	1	1	HALIPLUS	470623006001	1	0	0
RC-GC-BIO-1	C	P	1	1	DERO DERO	450203005006007	7	0	0
RC-GC-BIO-1	C	P	1	1	TRIBELOS	470630014117	4	0	0
RC-GC-BIO-1	C	P	1	1	CERATOPOGONIDAE	470630010	1	0	0
RC-GC-BIO-1	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	8	0	0
RC-GC-BIO-1	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	23	0	0
RC-GC-BIO-2		D	2	28	PALAEMONETES PALUDOSUS	470534015003002	1	0	0
RC-GC-BIO-2		D	2	28	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
[illegible]GC-BIO-2		D	2	28	PHAENOPSECTRA	470630014152	2	0	0
[illegible]-GC-BIO-2		D	2	28	DICROTENDIPES	470630014043	12	0	0
RC-GC-BIO-2		D	2	28	TRIBELOS	470630014117	3	0	0
RC-GC-BIO-2		D	2	28	CHIRONOMUS	470630014032	4	0	0
RC-GC-BIO-2		D	2	28	PARATANYTARSUS	470630014091	2	0	0
RC-GC-BIO-2		D	2	28	SLAVINA APPENDICULATA	450203005001001	4	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
RC-GC-BIO-2		D	2	28	DERO DERO	450203005006007	16	0	0
RC-GC-BIO-2		D	2	28	DERO FLABELLIGER	450203005006002	2	0	0
RC-GC-BIO-2		D	2	28	DERO AULOPHORUS	450203005006 A	4	0	0
RC-GC-BIO-2		D	2	28	PLANORBIDAE	460108012	6	0	0
RC-GC-BIO-2		D	2	28	ANCYLIDAE	460108011	8	0	0
RC-GC-BIO-2		D	2	28	CAENIS	470604011002	10	0	0
RC-GC-BIO-2		D	2	28	OXYETHIRA	470628005005	2	0	0
RC-GC-BIO-2		D	2	28	ACARINA	47021100	3	0	0
RC-GC-BIO-2		D	2	28	CHIRONOMIDAE	470630014	0	1	0
RC-GC-BIO-2		D	2	28	DUBIRAPHIA	470623050002	0	0	4
RC-GC-BIO-2		D	2	28	DUBIRAPHIA	470623050002	1	0	0
RC-GC-BIO-2		D	2	28	COENAGRIONIDAE	470606003	8	0	0
RC-GC-BIO-2		D	2	28	LIBELLULIDAE	470605004	2	0	0
RC-GC-BIO-2		D	2	28	DYTISCIDAE	470623008	0	0	1
RC-GC-BIO-3		D	7	28	TRIBELOS	470630014117	2	0	0
RC-GC-BIO-3		D	7	28	CHIRONOMUS	470630014032	3	0	0
RC-GC-BIO-3		D	7	28	PARATANYTARSUS	470630014091	4	0	0
RC-GC-BIO-3		D	7	28	TANYTARSUS	470630014030	1	0	0
RC-GC-BIO-3		D	7	28	CHIRONOMIDAE	470630014	1	0	0
RC-GC-BIO-3		D	7	28	POLYPEDILUM ILLINOENSE	470630014036031	7	0	0
RC-GC-BIO-3		D	7	28	DERO DERO	450203005006007	2	0	0
RC-GC-BIO-3		D	7	28	ANCYLIDAE	460108011	9	0	0
RC-GC-BIO-3		D	7	28	PLANORBIDAE	460108012	1	0	0
RC-GC-BIO-3		D	7	28	PHYSELLA	460108013003	1	0	0
RC-GC-BIO-3		D	7	28	PELECYPODA	4605 A	5	0	0
RC-GC-BIO-3		D	7	28	CHIRONOMIDAE	470630014	0	7	0
RC-GC-BIO-3		D	7	28	DUBIRAPHIA	470623050002	0	0	1
RC-GC-BIO-3		D	7	28	STENELMIS	470623050001	0	0	1
RC-GC-BIO-3		D	7	28	ANCYRONYX VARIEGATA	470623050009001	2	0	0
RC-GC-BIO-3		D	7	28	ELMIDAE	470623050	6	0	
RC-GC-BIO-3		D	7	28	LIBELLULIDAE	470605004	7	0	0
RC-GC-BIO-3		D	7	28	COENAGRIONIDAE	470606003	7	0	0
RC-GC-BIO-3		D	7	28	AESHNIDAE	470605001	1	0	0
RC-GC-BIO-3		D	7	28	SIALIS	470627001001	2	0	0
RC-GC-BIO-3		D	7	28	CORIXIDAE	470621001	2	0	0
RC-GC-BIO-3		D	7	28	CULICIDAE	470630009	1	0	0
RC-GC-BIO-3		D	7	28	PHAENOPSECTRA	470630014152	3	0	0
RC-GC-BIO-3		D	7	28	DICROTENDIPES	470630014043	19	0	0
STC-BIO-1		D	2	28	COENAGRIONIDAE	470606003	3	0	0
STC-BIO-1		D	2	28	CORIXIDAE	470621001	1	0	0
STC-BIO-1		D	2	28	CHIRONOMUS	470630014032	2	0	0
STC-BIO-1		D	2	28	TUBIFICIDAE IMM. W/O	450203004 B	3	0	0
STC-BIO-1		D	2	28	DERO DERO	450203005006007	58	0	0
STC-BIO-1		D	2	28	ENCHYTRAEIDAE	450203003	5	0	0
STC-BIO-1		D	2	28	TUBIFICIDAE IMM. W	450203004 A	18	0	0
STC-BIO-1	A	H	1	1	DERO DERO	450203005006007	1	0	0
STC-BIO-1	A	H	1	1	TUBIFICIDAE IMM. W	450203004 A	20	0	0
STC-BIO-1	B	H	1	1	DERO DERO	450203005006007	3	0	0
STC-BIO-1	B	H	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
STC-BIO-1	C	H	1	1	DERO DERO	450203005006007	9	0	0
STC-BIO-1	C	H	1	1	TUBIFICIDAE IMM. W	450203004 A	2	0	0
STC-BIO-1	A	P	1	1	NAIDIDAE	450203005	1	0	0
STC-BIO-1	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	2	0	0
STC-BIO-1	C	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
STC-BIO-1	C	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
STC-BIO-1	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	5	0	0
STC-BIO-2		D	5	28	CHIRONOMIDAE	470630014	0	2	
STC-BIO-2		D	5	28	COENAGRIONIDAE	470606003	8	0	
STC-BIO-2		D	5	28	PELTODYTES	470623006003	0	0	1
STC-BIO-2		D	5	28	CORDULIIDAE	470605006	5	0	0
STC-BIO-2		D	5	28	NAIS	450203005008	2	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
BIO-2		D	5	28	DERO	450203005006	3	0	0
BIO-2		D	5	28	ANCYLIDAE	460108011	3	0	0
STC-BIO-2		D	5	28	LIMNODRILUS HOFFMEISTERI	450203004005001	2	0	0
STC-BIO-2		D	5	28	TANYPODINAE	470630014 C	6	0	0
STC-BIO-2		D	5	28	PARACHIRONOMUS	470630014052	2	0	0
STC-BIO-2		D	5	28	ABLABESMYIA	470630014042	2	0	0
STC-BIO-2		D	5	28	CERATOPOGONIDAE	470630010	4	0	0
STC-BIO-2		D	5	28	TUBIFICIDAE IMM. W/O	450203004 B	5	0	0
STC-BIO-2		D	5	28	ASTACIDAE	470534093	2	0	0
STC-BIO-2		D	5	28	DICROTENDIPES	470630014043	46	0	0
STC-BIO-2		D	5	28	POLYPEDILUM ILLINOENSE	470630014036031	11	0	0
STC-BIO-2	A	H	1	1	CHIRONOMIDAE	470630014	0	1	0
STC-BIO-2	A	H	1	1	CORDULIIDAE	470605006	1	0	0
STC-BIO-2	A	H	1	1	DICROTENDIPES	470630014043	23	0	0
STC-BIO-2	A	H	1	1	ABLABESMYIA	470630014042	3	0	0
STC-BIO-2	B	H	1	1	ABLABESMYIA	470630014042	4	0	0
STC-BIO-2	B	H	1	1	DICROTENDIPES	470630014043	28	0	0
STC-BIO-2	B	H	1	1	DERO AULOPHORUS	450203005006 A	3	0	0
STC-BIO-2	B	H	1	1	ANCYLIDAE	460108011	2	0	0
STC-BIO-2	B	H	1	1	DERO	450203005006	22	0	0
STC-BIO-2	C	H	1	1	ABLABESMYIA	470630014042	3	0	0
STC-BIO-2	C	H	1	1	DICROTENDIPES	470630014043	30	0	0
STC-BIO-2	A	P	1	1	RHEOCRICOTOPUS	470630014110	1	0	0
STC-BIO-2	A	P	1	1	ABLABESMYIA	470630014042	1	0	0
STC-BIO-2	A	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
STC-BIO-2	A	P	1	1	LUMBRICULIDAE	450201001	1	0	0
STC-BIO-2	A	P	1	1	DICROTENDIPES	470630014043	7	0	0
STC-BIO-2	B	P	1	1	ABLABESMYIA	470630014042	1	0	0
-BIO-2	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	4	0	0
STC-BIO-2	B	P	1	1	TANYPODINAE	470630014 C	1	0	0
STC-BIO-2	B	P	1	1	PRISTINA LEIDYI	450203005005013	1	0	0
STC-BIO-2	B	P	1	1	PROCLADIUS	470630014004	1	0	0
STC-BIO-2	B	P	1	1	PARACHIRONOMUS	470630014052	1	0	0
STC-BIO-2	B	P	1	1	DICROTENDIPES	470630014043	40	0	0
STC-BIO-2	B	P	1	1	COENAGRIONIDAE	470606003	1	0	0
STC-BIO-2	B	P	1	1	CHIRONOMIDAE	470630014	0	1	0
STC-BIO-2	B	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	4	0	0
STC-BIO-2	B	P	1	1	DERO	450203005006	1	0	0
STC-BIO-2	B	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	2	0	0
STC-BIO-2	B	P	1	1	NAIS COMMUNIS	450203005008003	1	0	0
STC-BIO-2	C	P	1	1	ASTACIDAE	470534093	1	0	0
STC-BIO-2	C	P	1	1	DICROTENDIPES	470630014043	7	0	0
STC-BIO-2	C	P	1	1	LARSIA	470630014102	2	0	0
STC-BIO-2	C	P	1	1	CELINA	470623008010	1	0	0
STC-BIO-2	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	2	0	0
STC-BIO-2	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	6	0	0
STC-BIO-3		D	6	28	CHIRONOMUS	470630014032	1	0	0
STC-BIO-3		D	6	28	CRICOTOPUS BICINCTUS	470630014025004	1	0	0
STC-BIO-3		D	6	28	TUBIFICIDAE IMM. W	450203004 A	1	0	0
STC-BIO-3		D	6	28	PROCLADIUS	470630014004	1	0	0
STC-BIO-3		D	6	28	TUBIFICIDAE IMM. W/O	450203004 B	5	0	0
STC-BIO-3		D	6	28	THIENEMANNIMYIA	470630014119	6	0	0
STC-BIO-3		D	6	28	DICROTENDIPES	470630014043	31	0	0
STC-BIO-3		D	6	28	NANOCLADIUS	470630014044	1	0	0
STC-BIO-3		D	1	1	ASTACIDAE	470534093	3	0	0
C-BIO-3		D	6	28	SPHAERIIDAE	460507046 A	1	0	0
STC-BIO-3		D	6	28	CHIRONOMIDAE	470630014	0	2	0
STC-BIO-3		D	6	28	LIMNODRILUS HOFFMEISTERI	450203004005001	2	0	0
STC-BIO-3		D	6	28	ABLABESMYIA	470630014042	3	0	0
STC-BIO-3		D	6	28	COENAGRIONIDAE	470606003	8	0	0
STC-BIO-3		D	6	28	CORDULIIDAE	470605006	1	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
STC-BIO-3		D	6	28	POLYPEDILUM ILLINOENSE	470630014036031	33	0	0
STC-BIO-3		D	6	28	HYDROPHILIDAE	470623016	1	0	
STC-BIO-3		D	6	28	PELTODYTES	470623006003	3	0	0
STC-BIO-3	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	4	0	0
STC-BIO-3	A	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
STC-BIO-3	A	P	1	1	DERO	450203005006	1	0	0
STC-BIO-3	A	P	1	1	SPHAERIIDAE	460507046 A	3	0	0
STC-BIO-3	A	P	1	1	HEMERODROMIA	470630041004	1	0	0
STC-BIO-3	A	P	1	1	CHIRONOMIDAE	470630014	0	1	0
STC-BIO-3	A	P	1	1	HYDROBIIDAE	460102013	3	0	0
STC-BIO-3	A	P	1	1	PROCLADIUS	470630014004	1	0	0
STC-BIO-3	A	P	1	1	DICROTENDIPES	470630014043	3	0	0
STC-BIO-3	A	P	1	1	ABLABESMYIA	470630014042	3	0	0
STC-BIO-3	B	P	1	1	CHIRONOMUS	470630014032	1	0	0
STC-BIO-3	C	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
STC-BIO-3	C	P	1	1	CHIRONOMINI	47063001401	1	0	0
STC-BIO-3	C	P	1	1	DICROTENDIPES	470630014043	5	0	0
STC-BIO-3	C	P	1	1	ABLABESMYIA	470630014042	2	0	0
STC-BIO-3	C	P	1	1	CHIRONOMUS	470630014032	1	0	0
STC-BIO-3	C	P	1	1	SPHAERIIDAE	460507046 A	1	0	0
STC-BIO-3	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	10	0	0
STC-BIO-3	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	3	0	0
STC-BIO-3	C	P	1	1	COLEOPTERA	470623	0	0	1
STC-BIO-3	C	P	1	1	CHIRONOMUS	470630014032	1	0	0
STC-BIO-3	C	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
STC-BIO-3	C	P	1	1	CHIRONOMIDAE	470630014	1	0	0
STC-BIO-3	C	P	1	1	DERO DIGITATA	450203005006004	1	0	0
STC-BIO-3	C	P	1	1	LUMBRICULIDAE	450201001	1	0	0
STC-BIO-4		D	1	1	PARACHIRONOMUS	470630014052	3	0	0
STC-BIO-4		D	1	1	PROCLADIUS	470630014004	24	0	
STC-BIO-4		D	1	1	CHIRONOMUS	470630014032	12	0	0
STC-BIO-4		D	1	1	DICROTENDIPES	470630014043	23	0	0
STC-BIO-4		D	1	1	POLYPEDILUM ILLINOENSE	470630014036031	13	0	0
STC-BIO-4		D	1	1	CERATOPOGONIDAE	470630010	2	0	0
STC-BIO-4		D	1	1	CORDULIIDAE	470605006	1	0	0
STC-BIO-4		D	1	1	TROPISTERNUS	470623016012	0	0	1
STC-BIO-4		D	1	1	LARSIA	470630014102	25	0	0
STC-BIO-4		D	1	1	COENAGRIONIDAE	470606003	8	0	0
STC-BIO-4		D	1	1	ABLABESMYIA	470630014042	1	0	0
STC-BIO-4		D	1	1	DERO FURCATA	450203005006008	2	0	0
STC-BIO-4		D	1	1	THIENEMANNIMYIA	470630014119	5	0	0
STC-BIO-4		D	1	1	PELTODYTES	470623006003	0	0	1
STC-BIO-4		D	1	1	GASTROPODA	4601	1	0	0
STC-BIO-4		D	1	1	NAIDIDAE	450203005	1	0	0
STC-BIO-4		D	1	1	CHIRONOMINI	47063001401	1	0	0
STC-BIO-4		D	1	1	LABRUNDINIA	470630014103	1	0	0
STC-BIO-4		D	1	1	ASTACIDAE	470534093	1	0	0
STC-BIO-4		D	1	1	CHIRONOMIDAE	470630014	0	5	0
STC-BIO-4	A	H	1	1	CHIRONOMINI	47063001401	1	0	0
STC-BIO-4	A	H	1	1	LARSIA	470630014102	1	0	0
STC-BIO-4	A	H	1	1	CHIRONOMIDAE	470630014	0	1	0
STC-BIO-4	A	H	1	1	DICROTENDIPES	470630014043	3	0	0
STC-BIO-4	B	H	1	1	CHIRONOMIDAE	470630014	0	1	0
STC-BIO-4	B	H	1	1	DERO	450203005006	1	0	0
STC-BIO-4	B	H	1	1	DICROTENDIPES	470630014043	4	0	0
STC-BIO-4	C	H	1	1	CHIRONOMUS	470630014032	2	0	0
STC-BIO-4	C	H	1	1	DICROTENDIPES	470630014043	6	0	
STC-BIO-4	C	H	1	1	POLYPEDILUM ILLINOENSE	470630014036031	8	0	
STC-BIO-4	C	H	1	1	LARSIA	470630014102	2	0	0
STC-BIO-4	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	1	0	0
STC-BIO-4	A	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
-BIO-4	B	P	1	1	DICROTENDIPES	470630014043	1	0	0
-BIO-4	B	P	1	1	PROCLADIUS	470630014004	3	0	0
STC-BIO-4	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	1	0	0
STC-BIO-4	C	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
STC-BIO-4	C	P	1	1	ILYOORILUS TEMPLETONI	450203004006002	1	0	0
STC-BIO-4	C	P	1	1	CERATOPOGONIDAE	470630010	2	0	0
STC-BIO-4	C	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	4	0	0
STC-BIO-4	C	P	1	1	PROCLADIUS	470630014004	12	0	0
STC-BIO-4	C	P	1	1	LARSIA	470630014102	3	0	0
STC-BIO-4	C	P	1	1	CHIRONOMUS	470630014032	2	0	0
STC-BIO-4	C	P	1	1	DICROTENDIPES	470630014043	5	0	0
STC-BIO-4	C	P	1	1	CHIRONOMIDAE	470630014	0	1	0
STC-BIO-5		D	1	28	PROCLADIUS	470630014004	3	0	0
STC-BIO-5		D	1	28	ORTHOCLADIINAE	470630014 B	1	0	0
STC-BIO-5		D	1	28	ABLABESMYIA	470630014042	2	0	0
STC-BIO-5		D	1	28	SPHAERIIDAE	460507046 A	27	0	0
STC-BIO-5		D	1	28	DERO	450203005006	1	0	0
STC-BIO-5		D	1	28	LEPTOCERIDAE	470628012	1	0	0
STC-BIO-5		D	1	28	DUBIRAPHIA	470623050002	1	0	0
STC-BIO-5		D	1	28	GOMPHIDAE	470605003	1	0	0
STC-BIO-5		D	1	28	CORDULIIDAE	470605006	7	0	0
STC-BIO-5		D	1	28	HYDROPTILIDAE	470628005	2	0	0
STC-BIO-5		D	1	28	DICROTENDIPES	470630014043	3	0	0
STC-BIO-5		D	1	28	TUBIFICIDAE IMM. W/O	450203004 B	1	0	0
STC-BIO-5		D	1	28	CRYPTOTENDIPES	470630014143	1	0	0
STC-BIO-5		D	1	28	TRIBELOS	470630014117	9	0	0
STC-BIO-5		D	1	28	ANCYLIDAE	460108011	1	0	0
STC-BIO-5		D	1	28	HYDROBIIDAE	460102013	77	0	0
-BIO-5		D	1	28	OECETIS	470628012004	1	0	0
-BIO-5		D	1	28	PELTODYTES	470623006003	1	0	0
STC-BIO-5		D	1	28	PALAEMONETES PALUDOSUS	470534015003002	1	0	0
STC-BIO-5		D	1	28	CHIRONOMIDAE	470630014	0	1	0
STC-BIO-5		D	1	28	LUMBRICULIDAE	450201001	2	0	0
STC-BIO-5		D	1	28	TANYTARSUS	470630014030	6	0	0
STC-BIO-5	A	H	1	1	ANCYLIDAE	460108011	1	0	0
STC-BIO-5	A	H	1	1	CYRNELLUS FRATERNUS	470628018005001	1	0	0
STC-BIO-5	A	H	1	1	CHIRONOMINI	47063001401	1	0	0
STC-BIO-5	A	H	1	1	TANYTARSUS	470630014030	2	0	0
STC-BIO-5	A	H	1	1	PROCLADIUS	470630014004	1	0	0
STC-BIO-5	A	H	1	1	TRICLADIDA	350109	2	0	0
STC-BIO-5	A	H	1	1	TRIBELOS	470630014117	3	0	0
STC-BIO-5	A	H	1	1	DICROTENDIPES	470630014043	12	0	0
STC-BIO-5	A	H	1	1	GASTROPODA	4601	10	0	0
STC-BIO-5	A	H	1	1	POLYPEDILUM SCALAENUM	470630014036038	3	0	0
STC-BIO-5	A	H	1	1	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
STC-BIO-5	A	H	1	1	DINEUTUS	470623010003	2	0	0
STC-BIO-5	A	H	1	1	ABLABESMYIA	470630014042	18	0	0
STC-BIO-5	A	H	1	1	POLYPEDILUM FALLAX	470630014036003	3	0	0
STC-BIO-5	A	H	1	1	PHAENOPSECTRA	470630014152	3	0	0
STC-BIO-5	B	H	1	1	CHIRONOMINI	47063001401	1	0	0
STC-BIO-5	B	H	1	1	TANYTARSUS	470630014030	5	0	0
STC-BIO-5	B	H	1	1	LABRUNDINIA	470630014103	1	0	0
STC-BIO-5	B	H	1	1	PHAENOPSECTRA	470630014152	3	0	0
STC-BIO-5	B	H	1	1	CHIRONOMUS	470630014032	1	0	0
STC-BIO-5	B	H	1	1	TRIBELOS	470630014117	4	0	0
-BIO-5	B	H	1	1	PROCLADIUS	470630014004	3	0	0
-C-BIO-5	B	H	1	1	ABLABESMYIA	470630014042	30	0	0
STC-BIO-5	B	H	1	1	POLYPEDILUM SCALAENUM	470630014036038	23	0	0
STC-BIO-5	B	H	1	1	TRICLADIDA	350109	4	0	0
STC-BIO-5	B	H	1	1	CORDULIIDAE	470605006	1	0	0
STC-BIO-5	B	H	1	1	COENAGRIONIDAE	470606003	2	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
STC-BIO-5	B	H	1	1	HYDROBIIDAE	460102013	13	0	0
STC-BIO-5	B	H	1	1	CHIRONOMIDAE	470630014	0	5	0
STC-BIO-5	B	H	1	1	ANCYLIDAE	460108011	1	0	0
STC-BIO-5	B	H	1	1	DERO	450203005006	1	0	0
STC-BIO-5	B	H	1	1	DICROTENDIPES	470630014043	10	0	0
STC-BIO-5	B	H	1	1	POLYPEDILUM FALLAX	470630014036003	8	0	0
STC-BIO-5	C	H	1	1	PROCLADIUS	470630014004	2	0	0
STC-BIO-5	C	H	1	1	ABLABESMYIA	470630014042	22	0	0
STC-BIO-5	C	H	1	1	CAENIS	470604011002	1	0	0
STC-BIO-5	C	H	1	1	POLYPEDILUM SCALAENUM	470630014036038	22	0	0
STC-BIO-5	C	H	1	1	DERO DERO	450203005006007	4	0	0
STC-BIO-5	C	H	1	1	POLYCENTROPODIDAE	470628018	1	0	0
STC-BIO-5	C	H	1	1	TRIBELOS	470630014117	6	0	0
STC-BIO-5	C	H	1	1	CHIRONOMIDAE	470630014	0	1	0
STC-BIO-5	C	H	1	1	TRICLADIDA	350109	11	0	0
STC-BIO-5	C	H	1	1	GASTROPODA	4601	57	0	0
STC-BIO-5	C	H	1	1	TANYTARSUS	470630014030	11	0	0
STC-BIO-5	C	H	1	1	COENAGRIONIDAE	470606003	2	0	0
STC-BIO-5	C	H	1	1	PHAENOPSECTRA	470630014152	6	0	0
STC-BIO-5	C	H	1	1	DICROTENDIPES	470630014043	8	0	0
STC-BIO-5	C	H	1	1	POLYPEDILUM FALLAX	470630014036003	1	0	0
STC-BIO-5	C	H	1	1	CLADOTANYTARSUS	470630014041	1	0	0
STC-BIO-5	C	H	1	1	LABRUNDINIA	470630014103	4	0	0
STC-BIO-5	C	H	1	1	CHIRONOMINI	47063001401	2	0	0
STC-BIO-5	C	H	1	1	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
STC-BIO-5	A	P	1	1	AULODRILUS PIGUETI	450203004008001	4	0	0
STC-BIO-5	A	P	1	1	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
STC-BIO-5	A	P	1	1	DERO DERO	450203005006007	1	0	0
STC-BIO-5	A	P	1	1	CLINOTANYPUS	470630014001	1	0	
STC-BIO-5	A	P	1	1	PARALAUTERBORNIELLA	470630014045	2	0	
STC-BIO-5	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	21	0	0
STC-BIO-5	A	P	1	1	ABLABESMYIA	470630014042	2	0	0
STC-BIO-5	A	P	1	1	CHIRONOMUS	470630014032	3	0	0
STC-BIO-5	A	P	1	1	PROCLADIUS	470630014004	15	0	0
STC-BIO-5	A	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	7	0	0
STC-BIO-5	A	P	1	1	TRIBELOS	470630014117	9	0	0
STC-BIO-5	A	P	1	1	HYDROBIIDAE	460102013	8	0	0
STC-BIO-5	A	P	1	1	SPHAERIIDAE	460507046 A	54	0	0
STC-BIO-5	A	P	1	1	TUBIFICIDAE IMM. W	450203004 A	4	0	0
STC-BIO-5	A	P	1	1	CHIRONOMINI	47063001401	1	0	0
STC-BIO-5	A	P	1	1	TANYTARSUS	470630014030	6	0	0
STC-BIO-5	A	P	1	1	DICROTENDIPES	470630014043	3	0	0
STC-BIO-5	A	P	1	1	DERO AULOPHORUS	450203005006 A	1	0	0
STC-BIO-5	B	P	1	1	CORDULIIDAE	470605006	1	0	0
STC-BIO-5	B	P	1	1	COENAGRIONIDAE	470606003	1	0	0
STC-BIO-5	B	P	1	1	HYDROBIIDAE	460102013	1	0	0
STC-BIO-5	B	P	1	1	COLLEMBOLA	470602	1	0	0
STC-BIO-5	B	P	1	1	SPHAERIIDAE	460507046 A	36	0	0
STC-BIO-5	B	P	1	1	TRIBELOS	470630014117	6	0	0
STC-BIO-5	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	10	0	0
STC-BIO-5	B	P	1	1	TUBIFICIDAE IMM. W	450203004 A	19	0	0
STC-BIO-5	B	P	1	1	DERO	450203005006	1	0	0
STC-BIO-5	B	P	1	1	CHIRONOMUS	470630014032	1	0	0
STC-BIO-5	B	P	1	1	AULODRILUS PIGUETI	450203004008001	1	0	0
STC-BIO-5	B	P	1	1	DICROTENDIPES	470630014043	3	0	0
STC-BIO-5	B	P	1	1	ABLABESMYIA	470630014042	1	0	
STC-BIO-5	B	P	1	1	PRISTINA AEQUISETA	450203005005003	1	0	
STC-BIO-5	B	P	1	1	CHIRONOMIDAE	470630014	1	0	0
STC-BIO-5	B	P	1	1	PARALAUTERBORNIELLA	470630014045	2	0	0
STC-BIO-5	B	P	1	1	PROCLADIUS	470630014004	11	0	0
STC-BIO-5	B	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	11	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
IO-5	B	P	1	1	DUBIRAPHIA	470623050002	1	0	0
S.. BIO-5	C	P	1	1	ACARINA	47021100	1	0	0
STC-BIO-5	C	P	1	1	TANYTARSUS	470630014030	3	0	0
STC-BIO-5	C	P	1	1	PLACOBDELLA PAPILLIFERA	450205002002001	1	0	0
STC-BIO-5	C	P	1	1	ABLABESMYIA	470630014042	1	0	0
STC-BIO-5	C	P	1	1	DERO DERO	450203005006007	2	0	0
STC-BIO-5	C	P	1	1	AULODRILUS PIGUETI	450203004008001	2	0	0
STC-BIO-5	C	P	1	1	NAIS	450203005008	1	0	0
STC-BIO-5	C	P	1	1	TRIBELOS	470630014117	10	0	0
STC-BIO-5	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	27	0	0
STC-BIO-5	C	P	1	1	TUBIFICIDAE IMM. W	450203004 A	22	0	0
STC-BIO-5	C	P	1	1	TANYPODINAE	470630014 C	1	0	0
STC-BIO-5	C	P	1	1	CHIRONOMIDAE	470630014	0	1	0
STC-BIO-5	C	P	1	1	HYDROBIIDAE	460102013	6	0	0
STC-BIO-5	C	P	1	1	PLANORBIDAE	460108012	1	0	0
STC-BIO-5	C	P	1	1	TANYPUS	470630014033	1	0	0
STC-BIO-5	C	P	1	1	SPHAERIIDAE	460507046 A	61	0	0
STC-BIO-5	C	P	1	1	DICROTENDIPES	470630014043	2	0	0
STC-BIO-5	C	P	1	1	CLADOPELMA	470630014159	1	0	0
STC-BIO-5	C	P	1	1	PROCLADIUS	470630014004	7	0	0
STC-BIO-5	C	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	7	0	0
STC-BIO-6		D	3	28	ELMIDAE	470623050	0	0	3
STC-BIO-6		D	3	28	DERO DERO	450203005006007	1	0	0
STC-BIO-6		D	3	28	LUMBRICULIDAE	450201001	2	0	0
STC-BIO-6		D	3	28	STENOCHIRONOMUS	470630014029	2	0	0
STC-BIO-6		D	3	28	TANYTARSUS	470630014030	16	0	0
STC-BIO-6		D	3	28	POLYPEDILUM SCALAENUM	470630014036038	1	0	0
BIO-6		D	3	28	POLYPEDILUM ILLINOENSE	470630014036031	2	0	0
BIO-6		D	3	28	PALAEMONETES PALUDOSUS	470534015003002	20	0	0
STC-BIO-6		D	3	28	TRICHOPTERA	470628	1	0	0
STC-BIO-6		D	3	28	GASTROPODA	4601	1	0	0
STC-BIO-6		D	3	28	ABLABESMYIA	470630014042	3	0	0
STC-BIO-6		D	3	28	LABRUNDINIA	470630014103	1	0	0
STC-BIO-6		D	3	28	STENELMIS	470623050001	0	0	2
STC-BIO-6		D	3	28	CENTROPTILUM	470604002007	1	0	0
STC-BIO-6		D	3	28	CHIRONOMIDAE	470630014	0	9	0
STC-BIO-6		D	3	28	OXYETHIRA	470628005005	7	0	0
STC-BIO-6		D	3	28	PELECYPODA	4605 A	3	0	0
STC-BIO-6		D	3	28	GOMPHIDAE	470605003	4	0	0
STC-BIO-6		D	3	28	PLANORBIDAE	460108012	1	0	0
STC-BIO-6		D	3	28	COENAGRIONIDAE	470606003	6	0	0
STC-BIO-6		D	3	28	HYDROBIIDAE	460102013	11	0	0
STC-BIO-6		D	3	28	ELMIDAE	470623050	7	0	0
STC-BIO-6		D	3	28	ASTACIDAE	470534093	2	0	0
STC-BIO-6		D	3	28	BAETIS	470604002006	1	0	0
STC-BIO-6		D	3	28	LEPTOCERIDAE	470628012	10	0	0
STC-BIO-6		D	3	28	ARGIA	470606003009	2	0	0
STC-BIO-6		D	3	28	DUBIRAPHIA	470623050002	0	0	1
STC-BIO-6		D	3	28	ANCYRONYX VARIEGATA	470623050009001	1	0	0
STC-BIO-6		D	3	28	PROCLADIUS	470630014004	1	0	0
STC-BIO-6		D	3	28	CAENIS	470604011002	2	0	0
STC-BIO-6		D	3	28	ANCYLIDAE	460108011	1	0	0
STC-BIO-6		D	3	28	NEMERTEA	38	1	0	0
STC-BIO-6		D	3	28	DICROTENDIPES	470630014043	4	0	0
STC-BIO-7		D	3	28	TANYTARSUS	470630014030	9	0	0
-BIO-7		D	3	28	DICROTENDIPES	470630014043	5	0	0
STC-BIO-7		D	3	28	BAETIS	470604002006	1	0	0
STC-BIO-7		D	3	28	POLYPEDILUM ILLINOENSE	470630014036031	12	0	0
STC-BIO-7		D	3	28	HEMERODROMIA	470630041004	2	0	0
STC-BIO-7		D	3	28	DERO DERO	450203005006007	1	0	0
STC-BIO-7		D	3	28	CHIRONOMIDAE	470630014	1	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
STC-BIO-7		D	3	28	LUMBRICULIDAE	450201001	1	0	0
STC-BIO-7		D	3	28	ANCYRONYX VARIEGATA	470623050009001	1	0	0
STC-BIO-7		D	3	28	ASTACIDAE	470534093	1	0	0
STC-BIO-7		D	3	28	PELECYPODA	4605 A	3	0	0
STC-BIO-7		D	3	28	TUBIFICIDAE IMM. W/O	450203004 B	1	0	0
STC-BIO-7		D	3	28	PALAEMONETES PALUDOSUS	470534015003002	3	0	0
STC-BIO-7		D	3	28	GASTROPODA	4601	3	0	0
STC-BIO-7		D	3	28	ELMIDAE	470623050	0	0	2
STC-BIO-7		D	3	28	ELMIDAE	470623050	4	0	0
STC-BIO-7		D	3	28	COENAGRIONIDAE	470606003	4	0	0
STC-BIO-7		D	3	28	CALOPTERYX	470606001004	2	0	0
STC-BIO-7		D	3	28	GOMPHIDAE	470605003	1	0	0
STC-BIO-7		D	3	28	POLYPEDILUM SCALAENUM	470630014036038	2	0	0
STC-BIO-7		D	3	28	OXYETHIRA	470628005005	3	0	0
STC-BIO-7		D	3	28	CHEUMATOPSYCHE	470628004002	3	0	0
STC-BIO-7		D	3	28	OECETIS	470628012004	8	0	0
STC-BIO-7		D	3	28	LEPTOCERIDAE	470628012	4	0	0
STC-BIO-7		D	3	28	TRICLADIDA	350109	1	0	0
STC-BIO-7		D	3	28	STENONEMA	470604001004	1	0	0
STC-BIO-7		D	3	28	DINEUTUS	470623010003	1	0	0
STC-BIO-7		D	3	28	HYDROPHILIDAE	470623016	1	0	0
STC-BIO-7		D	3	28	HYDROPTILIDAE	470628005	1	0	0
STC-BIO-7		D	3	28	TANYPODINAE	470630014 C	1	0	0
STC-BIO-7		D	3	28	TRIBELOS	470630014117	1	0	0
STC-BIO-7		D	3	28	STENOCHIRONOMUS	470630014029	6	0	0
STC-BIO-7		D	3	28	TRICHOPTERA	470628	1	0	0
STC-BIO-7		D	3	28	ABLABESMYIA	470630014042	2	0	0
STC-BIO-7		D	3	28	CHIRONOMIDAE	470630014	0	4	0
STC-BIO-R1		D	1	1	PHAENOPSECTRA	470630014152	1	0	
STC-BIO-R1		D	1	1	STENELMIS	470623050001	0	0	[illegible]
STC-BIO-R1		D	1	1	CHIRONOMUS	470630014032	1	0	0
STC-BIO-R1		D	1	1	LYMNAEIDAE	460108010	2	0	0
STC-BIO-R1		D	1	1	ANCYLIDAE	460108011	4	0	0
STC-BIO-R1		D	1	1	POLYPEDILUM ILLINOENSE	470630014036031	2	0	0
STC-BIO-R1		D	1	1	COENAGRIONIDAE	470606003	3	0	0
STC-BIO-R1		D	1	1	PLANORBIDAE	460108012	1	0	0
STC-BIO-R1		D	1	1	CHIRONOMIDAE	470630014	0	1	0
STC-BIO-R1		D	1	1	TIPULIDAE	470630001	1	0	0
STC-BIO-R1		D	1	1	ASTACIDAE	470534093	1	0	0
STC-BIO-R1		D	1	1	ASELLUS	470531015001	3	0	0
STC-BIO-R1		D	1	1	AULODRILUS PIGUETI	450203004008001	4	0	0
STC-BIO-R1		D	1	1	CORDULIIDAE	470605006	17	0	0
STC-BIO-R1	A	P	1	1	DUBIRAPHIA	470623050002	1	0	0
STC-BIO-R1	A	P	1	1	LUMBRICULIDAE	450201001	8	0	0
STC-BIO-R1	A	P	1	1	AULODRILUS PIGUETI	450203004008001	5	0	0
STC-BIO-R1	A	P	1	1	BOTHRIONEURUM VEJDOVSKYANUM	450203004028001	2	0	0
STC-BIO-R1	A	P	1	1	TUBIFICIDAE IMM. W	450203004 A	11	0	0
STC-BIO-R1	A	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
STC-BIO-R1	A	P	1	1	CHIRONOMIDAE	470630014	0	1	0
STC-BIO-R1	A	P	1	1	DERO DERO	450203005006007	2	0	0
STC-BIO-R1	A	P	1	1	DICROTENDIPES	470630014043	1	0	0
STC-BIO-R1	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	25	0	0
STC-BIO-R1	A	P	1	1	PLANORBIDAE	460108012	3	0	0
STC-BIO-R1	A	P	1	1	ANCYLIDAE	460108011	5	0	0
STC-BIO-R1	A	P	1	1	CORDULIIDAE	470605006	2	0	0
STC-BIO-R1	A	P	1	1	COLLEMBOLA	470602	1	0	
STC-BIO-R1	A	P	1	1	ASELLUS	470531015001	1	0	
STC-BIO-R1	A	P	1	1	NATARSIA	470630014098	3	0	0
STC-BIO-R1	A	P	1	1	LABRUNDINIA	470630014103	1	0	0
STC-BIO-R1	A	P	1	1	NILOTANYPUS	470630014108	1	0	0
STC-BIO-R1	A	P	1	1	PHAENOPSECTRA	470630014152	1	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
BIO-R1	A	P	1	1	SPHAERIIDAE	460507046 A	13	0	0
-BIO-R1	B	P	1	1	OXYETHIRA	470628005005	1	0	0
STC-BIO-R1	B	P	1	1	ILYODRILUS TEMPLETONI	450203004006002	1	0	0
STC-BIO-R1	B	P	1	1	DUBIRAPHIA	470623050002	1	0	0
STC-BIO-R1	B	P	1	1	TUBIFICIDAE IMM. W	450203004 A	4	0	0
STC-BIO-R1	B	P	1	1	AULODRILUS PIGUETI	450203004008001	5	0	0
STC-BIO-R1	B	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
STC-BIO-R1	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	22	0	0
STC-BIO-R1	B	P	1	1	DICROTENDIPES	470630014043	1	0	0
STC-BIO-R1	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	25	0	0
STC-BIO-R1	C	P	1	1	NEMATODA	4301	1	0	0
STC-BIO-R1	C	P	1	1	COENAGRIONIDAE	470606003	1	0	0
STC-BIO-R1	C	P	1	1	AULODRILUS PIGUETI	450203004008001	1	0	0
STC-BIO-R1	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
STC-BIO-R1	C	P	1	1	TUBIFICIDAE IMM. W	450203004 A	4	0	0
STC-BIO-R1	C	P	1	1	LUMBRICULIDAE	450201001	26	0	0
YWC-BIO-1		D	3	28	ANCYRONYX VARIEGATA	470623050009001	0	0	2
YWC-BIO-1		D	3	28	DUBIRAPHIA	470623050002	1	0	0
YWC-BIO-1		D	3	28	ANCYRONYX VARIEGATA	470623050009001	1	0	0
YWC-BIO-1		D	3	28	STENELMIS	470623050001	3	0	0
YWC-BIO-1		D	3	28	STENELMIS	470623050001	0	0	3
YWC-BIO-1		D	3	28	ELMIDAE	470623050	9	0	0
YWC-BIO-1		D	3	28	CAENIS	470604011002	5	0	0
YWC-BIO-1		D	3	28	STENACRON	470604001017	2	0	0
YWC-BIO-1		D	3	28	PELECYPODA	4605 A	4	0	0
YWC-BIO-1		D	3	28	CERATOPOGONIDAE	470630010	1	0	0
YWC-BIO-1		D	3	28	PSYCHODIDAE	470630003	1	0	0
YWC-BIO-1		D	3	28	HYDROBIIDAE	460102013	9	0	0
-BIO-1		D	3	28	ANCYLIDAE	460108011	1	0	0
YWC-BIO-1		D	3	28	ASELLUS	470531015001	23	0	0
YWC-BIO-1		D	3	28	TRICLADIDA	350109	1	0	0
YWC-BIO-1		D	3	28	GLOSSIPHONIIDAE	450205002	1	0	0
YWC-BIO-1		D	3	28	CRANGONYX	470532057001	1	0	0
YWC-BIO-1		D	3	28	BELOSTOMATIDAE	470621005	1	0	0
YWC-BIO-1		D	3	28	TRIBELOS	470630014117	10	0	0
YWC-BIO-1		D	3	28	DICROTENDIPES	470630014043	5	0	0
YWC-BIO-1		D	3	28	STENOCHIRONOMUS	470630014029	1	0	0
YWC-BIO-1		D	3	28	POLYPEDILUM SCALAENUM	470630014036038	3	0	0
YWC-BIO-1		D	3	28	CHIRONOMINI	47063001401	2	0	0
YWC-BIO-1		D	3	28	ABLABESMYIA	470630014042	1	0	0
YWC-BIO-1		D	3	28	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
YWC-BIO-1		D	3	28	DERO DERO	450203005006007	3	0	0
YWC-BIO-1		D	3	28	DERO AULOPHORUS	450203005006 A	1	0	0
YWC-BIO-1	A	H	102	186	PHAENOPSECTRA	470630014152	1	0	0
YWC-BIO-1	A	H	1	1	DERO DERO	450203005006007	51	0	0
YWC-BIO-1	A	H	102	186	CRICOTOPUS BICINCTUS	470630014025004	1	0	0
YWC-BIO-1	A	H	102	186	POLYPEDILUM FALLAX	470630014036003	2	0	0
YWC-BIO-1	A	H	102	186	CHIRONOMUS	470630014032	1	0	0
YWC-BIO-1	A	H	1	1	HEMERODROMIA	470630041004	6	0	0
YWC-BIO-1	A	H	1	1	HYDROBIIDAE	460102013	10	0	0
YWC-BIO-1	A	H	102	186	CHIRONOMINI	47063001401	1	0	0
YWC-BIO-1	A	H	102	186	ABLABESMYIA	470630014042	2	0	0
YWC-BIO-1	A	H	102	186	PENTANEURA	470630014054	1	0	0
YWC-BIO-1	A	H	102	186	TRIBELOS	470630014117	3	0	0
YWC-BIO-1	A	H	1	1	STENACRON	470604001017	7	0	0
C-BIO-1	A	H	102	186	POLYPEDILUM ILLINOENSE	470630014036031	2	0	0
WC-BIO-1	A	H	1	1	CHIRONOMIDAE	470630014	0	8	0
YWC-BIO-1	A	H	102	186	PARATANYTARSUS	470630014091	1	0	0
YWC-BIO-1	A	H	1	1	ANCYLIDAE	460108011	1	0	0
YWC-BIO-1	A	H	102	186	DICROTENDIPES	470630014043	81	0	0
YWC-BIO-1	A	H	1	1	GLOSSIPHONIIDAE	450205002	1	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
YWC-BIO-1	A	H	102	186	CRYPTOCHIRONOMUS	470630014035	1	0	0
YWC-BIO-1	A	H	102	186	TANYTARSUS	470630014030	5	0	
YWC-BIO-1	A	H	1	1	ANCYRONYX VARIEGATA	470623050009001	2	0	0
YWC-BIO-1	A	H	1	1	CAENIS	470604011002	5	0	0
YWC-BIO-1	A	H	1	1	COENAGRIONIDAE	470606003	3	0	0
YWC-BIO-1	B	H	1	1	DERO DERO	450203005006007	7	0	0
YWC-BIO-1	B	H	1	1	TUBIFICIDAE IMM. W/O	450203004 B	1	0	0
YWC-BIO-1	B	H	101	152	CHIRONOMUS	470630014032	1	0	0
YWC-BIO-1	B	H	101	152	TRIBELOS	470630014117	2	0	0
YWC-BIO-1	B	H	1	1	ANCYRONYX VARIEGATA	470623050009001	0	0	1
YWC-BIO-1	B	H	101	152	TANYTARSUS	470630014030	1	0	0
YWC-BIO-1	B	H	1	1	STENACRON	470604001017	7	0	0
YWC-BIO-1	B	H	101	152	DICROTENDIPES	470630014043	90	0	0
YWC-BIO-1	B	H	1	1	CAENIS	470604011002	5	0	0
YWC-BIO-1	B	H	1	1	HYDROBIIDAE	460102013	2	0	0
YWC-BIO-1	B	H	1	1	DINEUTUS	470623010003	1	0	0
YWC-BIO-1	B	H	101	152	ABLABESMYIA	470630014042	3	0	0
YWC-BIO-1	B	H	1	1	GAMMARIDAE	470532021	1	0	0
YWC-BIO-1	B	H	1	1	GLOSSIPHONIIDAE	450205002	1	0	0
YWC-BIO-1	B	H	1	1	COENAGRIONIDAE	470606003	4	0	0
YWC-BIO-1	B	H	1	1	AESHNIDAE	470605001	1	0	0
YWC-BIO-1	B	H	1	1	TRICLADIDA	350109	4	0	0
YWC-BIO-1	B	H	1	1	HEMERODROMIA	470630041004	2	0	0
YWC-BIO-1	B	H	1	1	CHIRONOMIDAE	470630014	0	5	0
YWC-BIO-1	B	H	101	152	POLYPEDILUM SCALAENUM	470630014036038	1	0	0
YWC-BIO-1	B	H	101	152	POLYPEDILUM FALLAX	470630014036003	3	0	0
YWC-BIO-1	C	H	1	1	PLANORBIDAE	460108012	1	0	0
YWC-BIO-1	C	H	1	1	CHIRONOMIDAE	470630014	0	6	0
YWC-BIO-1	C	H	1	1	ANCYRONYX VARIEGATA	470623050009001	0	0	
YWC-BIO-1	C	H	1	1	STENACRON	470604001017	6	0	
YWC-BIO-1	C	H	102	195	PHAENOPSECTRA	470630014152	2	0	0
YWC-BIO-1	C	H	1	1	CAENIS	470604011002	5	0	0
YWC-BIO-1	C	H	102	195	TANYTARSUS	470630014030	5	0	0
YWC-BIO-1	C	H	1	1	COENAGRIONIDAE	470606003	1	0	0
YWC-BIO-1	C	H	102	195	POLYPEDILUM SCALAENUM	470630014036038	3	0	0
YWC-BIO-1	C	H	1	1	TRICLADIDA	350109	2	0	0
YWC-BIO-1	C	H	102	195	DICROTENDIPES	470630014043	79	0	0
YWC-BIO-1	C	H	102	195	TRIBELOS	470630014117	2	0	0
YWC-BIO-1	C	H	1	1	DINEUTUS	470623010003	1	0	0
YWC-BIO-1	C	H	102	195	CHIRONOMINI	470630014001	1	0	0
YWC-BIO-1	C	H	102	195	ABLABESMYIA	470630014042	5	0	0
YWC-BIO-1	C	H	102	195	POLYPEDILUM FALLAX	470630014036003	1	0	0
YWC-BIO-1	C	H	102	195	POLYPEDILUM ILLINOENSE	470630014036031	2	0	0
YWC-BIO-1	C	H	102	195	ENDOCHIRONOMUS	470630014086	1	0	0
YWC-BIO-1	C	H	102	195	PARALAUTERBORNIELLA	470630014045	1	0	0
YWC-BIO-1	C	H	1	1	SLAVINA APPENDICULATA	450203005001001	1	0	0
YWC-BIO-1	C	H	1	1	DERO AULOPHORUS	450203005006 A	1	0	0
YWC-BIO-1	C	H	1	1	DERO DERO	450203005006007	7	0	0
YWC-BIO-1	C	H	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
YWC-BIO-1	C	H	1	1	HEMERODROMIA	470630041004	4	0	0
YWC-BIO-1	C	H	1	1	HYDROBIIDAE	460102013	10	0	0
YWC-BIO-1	A	P	1	1	CHIRONOMIDAE	470630014	0	2	0
YWC-BIO-1	A	P	1	1	CERATOPOGONIDAE	470630010	6	0	0
YWC-BIO-1	A	P	1	1	HYDROBIIDAE	460102013	2	0	0
YWC-BIO-1	A	P	1	1	PELECYPODA	4605 A	17	0	0
YWC-BIO-1	A	P	1	1	CAENIS	470604011002	1	0	0
YWC-BIO-1	A	P	1	1	ASELLUS	470531015001	10	0	
YWC-BIO-1	A	P	1	1	PHYLOCENTROPUS	470628018006	1	0	0
YWC-BIO-1	A	P	1	1	DROMOGOMPHUS	470605003005	1	0	0
YWC-BIO-1	A	P	1	1	UNIONIDAE	460504002	3	0	0
YWC-BIO-1	A	P	1	1	LUMBRICULIDAE	450201001	5	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
BIO-1	A	P	1	1	NAIDIDAE	450203005	1	0	0
BIO-1	A	P	1	1	MICROTENDIPES	470630014027	1	0	0
YWC-BIO-1	A	P	1	1	THIENEMANNIMYIA	470630014119	1	0	0
YWC-BIO-1	A	P	1	1	DICROTENDIPES	470630014043	1	0	0
YWC-BIO-1	A	P	1	1	STENELMIS	470623050001	10	0	0
YWC-BIO-1	A	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
YWC-BIO-1	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	33	0	0
YWC-BIO-1	A	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	16	0	0
YWC-BIO-1	A	P	1	1	CRYPTOCHIRONOMUS	470630014035	1	0	0
YWC-BIO-1	A	P	1	1	TUBIFICIDAE IMM. W	450203004 A	2	0	0
YWC-BIO-1	A	P	1	1	TRIBELOS	470630014117	2	0	0
YWC-BIO-1	A	P	1	1	PARACLADOPELMA	470630014151	1	0	0
YWC-BIO-1	A	P	1	1	CHIRONOMINI	47063001401	1	0	0
YWC-BIO-1	A	P	1	1	TANYTARSUS	470630014030	1	0	0
YWC-BIO-1	B	P	1	1	CHIRONOMIDAE	470630014	0	1	0
YWC-BIO-1	B	P	1	1	STENELMIS	470623050001	0	0	1
YWC-BIO-1	B	P	1	1	CRYPTOCHIRONOMUS	470630014035	2	0	0
YWC-BIO-1	B	P	1	1	UNIONIDAE	460504002	1	0	0
YWC-BIO-1	B	P	1	1	CERATOPOGONIDAE	470630010	3	0	0
YWC-BIO-1	B	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	6	0	0
YWC-BIO-1	B	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
YWC-BIO-1	B	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
YWC-BIO-1	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	2	0	0
YWC-BIO-1	B	P	1	1	PHYLOCENTROPUS	470628018006	1	0	0
YWC-BIO-1	B	P	1	1	LUMBRICULIDAE	450201001	1	0	0
YWC-BIO-1	B	P	1	1	PELECYPODA	4605 A	4	0	0
YWC-BIO-1	C	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
YWC-BIO-1	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	10	0	0
-BIO-1	C	P	1	1	TANYPODINAE	470630014 C	2	0	0
-BIO-1	C	P	1	1	CHIRONOMUS	470630014032	1	0	0
YWC-BIO-1	C	P	1	1	TRIBELOS	470630014117	3	0	0
YWC-BIO-1	C	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	6	0	0
YWC-BIO-1	C	P	1	1	LUMBRICULIDAE	450201001	7	0	0
YWC-BIO-1	C	P	1	1	UNIONIDAE	460504002	1	0	0
YWC-BIO-1	C	P	1	1	PELECYPODA	4605 A	51	0	0
YWC-BIO-1	C	P	1	1	PLANORBIDAE	460108012	2	0	0
YWC-BIO-1	C	P	1	1	CERATOPOGONIDAE	470630010	1	0	0
YWC-BIO-1	C	P	1	1	HEXATOMA	470630001038	1	0	0
YWC-BIO-1	C	P	1	1	HEMERODROMIA	470630041004	1	0	0
YWC-BIO-2		D	3	28	HYDROPHILIDAE	470623016	0	0	2
YWC-BIO-2		D	3	28	ELMIDAE	470623050	5	0	0
YWC-BIO-2		D	3	28	DUBIRAPHIA	470623050002	0	0	1
YWC-BIO-2		D	3	28	CAENIS	470604011002	1	0	0
YWC-BIO-2		D	3	28	BELOSTOMATIDAE	470621005	1	0	0
YWC-BIO-2		D	3	28	STENELMIS	470623050001	0	0	2
YWC-BIO-2		D	3	28	ANCYRONYX VARIEGATA	470623050009001	2	0	0
YWC-BIO-2		D	3	28	OECETIS	470628012004	6	0	0
YWC-BIO-2		D	3	28	CHIRONOMIDAE	470630014	0	3	0
YWC-BIO-2		D	3	28	STENACRON	470604001017	4	0	0
YWC-BIO-2		D	3	28	COENAGRIONIDAE	470606003	16	0	0
YWC-BIO-2		D	3	28	CALOPTERYX	470606001004	1	0	0
YWC-BIO-2		D	3	28	LIBELLULIDAE	470605004	2	0	0
YWC-BIO-2		D	3	28	GOMPHIDAE	470605003	1	0	0
YWC-BIO-2		D	3	28	BOYERIA	470605001007	4	0	0
YWC-BIO-2		D	3	28	ANCYLIDAE	460108011	6	0	0
-BIO-2		D	3	28	PELECYPODA	4605 A	1	0	0
-BIO-2		D	3	28	PALAEMONETES PALUDOSUS	470534015003002	7	0	0
YWC-BIO-2		D	3	28	PLANORBIDAE	460108012	2	0	0
YWC-BIO-2		D	3	28	PHYSELLA	460108013003	6	0	0
YWC-BIO-2		D	3	28	HYDROBIIDAE	460102013	4	0	0
YWC-BIO-2		D	3	28	ASELLUS	470531015001	5	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
YWC-BIO-2		D	3	28	TRICLADIDA	350109	1	0	0
YWC-BIO-2		D	3	28	ACARINA	47021100	2	0	
YWC-BIO-2		D	3	28	DEROVATELLUS	470623008014	1	0	0
YWC-BIO-2		D	3	28	POLYPEDILUM ILLINOENSE	470630014036031	1	0	0
YWC-BIO-2		D	3	28	DICROTENDIPES	470630014043	1	0	0
YWC-BIO-2		D	3	28	TANYTARSUS	470630014030	8	0	0
YWC-BIO-2		D	3	28	STENOCHIRONOMUS	470630014029	2	0	0
YWC-BIO-2		D	3	28	STELECHOMYIA	470630014165	1	0	0
YWC-BIO-2		D	3	28	CHIRONOMINI	47063001401	1	0	0
YWC-BIO-2		D	3	28	PHAENOPSECTRA	470630014152	1	0	0
YWC-BIO-2		D	3	28	POLYPEDILUM SCALAENUM	470630014036038	3	0	0
YWC-BIO-2		D	3	28	ABLABESMYIA	470630014042	1	0	0
YWC-BIO-2		D	3	28	ELMIDAE	470623050	5	0	0
YWC-BIO-2		D	3	28	STENELMIS	470623050001	5	0	0
YWC-BIO-2		D	3	28	POLYCENTROPUS	470628018002	1	0	0
YWC-BIO-2	A	H	103	162	POLYPEDILUM FALLAX	470630014036003	1	0	0
YWC-BIO-2	A	H	103	162	ABLABESMYIA	470630014042	3	0	0
YWC-BIO-2	A	H	1	1	ARGIA	470606003009	1	0	0
YWC-BIO-2	A	H	103	162	PHAENOPSECTRA	470630014152	1	0	0
YWC-BIO-2	A	H	1	1	STENACRON	470604001017	2	0	0
YWC-BIO-2	A	H	103	162	POLYPEDILUM SCALAENUM	470630014036038	2	0	0
YWC-BIO-2	A	H	103	162	DICROTENDIPES	470630014043	77	0	0
YWC-BIO-2	A	H	103	162	TRIBELOS	470630014117	6	0	0
YWC-BIO-2	A	H	103	162	POLYPEDILUM ILLINOENSE	470630014036031	3	0	0
YWC-BIO-2	A	H	1	1	CAENIS	470604011002	2	0	0
YWC-BIO-2	A	H	1	1	TRICLADIDA	350109	1	0	0
YWC-BIO-2	A	H	103	162	TANYTARSUS	470630014030	6	0	0
YWC-BIO-2	A	H	1	1	CHIRONOMIDAE	470630014	0	2	0
YWC-BIO-2	A	H	103	162	CHIRONOMINI	47063001401	2	0	
YWC-BIO-2	A	H	103	162	LABRUNDINIA	470630014103	2	0	
YWC-BIO-2	A	H	1	1	DERO DERO	450203005006007	2	0	0
YWC-BIO-2	A	H	1	1	DERO AULOPHORUS	450203005006 A	1	0	0
YWC-BIO-2	A	H	1	1	NAIDIDAE	450203005	1	0	0
YWC-BIO-2	B	H	102	180	DICROTENDIPES	470630014043	49	0	0
YWC-BIO-2	B	H	1	1	PLANORBIDAE	460108012	1	0	0
YWC-BIO-2	B	H	102	180	TANYTARSUS	470630014030	25	0	0
YWC-BIO-2	B	H	1	1	STENELMIS	470623050001	0	0	1
YWC-BIO-2	B	H	102	180	TRIBELOS	470630014117	9	0	0
YWC-BIO-2	B	H	1	1	NAIDIDAE	450203005	1	0	0
YWC-BIO-2	B	H	1	1	PARALEPTOPHLEBIA	470604002009	2	0	0
YWC-BIO-2	B	H	1	1	DERO DERO	450203005006007	6	0	0
YWC-BIO-2	B	H	1	1	STENACRON	470604001017	6	0	0
YWC-BIO-2	B	H	102	180	CHIRONOMINI	47063001401	2	0	0
YWC-BIO-2	B	H	1	1	LIBELLULIDAE	470605004	4	0	0
YWC-BIO-2	B	H	102	180	ABLABESMYIA	470630014042	9	0	0
YWC-BIO-2	B	H	1	1	COENAGRIONIDAE	470606003	1	0	0
YWC-BIO-2	B	H	1	1	CHIRONOMIDAE	470630014	0	4	0
YWC-BIO-2	B	H	102	180	LABRUNDINIA	470630014103	2	0	0
YWC-BIO-2	B	H	102	180	POLYPEDILUM FALLAX	470630014036003	6	0	0
YWC-BIO-2	B	H	1	1	DERO AULOPHORUS	450203005006 A	1	0	0
YWC-BIO-2	B	H	1	1	ARGIA	470606003009	1	0	0
YWC-BIO-2	B	H	1	1	TRICLADIDA	350109	8	0	0
YWC-BIO-2	B	H	1	1	CERATOPOGONIDAE	470630010	1	0	0
YWC-BIO-2	C	H	1	1	DERO DERO	450203005006007	1	0	0
YWC-BIO-2	C	H	1	1	ANCYLIDAE	460108011	1	0	0
YWC-BIO-2	C	H	1	1	CHIRONOMIDAE	470630014	0	2	0
YWC-BIO-2	C	H	1	1	PARALEPTOPHLEBIA	470604002009	2	0	
YWC-BIO-2	C	H	1	1	ABLABESMYIA	470630014042	5	0	0
YWC-BIO-2	C	H	1	1	LABRUNDINIA	470630014103	1	0	0
YWC-BIO-2	C	H	1	1	STENACRON	470604001017	8	0	0
YWC-BIO-2	C	H	1	1	POLYPEDILUM FALLAX	470630014036003	5	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
-BIO-2	C	H	1	1	ARGIA	470606003009	1	0	0
-BIO-2	C	H	1	1	CHIRONOMUS	470630014032	1	0	0
YWC-BIO-2	C	H	1	1	TANYTARSUS	470630014030	17	0	0
YWC-BIO-2	C	H	1	1	PHAENOPSECTRA	470630014152	3	0	0
YWC-BIO-2	C	H	1	1	DICROTENDIPES	470630014043	45	0	0
YWC-BIO-2	C	H	1	1	TRICLADIDA	350109	1	0	0
YWC-BIO-2	C	H	1	1	LIBELLULIDAE	470605004	1	0	0
YWC-BIO-2	C	H	1	1	TRIBELOS	470630014117	18	0	0
YWC-BIO-2	C	H	1	1	CAENIS	470604011002	1	0	0
YWC-BIO-2	C	H	1	1	PROCLADIUS	470630014004	1	0	0
YWC-BIO-2	C	H	1	1	PARACHIRONOMUS	470630014052	1	0	0
YWC-BIO-2	C	H	1	1	POLYPEDILUM SCALAENUM	470630014036038	1	0	0
YWC-BIO-2	C	H	1	1	CHIRONOMINI	47063001401	8	0	0
YWC-BIO-2	C	H	1	1	CHIRONOMIDAE	470630014	1	0	0
YWC-BIO-2	A	P	1	1	ARGIA	470606003009	2	0	0
YWC-BIO-2	A	P	1	1	DICROTENDIPES	470630014043	2	0	0
YWC-BIO-2	A	P	1	1	PHYLOCENTROPUS	470628018006	1	0	0
YWC-BIO-2	A	P	1	1	LUMBRICULIDAE	450201001	2	0	0
YWC-BIO-2	A	P	1	1	NEMATODA	4301	1	0	0
YWC-BIO-2	A	P	1	1	TRIBELOS	470630014117	4	0	0
YWC-BIO-2	A	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	4	0	0
YWC-BIO-2	A	P	1	1	NEMERTEA	38	1	0	0
YWC-BIO-2	A	P	1	1	PLEUROCERIDAE	460102040	1	0	0
YWC-BIO-2	A	P	1	1	UNIONIDAE	460504002	8	0	0
YWC-BIO-2	A	P	1	1	TRICLADIDA	350109	1	0	0
YWC-BIO-2	A	P	1	1	CAENIS	470604011002	1	0	0
YWC-BIO-2	A	P	1	1	PLANORBIDAE	460108012	3	0	0
YWC-BIO-2	A	P	1	1	THIENEMANNIMYIA	470630014119	1	0	0
-BIO-2	A	P	1	1	PELECYPODA	4605 A	22	0	0
YWC-BIO-2	A	P	1	1	DROMOGOMPHUS	470605003005	1	0	0
YWC-BIO-2	A	P	1	1	HYDROBIIDAE	460102013	6	0	0
YWC-BIO-2	A	P	1	1	CHIRONOMINI	47063001401	3	0	0
YWC-BIO-2	A	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	12	0	0
YWC-BIO-2	A	P	1	1	PARALAUTERBORNIELLA	470630014045	3	0	0
YWC-BIO-2	A	P	1	1	TANYTARSUS	470630014030	4	0	0
YWC-BIO-2	A	P	1	1	CHIRONOMIDAE	470630014	2	0	0
YWC-BIO-2	A	P	1	1	TANYPODINAE	470630014 C	1	0	0
YWC-BIO-2	A	P	1	1	TUBIFICIDAE IMM. W	450203004 A	1	0	0
YWC-BIO-2	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	25	0	0
YWC-BIO-2	A	P	1	1	CERATOPOGONIDAE	470630010	2	0	0
YWC-BIO-2	A	P	1	1	SIALIS	470627001001	1	0	0
YWC-BIO-2	A	P	1	1	LEPTOCERIDAE	470628012	2	0	0
YWC-BIO-2	A	P	1	1	PSYCHOMYIA FLAVIDA	470628003001001	1	0	0
YWC-BIO-2	A	P	1	1	POLYCENTROPODIDAE	470628018	1	0	0
YWC-BIO-2	A	P	1	1	DUBIRAPHIA	470623050002	7	0	0
YWC-BIO-2	A	P	1	1	STENELMIS	470623050001	12	0	0
YWC-BIO-2	A	P	1	1	ABLABESMYIA	470630014042	4	0	0
YWC-BIO-2	B	P	1	1	STENELMIS	470623050001	1	0	0
YWC-BIO-2	B	P	1	1	ELMIDAE	470623050	1	0	0
YWC-BIO-2	B	P	1	1	DUBIRAPHIA	470623050002	2	0	0
YWC-BIO-2	B	P	1	1	HEMERODROMIA	470630041004	2	0	0
YWC-BIO-2	B	P	1	1	ANCYLIDAE	460108011	2	0	0
YWC-BIO-2	B	P	1	1	CERATOPOGONIDAE	470630010	8	0	0
YWC-BIO-2	B	P	1	1	PLANORBIDAE	460108012	6	0	0
YWC-BIO-2	B	P	1	1	HYDROBIIDAE	460102013	5	0	0
C-BIO-2	B	P	1	1	PELECYPODA	4605 A	5	0	0
WC-BIO-2	B	P	1	1	PHYLOCENTROPUS	470628018006	1	0	0
YWC-BIO-2	B	P	1	1	LEPTOCERIDAE	470628012	1	0	0
YWC-BIO-2	B	P	1	1	SIALIS	470627001001	2	0	0
YWC-BIO-2	B	P	1	1	LUMBRICULIDAE	450201001	3	0	0
YWC-BIO-2	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	17	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
YWC-BIO-2	B	P	1	1	UNIONIDAE	460504002	3	0	0
YWC-BIO-2	B	P	1	1	NAIDIDAE	450203005	1	0	[illegible]
YWC-BIO-2	B	P	1	1	ABLABESMYIA	470630014042	7	0	0
YWC-BIO-2	B	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	2	0	0
YWC-BIO-2	B	P	1	1	MICROTENDIPES	470630014027	2	0	0
YWC-BIO-2	B	P	1	1	DICROTENDIPES	470630014043	8	0	0
YWC-BIO-2	B	P	1	1	PROCLADIUS	470630014004	1	0	0
YWC-BIO-2	B	P	1	1	CHIRONOMINI	470630001401	5	0	0
YWC-BIO-2	B	P	1	1	TRIBELOS	470630014117	1	0	0
YWC-BIO-2	B	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	10	0	0
YWC-BIO-2	B	P	1	1	CRYPTOCHIRONOMUS	470630014035	1	0	0
YWC-BIO-2	B	P	1	1	TANYTARSUS	470630014030	1	0	0
YWC-BIO-2	C	P	1	1	HYDROBIIDAE	460102013	2	0	0
YWC-BIO-2	C	P	1	1	PLANORBIDAE	460108012	3	0	0
YWC-BIO-2	C	P	1	1	PELECYPODA	4605 A	10	0	0
YWC-BIO-2	C	P	1	1	SIALIS	470627001001	1	0	0
YWC-BIO-2	C	P	1	1	TANYTARSUS	470630014030	1	0	0
YWC-BIO-2	C	P	1	1	STENELMIS	470623050001	6	0	0
YWC-BIO-2	C	P	1	1	TRICLADIDA	350109	1	0	0
YWC-BIO-2	C	P	1	1	CAENIS	470604011002	1	0	0
YWC-BIO-2	C	P	1	1	PHYLOCENTROPUS	470628018006	1	0	0
YWC-BIO-2	C	P	1	1	ASELLUS	470531015001	3	0	0
YWC-BIO-2	C	P	1	1	CHIRONOMIDAE	470630014	0	1	0
YWC-BIO-2	C	P	1	1	DROMOGOMPHUS	470605003005	1	0	0
YWC-BIO-2	C	P	1	1	UNIONIDAE	460504002	3	0	0
YWC-BIO-2	C	P	1	1	ERPOBDELLIDAE	450205006	1	0	0
YWC-BIO-2	C	P	1	1	GAMMARIDAE	470532021	1	0	0
YWC-BIO-2	C	P	1	1	NEMERTEA	38	1	0	0
YWC-BIO-2	C	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	9	0	
YWC-BIO-2	C	P	1	1	ABLABESMYIA	470630014042	1	0	[illegible]
YWC-BIO-2	C	P	1	1	TANYPODINAE	470630014 C	1	0	0
YWC-BIO-2	C	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	5	0	0
YWC-BIO-2	C	P	1	1	PARACHIRONOMUS	470630014052	1	0	0
YWC-BIO-2	C	P	1	1	TRIBELOS	470630014117	3	0	0
YWC-BIO-2	C	P	1	1	LABRUNDINIA	470630014103	1	0	0
YWC-BIO-2	C	P	1	1	DICROTENDIPES	470630014043	5	0	0
YWC-BIO-2	C	P	1	1	PROCLADIUS	470630014004	1	0	0
YWC-BIO-2	C	P	1	1	CRYPTOCHIRONOMUS	470630014035	2	0	0
YWC-BIO-2	C	P	1	1	MICROTENDIPES	470630014027	1	0	0
YWC-BIO-2	C	P	1	1	CERATOPOGONIDAE	470630010	12	0	0
YWC-BIO-2	C	P	1	1	ANCYRONYX VARIEGATA	470623050009001	1	0	0
YWC-BIO-2	C	P	1	1	DUBIRAPHIA	470623050002	1	0	0
YWC-BIO-2	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	27	0	0
YWC-BIO-R1		D	3	28	DUBIRAPHIA	470623050002	2	0	0
YWC-BIO-R1		D	3	28	PROGOMPHUS	470605003003	1	0	0
YWC-BIO-R1		D	3	28	CYRNELLUS FRATERNUS	470628018005001	1	0	0
YWC-BIO-R1		D	3	28	CERATOPOGONIDAE	470630010	1	0	0
YWC-BIO-R1		D	3	28	POLYPEDILUM SCALAENUM	470630014036038	1	0	0
YWC-BIO-R1		D	3	28	HEMERODROMIA	470630041004	1	0	0
YWC-BIO-R1		D	3	28	ELMIDAE	470623050	0	0	21
YWC-BIO-R1		D	3	28	STENONEMA	470604001004	6	0	0
YWC-BIO-R1		D	3	28	ANCYRONYX VARIEGATA	470623050009001	0	0	2
YWC-BIO-R1		D	3	28	PHYSELLA	460108013003	1	0	0
YWC-BIO-R1		D	3	28	STENELMIS	470623050001	18	0	0
YWC-BIO-R1		D	3	28	ANCYLIDAE	460108011	26	0	0
YWC-BIO-R1		D	3	28	CLADOTANYTARSUS	470630014041	2	0	[illegible]
YWC-BIO-R1		D	3	28	DUBIRAPHIA	470623050002	0	0	
YWC-BIO-R1		D	3	28	STENELMIS	470623050001	0	0	20
YWC-BIO-R1		D	3	28	TANYTARSUS	470630014030	2	0	0
YWC-BIO-R1		D	3	28	STENOCHIRONOMUS	470630014029	1	0	0
YWC-BIO-R1		D	3	28	HYDROBIIDAE	460102013	4	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
BIO-R1		D	3	28	PLANORBIDAE	460108012	1	0	0
BIO-R1		D	3	28	SPHAERIIDAE	460507046 A	2	0	0
YWC-BIO-R1		D	3	28	BOYERIA	470605001007	1	0	0
YWC-BIO-R1		D	3	28	CHEUMATOPSYCHE	470628004002	6	0	0
YWC-BIO-R1	A	H	1	1	PHAENOPSECTRA	470630014152	3	0	0
YWC-BIO-R1	A	H	1	1	ARGIA	470606003009	2	0	0
YWC-BIO-R1	A	H	1	1	TRICLADIDA	350109	7	0	0
YWC-BIO-R1	A	H	1	1	LYPE DIVERSA	470628003009001	14	0	0
YWC-BIO-R1	A	H	1	1	CHEUMATOPSYCHE	470628004002	1	0	0
YWC-BIO-R1	A	H	1	1	BAETIS	470604002006	1	0	0
YWC-BIO-R1	A	H	1	1	ANCYLIDAE	460108011	56	0	0
YWC-BIO-R1	A	H	1	1	SPHAERIIDAE	460507046 A	1	0	0
YWC-BIO-R1	A	H	1	1	PHYSELLA	460108013003	2	0	0
YWC-BIO-R1	A	H	1	1	TANYTARSUS	470630014030	17	0	0
YWC-BIO-R1	A	H	1	1	ABLABESMYIA	470630014042	4	0	0
YWC-BIO-R1	A	H	1	1	CLADOTANYTARSUS	470630014041	7	0	0
YWC-BIO-R1	A	H	1	1	CRYPTOCHIRONOMUS	470630014035	2	0	0
YWC-BIO-R1	A	H	1	1	PENTANEURA	470630014054	4	0	0
YWC-BIO-R1	A	H	1	1	POLYPEDILUM SCALAENUM	470630014036038	3	0	0
YWC-BIO-R1	A	H	1	1	BAETIS	470604002006	4	0	0
YWC-BIO-R1	A	H	1	1	ANCYRONYX VARIEGATA	470623050009001	2	0	0
YWC-BIO-R1	A	H	1	1	THIENEMANNIMYIA	470630014119	1	0	0
YWC-BIO-R1	A	H	1	1	DERO FURCATA	450203005006008	1	0	0
YWC-BIO-R1	A	H	1	1	DERO DERO	450203005006007	3	0	0
YWC-BIO-R1	A	H	1	1	STENELMIS	470623050001	6	0	0
YWC-BIO-R1	A	H	1	1	DUBIRAPHIA	470623050002	0	0	2
YWC-BIO-R1	A	H	1	1	ELMIDAE	470623050	0	0	1
YWC-BIO-R1	A	H	1	1	STENELMIS	470623050001	0	0	14
BIO-R1	A	H	1	1	STENACRON	470604001017	6	0	0
YWC-BIO-R1	A	H	1	1	HEMERODROMIA	470630041004	11	0	0
YWC-BIO-R1	A	H	1	1	CERATOPOGONIDAE	470630010	1	0	0
YWC-BIO-R1	A	H	1	1	STENONEMA	470604001004	2	0	0
YWC-BIO-R1	B	H	1	1	CLADOTANYTARSUS	470630014041	3	0	0
YWC-BIO-R1	B	H	1	1	CERATOPOGONIDAE	470630010	1	0	0
YWC-BIO-R1	B	H	1	1	PLANORBIDAE	460108012	1	0	0
YWC-BIO-R1	B	H	1	1	HEMERODROMIA	470630041004	15	0	0
YWC-BIO-R1	B	H	1	1	THIENEMANNIMYIA	470630014119	1	0	0
YWC-BIO-R1	B	H	1	1	LYPE DIVERSA	470628003009001	1	0	0
YWC-BIO-R1	B	H	1	1	STENONEMA	470604001004	13	0	0
YWC-BIO-R1	B	H	1	1	PHYSELLA	460108013003	1	0	0
YWC-BIO-R1	B	H	1	1	CHIRONOMIDAE	470630014	0	2	0
YWC-BIO-R1	B	H	1	1	ARGIA	470606003009	1	0	0
YWC-BIO-R1	B	H	1	1	LYPE DIVERSA	470628003009001	15	0	0
YWC-BIO-R1	B	H	1	1	CHIMARRA	470628002002	2	0	0
YWC-BIO-R1	B	H	1	1	ANCYRONYX VARIEGATA	470623050009001	2	0	0
YWC-BIO-R1	B	H	1	1	STENACRON	470604001017	5	0	0
YWC-BIO-R1	B	H	1	1	TRICLADIDA	350109	3	0	0
YWC-BIO-R1	B	H	1	1	DERO DERO	450203005006007	6	0	0
YWC-BIO-R1	B	H	1	1	STENELMIS	470623050001	10	0	0
YWC-BIO-R1	B	H	1	1	STENELMIS	470623050001	0	0	8
YWC-BIO-R1	B	H	1	1	CERATOPOGONIDAE	470630010	1	0	0
YWC-BIO-R1	B	H	1	1	ABLABESMYIA	470630014042	1	0	0
YWC-BIO-R1	B	H	1	1	TANYPODINAE	470630014 C	1	0	0
YWC-BIO-R1	B	H	1	1	PHAENOPSECTRA	470630014152	2	0	0
YWC-BIO-R1	B	H	1	1	POLYPEDILUM FALLAX	470630014036003	1	0	0
BIO-R1	B	H	1	1	POLYPEDILUM SCALAENUM	470630014036038	6	0	0
BIO-R1	B	H	1	1	TANYTARSUS	470630014030	11	0	0
YWC-BIO-R1	B	H	1	1	ELMIDAE	470623050	0	0	2
YWC-BIO-R1	B	H	1	1	ANCYRONYX VARIEGATA	470623050009001	0	0	3
YWC-BIO-R1	B	H	1	1	ANCYLIDAE	460108011	50	0	0
YWC-BIO-R1	C	H	1	1	PHAENOPSECTRA	470630014152	1	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
YWC-BIO-R1	C	H	1	1	CHIRONOMUS	470630014032	2	0	0
YWC-BIO-R1	C	H	1	1	SLAVINA APPENDICULATA	450203005001001	2	0	
YWC-BIO-R1	C	H	1	1	THIENEMANNIMYIA	470630014119	2	0	0
YWC-BIO-R1	C	H	1	1	ANCYRONYX VARIEGATA	470623050009001	2	0	0
YWC-BIO-R1	C	H	1	1	CLADOTANYTARSUS	470630014041	5	0	0
YWC-BIO-R1	C	H	1	1	STENELMIS	470623050001	0	0	2
YWC-BIO-R1	C	H	1	1	POLYPEDILUM SCALAENUM	470630014036038	5	0	0
YWC-BIO-R1	C	H	1	1	ANCYRONYX VARIEGATA	470623050009001	0	0	2
YWC-BIO-R1	C	H	1	1	DICROTENDIPES	470630014043	2	0	0
YWC-BIO-R1	C	H	1	1	STENACRON	470604001017	2	0	0
YWC-BIO-R1	C	H	1	1	POLYPEDILUM FALLAX	470630014036003	3	0	0
YWC-BIO-R1	C	H	1	1	CERATOPOGONIDAE	470630010	37	0	0
YWC-BIO-R1	C	H	1	1	TANYTARSUS	470630014030	21	0	0
YWC-BIO-R1	C	H	1	1	TRICLADIDA	350109	5	0	0
YWC-BIO-R1	C	H	1	1	ABLABESMYIA	470630014042	2	0	0
YWC-BIO-R1	C	H	1	1	CHIRONOMIDAE	470630014	1	0	0
YWC-BIO-R1	C	H	1	1	PENTANEURA	470630014054	5	0	0
YWC-BIO-R1	C	H	1	1	STENELMIS	470623050001	4	0	0
YWC-BIO-R1	C	H	1	1	PLANORBIDAE	460108012	2	0	0
YWC-BIO-R1	C	H	1	1	TRICLADIDA	350109	1	0	0
YWC-BIO-R1	C	H	1	1	HYDROBIIDAE	460102013	3	0	0
YWC-BIO-R1	C	H	1	1	STENONEMA	470604001004	10	0	0
YWC-BIO-R1	C	H	1	1	PHYSELLA	460108013003	2	0	0
YWC-BIO-R1	C	H	1	1	CRYPTOCHIRONOMUS	470630014035	1	0	0
YWC-BIO-R1	C	H	1	1	ELMIDAE	470623050	0	0	1
YWC-BIO-R1	C	H	1	1	BAETIS	470604002006	3	0	0
YWC-BIO-R1	C	H	1	1	HEMERODROMIA	470630041004	16	0	0
YWC-BIO-R1	C	H	1	1	DERO	450203005006	2	0	0
YWC-BIO-R1	C	H	1	1	ANCYLIDAE	460108011	50	0	
YWC-BIO-R1	C	H	1	1	BAETIS	470604002006	2	0	
YWC-BIO-R1	C	H	1	1	STENONEMA	470604001004	1	0	0
YWC-BIO-R1	C	H	1	1	STENELMIS	470623050001	1	0	0
YWC-BIO-R1	C	H	1	1	LYPE DIVERSA	470628003009001	16	0	0
YWC-BIO-R1	A	P	1	1	PHAENOPSECTRA	470630014152	1	0	0
YWC-BIO-R1	A	P	1	1	CLADOTANYTARSUS	470630014041	5	0	0
YWC-BIO-R1	A	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	4	0	0
YWC-BIO-R1	A	P	1	1	TANYTARSUS	470630014030	2	0	0
YWC-BIO-R1	A	P	1	1	PENTANEURA	470630014054	2	0	0
YWC-BIO-R1	A	P	1	1	CERATOPOGONIDAE	470630010	8	0	0
YWC-BIO-R1	A	P	1	1	HEMERODROMIA	470630041004	1	0	0
YWC-BIO-R1	A	P	1	1	DUBIRAPHIA	470623050002	10	0	0
YWC-BIO-R1	A	P	1	1	STENELMIS	470623050001	33	0	0
YWC-BIO-R1	A	P	1	1	ABLABESMYIA	470630014042	3	0	0
YWC-BIO-R1	A	P	1	1	LUMBRICULIDAE	450201001	3	0	0
YWC-BIO-R1	A	P	1	1	GASTROPODA	4601	1	0	0
YWC-BIO-R1	A	P	1	1	ANCYLIDAE	460108011	4	0	0
YWC-BIO-R1	A	P	1	1	LIMNODRILUS HOFFMEISTERI	450203004005001	1	0	0
YWC-BIO-R1	A	P	1	1	SPHAERIIDAE	460507046 A	4	0	0
YWC-BIO-R1	A	P	1	1	GOMPHIDAE	470605003	5	0	0
YWC-BIO-R1	A	P	1	1	CORDULIIDAE	470605006	1	0	0
YWC-BIO-R1	A	P	1	1	CRYPTOCHIRONOMUS	470630014035	4	0	0
YWC-BIO-R1	A	P	1	1	CHEUMATOPSYCHE	470628004002	1	0	0
YWC-BIO-R1	A	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	7	0	0
YWC-BIO-R1	A	P	1	1	PHYLOCENTROPUS	470628018006	6	0	0
YWC-BIO-R1	A	P	1	1	ACARINA	47021100	1	0	0
YWC-BIO-R1	A	P	1	1	ELMIDAE	470623050	0	0	
YWC-BIO-R1	A	P	1		ELMIDAE	470623050	0	0	
YWC-BIO-R1	A	P	1		LUMBRICULIDAE	450201001	1	0	
YWC-BIO-R1	A	P	1	1	DUBIRAPHIA	470623050002	0	0	4
YWC-BIO-R1	B	P	1	1	LUMBRICULIDAE	450201001	1	0	0
YWC-BIO-R1	B	P	1	1	ANCYLIDAE	460108011	3	0	0

FIELD NAME	REP	GEAR	DEN	NUM	SPECIES	SPECIES CODE	SPECIES COUNT	PUPAE COUNT	ADULT COUNT
BIO-R1	B	P	1	1	SPHAERIIDAE	460507046 A	19	0	0
BIO-R1	B	P	1	1	HYDROBIIDAE	460102013	2	0	0
YWC-BIO-R1	B	P	1	1	PHYLOCENTROPUS	470628018006	5	0	0
YWC-BIO-R1	B	P	1	1	CHIRONOMIDAE	470630014	0	1	0
YWC-BIO-R1	B	P	1	1	CLADOTANYTARSUS	470630014041	8	0	0
YWC-BIO-R1	B	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	40	0	0
YWC-BIO-R1	B	P	1	1	PHAENOPSECTRA	470630014152	2	0	0
YWC-BIO-R1	B	P	1	1	LUMBRICULIDAE	450201001	2	0	0
YWC-BIO-R1	B	P	1	1	CRYPTOCHIRONOMUS	470630014035	2	0	0
YWC-BIO-R1	B	P	1	1	PARACLADOPELMA	470630014151	1	0	0
YWC-BIO-R1	B	P	1	1	TRICLADIDA	350109	2	0	0
YWC-BIO-R1	B	P	1	1	DUBIRAPHIA	470623050002	4	0	0
YWC-BIO-R1	B	P	1	1	STENELMIS	470623050001	45	0	0
YWC-BIO-R1	B	P	1	1	STENELMIS	470623050001	0	0	5
YWC-BIO-R1	B	P	1	1	ELMIDAE	470623050	0	0	7
YWC-BIO-R1	B	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	17	0	0
YWC-BIO-R1	B	P	1	1	PROGOMPHUS	470605003003	1	0	0
YWC-BIO-R1	B	P	1	1	CHEUMATOPSYCHE	470628004002	1	0	0
YWC-BIO-R1	B	P	1	1	PROCLADIUS	470630014004	1	0	0
YWC-BIO-R1	B	P	1	1	CERATOPOGONIDAE	470630010	2	0	0
YWC-BIO-R1	C	P	1	1	DUBIRAPHIA	470623050002	1	0	0
YWC-BIO-R1	C	P	1	1	LUMBRICULIDAE	450201001	1	0	0
YWC-BIO-R1	C	P	1	1	STENELMIS	470623050001	50	0	0
YWC-BIO-R1	C	P	1	1	PHYLOCENTROPUS	470628018006	4	0	0
YWC-BIO-R1	C	P	1	1	POLYPEDILUM SCALAENUM	470630014036038	31	0	0
YWC-BIO-R1	C	P	1	1	COENAGRIONIDAE	470606003	1	0	0
YWC-BIO-R1	C	P	1	1	CLADOTANYTARSUS	470630014041	8	0	0
YWC-BIO-R1	C	P	1	1	CHIRONOMIDAE	470630014	0	1	0
BIO-R1	C	P	1	1	CRYPTOCHIRONOMUS	470630014035	2	0	0
YWC-BIO-R1	C	P	1	1	SPHAERIIDAE	460507046 A	31	0	0
YWC-BIO-R1	C	P	1	1	CHIRONOMINI	47063001401	1	0	0
YWC-BIO-R1	C	P	1	1	CHEUMATOPSYCHE	470628004002	4	0	0
YWC-BIO-R1	C	P	1	1	DROMOGOMPHUS	470605003005	1	0	0
YWC-BIO-R1	C	P	1	1	ANCYLIDAE	460108011	7	0	0
YWC-BIO-R1	C	P	1	1	HYDROBIIDAE	460102013	2	0	0
YWC-BIO-R1	C	P	1	1	BAETIS	470604002006	1	0	0
YWC-BIO-R1	C	P	1	1	HEMERODROMIA	470630041004	3	0	0
YWC-BIO-R1	C	P	1	1	CERATOPOGONIDAE	470630010	1	0	0
YWC-BIO-R1	C	P	1	1	ACARINA	47021100	1	0	0
YWC-BIO-R1	C	P	1	1	STENELMIS	470623050001	0	0	2
YWC-BIO-R1	C	P	1	1	PROGOMPHUS	470605003003	1	0	0
YWC-BIO-R1	C	P	1	1	TUBIFICIDAE IMM. W/O	450203004 B	8	0	0
YWC-BIO-R1	C	P	1	1	ELMIDAE	470623050	0	0	4